NPDES Phase II Permit Monitoring Report Biological and Bacteriological Sampling

Montgomery County Jurisdiction Assessment Montgomery County, Tennessee

PREPARED FOR:





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TABLE OF CONTENTS

Montgomery County Watershed Assessment Plan Biological Monitoring Report

EXECL	JTIVE SUMMARYA
1.0	INTRODUCTION
1.1	Study Area Location1
2.0	METHODS
2.1 F	Physical Characterization2
2.	1.1 Physical Habitat Assessment
2.2 \	Nater Chemistry2
2.3 1	Vacroinvertebrate Assessment
3.0	RESULTS AND DISCUSSION
3.1 F	Physical Characterization2
3.	1.1 Habitat Assessment
3.	1.2 Stream Assessment
3.2 I	n Situ Stream Measurements5
3.3 I	Macroinvertebrate Assessment
3.	3.1 Tennessee Macroinvertebrate Index
4.0	SUMMARY7
5.0	QUALIFICATIONS STATEMENT7
6.0	REFERENCES

APPENDIX 1: SUPPORTING INFORMATION APPENDIX 2: PHOTOGRAPHS APPENDIX 3: SCIENTIFIC COLLECTION PERMIT



EXECUTIVE SUMMARY

Barge Design Solutions, Inc. (BARGE) was retained by Montgomery County Buildings and Codes Department to perform biological monitoring in Montgomery County's jurisdiction area. Under the National Pollutant Discharge Elimination System (NPDES) permit requirements of the Tennessee Department of Environment and Conservation (TDEC), biological assessments to determine the current condition of the streams located within the jurisdictional boundaries of the county in which the permitted facility serves must be performed. Biological monitoring is required at selected monitoring sites currently listed as impaired.

Methodologies were followed according to the TDEC Division of Water Resources Standard Operating Procedures -*Quality System Standard Operation Procedure for Macroinvertebrate Stream Surveys* (TDEC, 2017) and *Quality System Standard Operating Procedure for Chemical and Bacteriological Sampling of Surface Water* (August 2018).

Nine monitoring stations were surveyed to determine biological integrity. Prior to surveying, a representative stream reach was identified at each location based on the available primary physical habitat characteristics. In situ water quality measurements, as well as physical characterizations were conducted at each monitoring site. In addition, a subset of three sites were selected to collect water samples to be analyzed for *E. coli*. Macroinvertebrates were collected from downstream to upstream locations using a multi-habitat approach. Sampling occurred during September and October of 2018.

An analysis of habitat, macroinvertebrate communities, and *E.coli* were conducted to determine current conditions of biotic integrity within each of the streams sampled. Comparisons were made with reference data acquired from TDEC for the Western Pennyroyal Karst (71e) and Western Highland Rim (71f), where applicable, for Tennessee Macroinvertebrate Index (TMI) (TDEC, 2017.)

A total of 85 macroinvertebrate taxa were collected. Species that were encountered during this survey were common representatives of those inhabiting the region. Sensitive/intolerant macroinvertebrate species were encountered at all sites. TMI scores ranged from 18-40, with five sites obtaining the required reference score for their given ecoregions.

Habitat was assessed at each site that a macroinvertebrate sample was taken from. Ecoregion 71e requires a score of greater than or equal to 114 to be considered to meet regional guidelines and Ecoregion 71f requires a score of greater than or equal to 123. Three of five sites in Ecoregion 71f did not meet regional guidelines and all of the sites in Ecoregion 71e met regional guidelines.

In addition, five *E.coli* samples were collected within a 30-day period at each of the sampling sites to determine the average most probable number (MPN)/100 mL of river water. These data were skewed by the above average amount of precipitation during September and October. The first three samples collected are ultimately the expected level of *E.coli* as the last two samples were influenced by rain events. Given the first three samples, two of the three sample locations are above the 132 MPN/100 mL threshold for an impaired stream.



1.0 INTRODUCTION

On behalf of Montgomery County Buildings and Codes Department, Barge Design Solutions, Inc. (BARGE) conducted a bioassessment in accordance with the Montgomery County NPDES permit issued by the Tennessee Department of Environment and Conservation (TDEC) following protocol set forth in the *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (TDEC, 2017).

1.1 Study Area Location

The project is located in the Highland Rim geographic region in Montgomery County, Tennessee. The survey area is situated within the Guthrie KY, Sango TN, Clarksville TN, Excell TN, and Henrietta TN 7.5-minute United States Geological Survey (USGS) Topographic Quadrangles, and the Red River Watershed (05130206) and Lower Cumberland River Watershed (05130205) 8-digit Hydrologic Unit Codes (HUC). Locations are further categorized into five different 10 digit HUCs.

In total, ten sites were sampled during this study. Nine TDEC long-term monitoring locations were selected to evaluate biological integrity and three sites were selected to evaluate the concentration of *E.coli* (Figure 1). Site locations and designations are as follows:

Station ID	Waterbody Name	Latitude/Longitude	Ecoregion	Site Assessment Type
SPRIN009.8MT	Spring Creek at Jim Johnson Road	36.6170, -87.2535	71e	Macroinvertebrate
SPRIN006.9MT	Spring Creek at Oakland Road	36.6154, -87.2876	71e	Macroinvertebrate
WALL000.6MT	Wall Branch off Hwy 12	36.4964, -87.2994	71f	Macroinvertebrate
LOUIS001.8	Louise Creek at Watkins Ford Road	36.3592, -87.3061	71f	Macroinvertebrate
EFORK003.9MT	East Fork Creek off Benton Ridge Road	36.3981, -87.5272	71f	Macroinvertebrate and E.coli
BMCAD004.9MT	Big McAdoo Creek near Gholson Road	36.4617, -87.2744	71f	Macroinvertebrate and E.coli
SPRIN13.7T0.4MT	UNT to Spring Creek at Hwy 79	36.6361, -87.2113	71e	Macroinvertebrate
BARTE001.4	Bartee Branch at Lake Road	36.502, -87.5177	71f	Macroinvertebrate
RED024.7MT	Red River DS Sulphur Fork	36.5562, -87.1473	71e	Macroinvertebrate
RED000.4MT	Red River at Highway 741A	36.542, -87.368	71f	E.coli

2.0 METHODS

Biological and bacteriological monitoring were performed according to the methods outlined in the TDEC *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (2017) and *Quality System Standard Operating Procedure for Chemical and Bacteriological Sampling of Surface Water* (TDEC, 2018). The primary components of the biomonitoring included physical stream characterization, macroinvertebrate sampling, and *E. coli*



sampling. Physical habitat assessments and in-situ water quality measurements were also performed at all sample locations.

2.1 Physical Characterization

2.1.1 Physical Habitat Assessment

Habitat quality was assessed by acquiring a consensus between field team members in each sampling reach using standard visual-based methods (Barbour et al. 1999). These methods address habitat quality based on the ten habitatquality parameters as described in the standard operating procedures (TDEC, 2017). For this study habitat quality was assessed concurrently with water quality and macroinvertebrate sample collection in all reaches.

Total scores for each sampling reach were derived from the sum of all of the parameter scores. All streams were assessed as a high-gradient stream status. Photographs were taken at the upstream and downstream ends of each sampling reach (Appendix 2). Field data sheets summarizing physical characterizations are provided in Appendix 1.

2.2 Water Chemistry

Prior to biological surveys, water quality was assessed via in situ measurements using a YSI Pro DSS Multi-parameter meter to obtain the following parameters: temperature, pH, specific conductivity, and dissolved oxygen. In addition, at three locations, *E. coli* was collected following the TDEC SOP for surface water sampling (2018)

2.3 Macroinvertebrate Assessment

Macroinvertebrates were collected using semi-quantitative sampling methods. Single habitat sampling was conducted using the kick sampling technique in accordance with TDEC's 2017 SOP for macroinvertebrate collection (TDEC, 2017). To maintain consistency with TDEC sampling protocols, two 1-m² kick net samples were obtained from specified sampling reaches, if habitat allowed. Care was taken to avoid disruption of substrate from which a subsequent subsample was planned.

Enumeration and identification of macroinvertebrate samples were conducted in accordance with TDEC 2017 Standard Operating Procedures, except that macroinvertebrates were identified to the lowest possible taxonomic unit (i.e. species if available). However, even though the macroinvertebrates were identified to the lowest possible taxonomic unit, the data analysis provided in this report is based on genus-level data in accordance with the 2017 protocols. The raw data generated from laboratory identification are included in Appendix 1.

3.0 RESULTS AND DISCUSSION

3.1 Physical Characterization

3.1.1 Habitat Assessment

Results of the visual habitat assessments all of the streams are presented in Table 1, in Appendix 1. Field data sheets are provided in Appendix 1. Erosion within noted in all of the sampling reaches, which can be attributed to surrounding land use and soil composition in the area. Six sample reaches scored out to have a assessment rating within the "optimal" range and three reaches scored within the "suboptimal" range. As evaluated by the habitat parameters, site



RED024.7MT had the highest habitat assessment score (163) while BMCAD004.9MT and LOUIS001.8MT had the lowest habitat assessment scores (116).

SPRIN009.8MT – Spring Creek at Jim Johnson Road

This stream segment was limited by the riparian zone and bank stability. The surrounding land use is primarily agriculture, with no buffer on the left bank. Erosion was evident throughout the reach and beyond as there was little vegetation to support the stability. There was, however, very little evidence of sediment deposition, especially in the riffle areas. Overall, the reach received a score of 126, which is above the ecoregion reference score.

SPRIN006.9MT – Spring Creek at Oakland Road

This stream segment was limited by the riparian width and sediment deposition in the low flow areas. Like the previous Spring Creek site, and all of the remaining sites, agriculture is a detriment to the quality of the stream. However, there has been very little channel alteration and the velocity/depth regime spectrum is intact at this site. Overall, the reach received a score of 142, which is well above the ecoregion reference score.

WALL000.6MT – Wall Branch off Highway 12

Bank stability and sediment deposition are the two limiting factors in this reach. Heavy erosion was noted on each bank throughout the reach, and because of that, there is sediment deposition along the margins and in pool areas. The riparian vegetation is well preserved at this site, the left bank has dense old growth forest that extends beyond 18 meters, and the right bank has been cleared along the outer edges near the water treatment facility. Overall, this reach scored a 140, which is well above the ecoregion reference score.

LOUIS001.8MT – Louise Creek at Watkins Ford Road

Little epifaunal cover was observed at this stream segment and was primarily cobble and leaf pack. In addition, there was no slow-moving deep water, and very little fast-moving deep water. Another limiting factor at this reach was the riparian zone, which primarily consisted of a fence row and then cultivated land, giving a large source of sediment deposition. This segment scored a 116, which is below the ecoregion reference score of 123.

EFORK003.9MT – East Fork Creek off Benton Ridge Road

Sediment and embeddedness of riffles were limiting factors at this site. However, the most glaring limiting factor is the riparian zone, which is used heavily by cattle. Additionally, there were very few riffles and bends within the reach which has led to heavy erosion on each bank. The available instream epifaunal substrate and available cover is sufficient for macroinvertebrates and fish, which is reflected in the TMI score. Overall, this reach scored a 121, which is below the ecoregion reference score of 123.

BMCAD004.9 – Big McAdoo Creek near Gholson Road

This stream segment was observed to have little riffle area and those present were small. Additionally, the riparian zone was non-existent on the right bank, as the land was cleared up to the channel. This was an obvious source of erosion in the stream, which yielded a low parameter score on each bank. The bank vegetation did little to curb the erosion, and most were grasses, or saplings that were nearly eroded underneath. This reach scored a 116, which is below the ecoregion reference score of 123.



SPRING13.7T0.4MT – Unnamed Tributary to Spring Creek at Highway 79

This site was observed twice during the course of this study. The stream during the first visit in September only contained a minor amount of flow. Therefore, no macroinvertebrate sample was taken. Upon the second visit, there was significant flow. Within the reach only cobble and large woody debris provided instream cover for aquatic fauna and there was very little vegetation on the bank for stability. These two characteristics were the limiting factors at the site. There was a significant riparian buffer on each bank and there was little channel alteration observed. Overall, this reach scored a 144, well above the ecoregion reference score.

BARTE001.4MT – Bartee Branch at Lake Road

Bartee Branch had a noticeably higher amount of sediment deposition and riffle embeddedness than the other reaches sampled during this study. In addition, the right bank was highly impacted by the land owner, as it was cleared to the edge with little old growth vegetation left standing. There was little channel alteration in the reach and there was an abundance of re-oxygenation zones. Overall, this reach scored a 145, which is above the ecoregion reference score of 123.

RED024.7 – Red River Downstream Sulfur Fork

This reach of the Red River contained very little riffle habitat and what was present was embedded by soft sediment. While there is little channel alteration in the reach, and upstream bridge appears to be changing the flow dynamics and is causing a greater percentage of run compared to riffle in the area. The riparian buffer on both banks remains largely in tact and provides good stability and protection from the surrounding land use. Overall, this reach scored a 163, which is an indication of the quality of protection for the river in the area.

3.1.2 Stream Assessment

Cross section and velocity measurements are displayed in Table 2. The sites where discharge was calculated are related to the sites in which *E. coli* samples were collected. The first three collection dates for bacteria, were similar in discharge, below is the measurements from October 10, 2018. Additionally, the fourth sample occurred shortly after a large rain event and flow was not attainable due to unsafe wading conditions. The final event allowed for flow measurement. During this event, flow was still elevated due to the recent rains and is reflected in the *E.coli* results.

		Table 2. E. coli Monitor	ing Sample Location S	tream Measurements		
Sample Location	Date	Stream Width (ft)	Average Depth (ft)	Cross Sectional Area (ft²)	Average Velocity (ft/sec)	Discharge (cfs)
EFORK003.9MT	10/10/2018	27.0	0.6125	16.54	1.90	26.7
BMCAD004.9MT	10/10/2018	18.0	0.379	6.825	0.76	4.41
EFORK003.9MT	10/18/2018	28.0	1.28	35.75	1.58	47.77
BMCAD004.9MT	10/18/2018	36.0	1.34	48.38	1.20	45.44



3.2 In Situ Stream Measurements

The *in situ* water quality parameters measured at all locations appear to be within state water quality standards and are generally within acceptable levels for biological integrity (Table 4). Temperature, pH, and dissolved oxygen did not deviate much between sites. The only exception to this was during the October 25 macroinvertebrate sample at RED024.7MT, which occurred after a rain event and during colder water temperatures. These factors lead to a higher dissolved oxygen during this event.

In addition, *E. coli* was collected at three locations on five separate occasions. Rain events appear to have impacted the level of *E. coli* found in the final two sample events. Given the first three samples, it appears that BMCAD004.9Mt and EFORK003.9MT are over the 132 MPN/100 mL threshold for impaired waters (Table 3). RED000.4MT is well below the threshold and does not appear to be a concern regarding *E. coli*.

	Table 3. E. coli Results (Reported in MPN/100 mL)										
Sample Location	9/20/2018	10/10/2018	10/11/2018	10/16/2018	10/18/2018						
EFORK003.9MT	130	150	160	1,200	310						
BMCAD004.9MT	25	34	37	>2,400	7,800						
RED000.4MT	1,700	1,700	650	29,000	9,800						

3.3 Macroinvertebrate Assessment

3.3.1 Tennessee Macroinvertebrate Index

Tennessee Macroinvertebrate Index (TMI) excel spread sheets are presented in Appendix 1 for all sample locations. In general, site index scores for each location increase with distance downstream. BARTE001.4MT had the lowest TMI score (18). SPRIN009.8MT and RED024.7MT both had the highest TMI scores (40). These scores seemed to be directly related to the presence and abundance of riffles in the reach. Below is a summary of each individual and key characteristics that represent the community composition.

SPRIN009.8MT – Spring Creek at Jim Johnson Road

The macroinvertebrate sample at this location yielded 25 distinct taxa and 8 distinct Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa. A significant number of the specimen at this location were from the Order Trichoptera and the family Hydropsychidae, which are all clinger species. Clinger species are an indication of high-quality habitat availability. The TMI at this location was 40, which is above the ecoregion reference score of 32.

SPRIN006.9MT – Spring Creek at Oakland Road

Unlike the upstream Spring Creek location, the number of distinct taxa at this sample location was 13. The EPT species were more similar, with 6 distinct species identified. The percentage of EPT in this community was dominant and a low percentage of nutrient tolerant species. Like the upstream Spring Creek site, this community



was dominated by the family Hydropsychidae. The TMI at this location was 34, which is above the ecoregion reference score of 32.

WALL000.6MT – Wall Branch off Highway 12

The community at this sample location was comprised of 20 distinct taxa and 7 distinct EPT taxa. The assemblage of EPT, excluding *Cheumatopsyche*, which are generally considered a more tolerant EPT species, was approximately 58 percent. The dominant species in this community was again from the Trichoptera Order, but the Philopotamidae family. Overall, this site scored below the ecoregion reference of 32 with a 30.

LOUIS001.8MT – Louise Creek at Watkins Ford Road

The Louise Creek macroinvertebrate community included 27 distinct taxa and 9 distinct EPT taxa. The percentage of EPT, excluding *Cheumatopsyche*, was approximately 32 percent. The percentage of nutrient tolerant species was 52 percent. The percentage of clingers in the community was nearly 60 percent. Overall, this site scored a 32, which is equal to the required ecoregion reference score.

EFORK003.9MT – East Fork Creek off Benton Ridge Road

East Fork Creek contained the greatest number of distinct taxa, 38, and also the greatest number of EPT taxa, 11. The Order Ephemeroptera was the dominant group within the community assemblage. Within the Order, the taxa were distributed evenly among three different Families. The nutrient tolerant species in the community comprised nearly 30 percent of the community. Overall, this site received a TMI score of 36, which is above the ecoregion reference score.

BMCAD004.9MT – Big McAdoo Creek near Gholson Road

The community in Big McAdoo Creek was comprised of 21 distinct taxa and 9 distinct EPT taxa. Nutrient tolerant species comprised nearly 53 percent of the community, and the EPT, excluding *Cheumatopsyche*, represented nearly 37 percent of the community. *Cheumatopsyche* was the dominant taxa in the Big McAdoo Creek community assemblage. This site scored a TMI of 28, which is below the ecoregion reference score of 32.

SPRING13.7T0.4MT – Unnamed Tributary to Spring Creek at Highway 79

30 distinct taxa were identified in the macroinvertebrate community collected in the Unnamed Tributary to Spring Creek. In addition, 6 distinct EPT taxa were also identified. The percentage of EPT, excluding *Cheumatopsyche*, was approximately 12 percent. This community was dominated by a specimen in the Order Coleoptera, which contributed to the high percentage of nutrient tolerant species, approximately 66 percent. This site scored a TMI of 28, which is below the ecoregion reference score of 32.

BARTE001.4MT – Bartee Branch at Lake Road

The Bartee Branch macroinvertebrate community was comprised of 26 distinct taxa and only 3 distinct EPT taxa. The EPT, excluding *Cheumatopsyche*, comprised only 17 percent. With nearly 25 percent of the community being represented by *Cheumatopsyche*. Secondarily, the Family Chironomidae was the most dominant grouping of species within the community. This site scored a TMI of 18, which is the lowest score of any site sampled during this investigation. This TMI is well below the ecoregion reference score of 32.



RED024.7MT – Red River Downstream Sulfur Fork

The Red River macroinvertebrate community contained 23 distinct taxa and 11 distinct EPT taxa. Nearly 75 percent of the community was represented by EPT taxa, excluding *Cheumatopsyche*. Only 22 percent of the community can be described as a nutrient tolerant species. The Order Ephemeroptera and Family Heptageniidae was the dominant grouping of specimen within this community. This site scored a TMI of 40, which was the highest score of all samples collected during this investigation. This TMI is above the ecoregion reference score of 32.

4.0 SUMMARY

Barge performed biological monitoring for Montgomery County Buildings and Codes Department as part of the biological monitoring in the Montgomery County jurisdiction area, under the National Pollutant Discharge Elimination System (NPDES) permit requirements. An analysis of habitat, macroinvertebrate communities, and bacteriological contamination were conducted to determine current conditions of streams within Montgomery County. Comparisons were made with reference data acquired from TDEC for the Western Pennyroyal Karst (71e) and Western Highland Rim (71f) ecoregions, where applicable, for macroinvertebrate TMI (TDEC, 2017) and habitat assessment (TDEC, 2017).

A total of 85 macroinvertebrate taxa were collected. Species that were encountered during this survey were common representatives of those inhabiting the Montgomery County jurisdiction tributaries to the Cumberland River. TMI scores ranged from 18-40, and four of the nine streams did not score above the ecoregion reference number of 32. Sensitive/intolerant macroinvertebrate species were encountered at all sites, which were reflected by the higher TMI scores where they were more abundant.

Overall, habitat at each of the sample locations was either above, or just below the ecoregion threshold for impairment. Those that were below were located within pastures and had been impacted severely by the surrounding land use. The lower habitat scores coincide with higher *E. coli* levels that were documented. EFORK003.9 MT and BMCAD004.9MT were both above the *E. coli* threshold for impairment and below the ecoregion reference score for habitat.

5.0 QUALIFICATIONS STATEMENT

Surveys were led by Barge representative Mr. Nick Carmean. Mr. Carmean holds a M.S. in Fisheries Biology with over 9 years of experience in freshwater ecology. He holds a TDEC Scientific Collection Permit (29-WJH-16-237) and has over 8 years of experience conducting biological surveys throughout the south. Field work support during the bioassessment was provided by Barge representatives Grant Lynch, Kayla Hillis, and Brandon Page.



6.0 REFERENCES

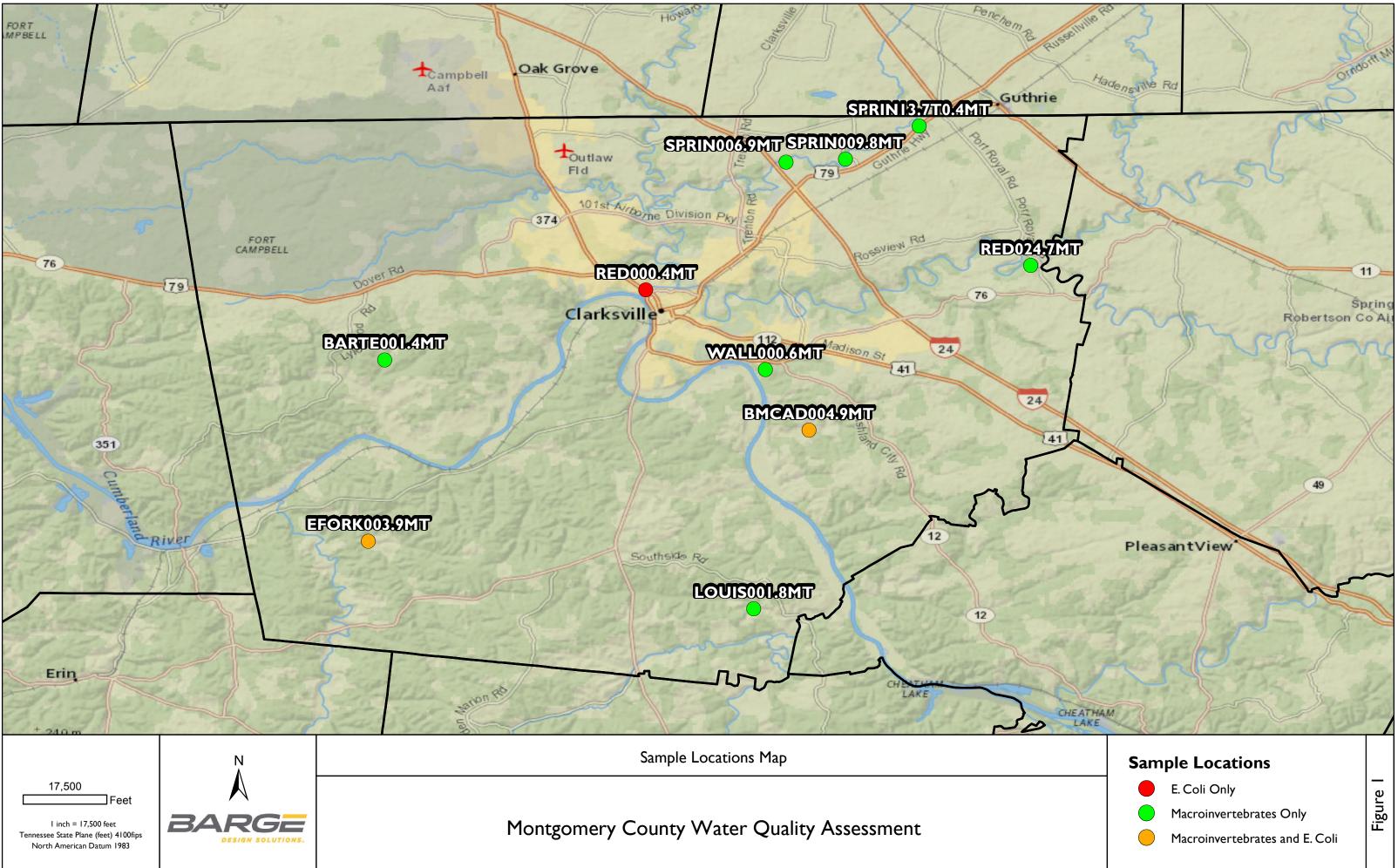
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Appendix 1

Supporting Information





	RED024.7	WALL000.6	SPRIN009.8	BARTE001.4	SPRIN13.7T0.4	EFORK0003.9	BMCAD004.9	SPRIN006.9	LOUIS001.8
Habitat_Parameter									
Epifaunal Substrate/Available Cover	18	14	15	15	10	16	12	15	10
Embeddedness	11	17	17	14	15	14	16	17	16
Velocity/Depth Regime	18	15	15	16	15	15	14	17	13
Sediment Deposition	16	12	18	12	16	12	16	14	17
Channel Flow Status	19	17	14	15	16	13	15	15	17
Channel Alteration	18	15	15	16	18	13	15	15	15
Frequency of Riffles (or bends)	15	16	12	18	15	8	10	15	15
Bank Stability (left bank)	9	3	4	9	4	4	3	5	6
Bank Stability (right bank)	9	3	4	6	4	4	3	7	3
Vegetative Protection (left bank)	8	7	5	9	7	6	5	6	2
Vegetative Protection (right bank)	8	6	5	5	7	6	5	6	2
Riparian Vegetative Zone Width (left bank)	7	9	0	9	10	6	2	2	0
Riparian Vegetative Zone Width (right bank)	7	6	2	1	7	4	0	8	0
Total Score	163	140	126	145	144	121	116	142	116

 TABLE 1

 Habitat Assessment Scores - Montgomery County 2018 Biological Monitoring

Notes:

Left and right bank designations are based on downstream orientation.

(a) Values indicate consensus scores from field team with condition category listed for each score. Reaches were at

Green = above ecoregion reference, Yellow = below ecoregion reference.

TABLE 4

Summary of Field Water Quality Results Montogomery County 2018 Biological Monitoring

		204111 2010 2	Specific	Dissolved	
		рН	Conductivity	Oxygen	Temperature
Activity	Date	SU	uS/cm	mg/L	°C
Macroinvertebrate					
SPRIN009.8MT	9/19/2018	8.58	449.6	8.55	21.6
SPRIN006.9MT	9/19/2018	8.17	462.6	8.89	22.6
WALL000.6MT	9/19/2018	8.04	552.0	7.45	22.3
LOUIS001.8MT	9/19/2018	8.63	320.2	8.93	26.8
EFORK003.9MT*	9/20/2018	7.42	339.7	7.09	23.3
BMCAD004.9MT*	9/20/2018	8.13	426.8	7.51	22.9
SPRIN13.7T0.4MT	10/3/2018	7.60	349.3	7.10	21.8
BARTE001.4MT	10/10/2018	7.32	442.5	7.05	23.4
RED024.7MT	10/25/2018	7.96	424.3	14.00	12.1
E.coli					
EFORK003.9MT	10/10/2018	7.67	354.2	8.97	22.2
EFORK003.9MT	10/11/2018	7.5	331.4	9.35	19.9
EFORK003.9MT	10/16/2018	6.98	319.5	9.6	15.4
EFORK003.9MT	10/18/2018	7.57	347.6	12.41	15.1
RED000.4MT	9/20/20108	7.51	225.4	7.48	27.0
RED000.4MT	10/10/2018	7.32	442.5	7.05	23.4
RED000.4MT	10/11/2018	7.61	445.1	5.79	21.8
RED000.4MT	10/16/2018	5.91	256	7.94	16.4
RED000.4MT	10/18/2018	7.23	327.5	11.43	14.6
BMCAD004.9MT	10/10/2018	7.81	441.4	9.35	21.7
BMCAD004.9MT	10/11/2018	7.41	442.2	9	19.3
BMCAD004.9MT	10/16/2018	7.34	376.5	9.46	15.0
BMCAD004.9MT	10/18/2018	7.57	421.2	12.72	14.8

* E.coli sample taken concurrently

					RED024.7MT	WALL000.6MT	SPRIN009.8MT	BARTE001.4MT	SPRIN13.7T0.4MT	EFORK003.9MT	BMACAD004.9MT	SPRIN006.9MT	LOUIS001.8MT
Phylum	Class	Order	Family	Genus/Final Identificati	10/25/18	09/09/18	09/19/18	10/10/18	10/03/18	09/20/18	09/20/18	09/19/18	09/19/18
Annelida	Clitellata	Enchytraeida	Enchytraeidae	Enchytraeidae					1				
Annelida	Clitellata	Lumbriculida	Lumbriculidae	Lumbriculidae						3			3
Annelida	Clitellata	Tubificida	Naididae	Branchiura									1
Annelida	Clitellata	Tubificida	Naididae	Bratislavia				1					
Annelida	Clitellata	Tubificida	Naididae	Nais	1	1	1	1					1
Annelida	Clitellata	Tubificida	Naididae	Slavina		1				10			
Annelida	Clitellata	Tubificida	Naididae	Tubificinae: bifid chaeta	1			3					
Annelida	Clitellata	Tubificida	Naididae	Tubificinae: hair+pectinate	e chaetae				1				
Annelida	Clitellata	Tubificida	Naididae	Varichaetadrilus				1					
Annelida	Clitellata			Opisthopora							2		
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	Atractides							3		
Arthropoda	Arachnida	Trombidiformes	Hygrobatidae	Hygrobates					1				
Arthropoda	Arachnida	Trombidiformes	Lebertiidae	Lebertia						3	1		
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	Sperchon			1		2	1			
Arthropoda	Arachnida	Trombidiformes	Sperchontidae	Sperchonopsis				1					
Arthropoda	Crustacea	Amphpoda	Crangonyctidae	Crangonyx			2			8			1
Arthropoda	Crustacea	Decapoda	Cambaridae	Cambaridae			2						
Arthropoda	Crustacea	Decapoda	Cambaridae	Faxonius			1						
Arthropoda	Crustacea	Isopoda	Asellidae	Lirceus				8	1	8			
Arthropoda	Insecta	Coleoptera	Elmidae	Elmidae									4
Arthropoda	Insecta	Coleoptera	Elmidae	Macronychus									1
Arthropoda	Insecta	Coleoptera	Elmidae	Optioservus						24			7
Arthropoda	Insecta	Coleoptera	Elmidae	Stenelmis	8	3	7	23	90	8	10	2	85
Arthropoda	Insecta	Coleoptera	Psephenidae	Psephenus			7		6	3	4	1	2
Arthropoda	Insecta	Diptera	Ceratopogonidae	Atrichopogon		1			1				
Arthropoda	Insecta	Diptera	Chironomidae	Chironomus				1					
Arthropoda	Insecta	Diptera	Chironomidae	Cladotanytarsus	1	1							
Arthropoda	Insecta	Diptera	Chironomidae	Conchapelopia		3	4	8	2	2	3		1
Arthropoda	Insecta	Diptera	Chironomidae	Corynoneura	1		1	2					2
Arthropoda	Insecta	Diptera	Chironomidae	Cricotopus	4			2	1		1		
Arthropoda	Insecta	Diptera	Chironomidae	Cryptochironomus	1			4					
Arthropoda	Insecta	Diptera	Chironomidae	Dicrotendipes		1							
Arthropoda	Insecta	Diptera	Chironomidae	Eukiefferiella			1						
Arthropoda	Insecta	Diptera	Chironomidae	Lopescladius	1								
Arthropoda	Insecta	Diptera	Chironomidae	Nanocladius				2					
Arthropoda	Insecta	Diptera	Chironomidae	Nilotanypus		1		1		1	3		1
Arthropoda	Insecta	Diptera	Chironomidae	Orthocladius						2			

					RED024.7MT	WALL000.6MT	SPRIN009.8MT	BARTE001.4MT	SPRIN13.7T0.4MT	EFORK003.9MT	BMACAD004.9MT	SPRIN006.9MT	LOUIS001.8MT
Phylum	Class	Order	Family	Genus/Final Identificati	10/25/18	09/09/18	09/19/18	10/10/18	10/03/18	09/20/18	09/20/18	09/19/18	09/19/18
Arthropoda	Insecta	Diptera	Chironomidae	Phaenopsectra							1		
Arthropoda	Insecta	Diptera	Chironomidae	Polypedilum	3	12	3	21	13	3	8	3	21
Arthropoda	Insecta	Diptera	Chironomidae	Rheocricotpus				2	1				
Arthropoda	Insecta	Diptera	Chironomidae	Rheotanytarus		5		43		11	8		10
Arthropoda	Insecta	Diptera	Chironomidae	Stempellinella					1	1			
Arthropoda	Insecta	Diptera	Chironomidae	Sublettea						1			
Arthropoda	Insecta	Diptera	Chironomidae	Tanypodinae				1					1
Arthropoda	Insecta	Diptera	Chironomidae	Tanytarsus	1			2	2	2			2
Arthropoda	Insecta	Diptera	Chironomidae	Thienemanniella		1		1	3				2
Arthropoda	Insecta	Diptera	Chironomidae	Thienemannimyia				3					
Arthropoda	Insecta	Diptera	Chironomidae	Thienemannimyia grp.	1			2					
Arthropoda	Insecta	Diptera	Chironomidae	Tvetenia			2						
Arthropoda	Insecta	Diptera	Empididae	Empididae		1							
Arthropoda	Insecta	Diptera	Empididae	Hemerodromia		1	2				3		
Arthropoda	Insecta	Diptera	Simuliidae	Simulium		4	2	2	1	2			
Arthropoda	Insecta	Diptera	Tabanidae	Tabanus						1			
Arthropoda	Insecta	Diptera	Tipulidae	Tipula					1				
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acentrella	1								
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acerpenna							1		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis	6	40	26	3	4	16	7	26	14
Arthropoda	Insecta	Ephemeroptera	Baetiscidae	Baetisca						1			
Arthropoda	Insecta	Ephemeroptera	Caenidae	Caenis	2			2			10	2	4
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Heptageniidae	7						7	20	9
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Leucrocuta									1
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	96	2	34		14	24	4	31	8
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenacron	4		1						
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenonema		4			1				
Arthropoda	Insecta	Ephemeroptera	Isonychiidae	Isonychia	9		7			2	9	21	20
Arthropoda	Insecta	Ephemeroptera	Leptohyphhidae	Tricorythodes	2					8	4		
Arthropoda	Insecta	Lepidoptera	Crambidae	Petrophila						1			
Arthropoda	Insecta	Megaloptera	Corydalidae	Corydalus	1		1	2		4		2	2
Arthropoda	Insecta	Odonata	Calopterygidae	Calopteryx			1						
Arthropoda	Insecta	Odonata	Coenagrionidae	Argia					4	6		1	
Arthropoda	Insecta	Odonata	Gomphidae	Gomphidae						1	1	1	1
Arthropoda	Insecta	Plecoptera	Leuctridae	Leuctra						3		1	
Arthropoda	Insecta	Plecoptera	Perlidae	Acroneuria						1		1	
Arthropoda	Insecta	Plecoptera	Perlidae	Agnetina						1			

					RED024.7MT	WALL000.6MT	SPRIN009.8MT	BARTE001.4MT	SPRIN13.7T0.4MT	EFORK003.9MT	BMACAD004.9MT	SPRIN006.9MT	LOUIS001.8MT
Phylum	Class	Order	Family	Genus/Final Identificati	10/25/18	<u>></u> 09/09/18	09/19/18	10/10/18	10/03/18	09/20/18	09/20/18	09/19/18	09/19/18
Arthropoda	Insecta	Plecoptera	Taeniopterygidae	Taeniopteryx	14	00/00/10	00/10/10	10/10/10	10/00/10	00/20/10	00/20/10	00/10/10	00/10/10
Arthropoda	Insecta	Trichoptera	Glossosomatidae	Agapetus	4								
Arthropoda	Insecta	Trichoptera	Glossosomatidae	Glossosomatidae		1							
Arthropoda	Insecta	Trichoptera	Helicopsychidae	Helicopsyche									1
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	24	47	47	51	5	21	65	45	6
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsyche	27	1	5	01	1	1	00	5	5
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Hydropsychidae		4	12	33	1	1	23	14	5
Arthropoda	Insecta	Trichoptera	Leptoceridae	Leptoceridae	1	т	12				20	17	
Arthropoda	Insecta	Trichoptera	Leptoceridae	Oecetis	1		1						
Arthropoda	Insecta	Trichoptera	Philopotamidae	Chimarra		64	9		3	1	2		12
Mollusca	Bivalvia	Veneroida	Corbiculidae	Corbicula	3	04	3	1	6	2	2		12
Mollusca	Bivalvia	Veneroida	Sphaeriidae	Pisidium	5			1	6	2			
Mollusca	Gastropoda	Basommatophora	Ancylidae	Ferrissia					0	1			
Mollusca	Gastropoda	Basommatophora	Physidae	Physidae					1	I			
Mollusca		Basommatophora	Planorbidae	Menetus					1				
Mollusca			Pleuroceridae	Pleurocera (Elimia)			4		17	1			
	Gastropoda	Neotaenioglossa	Fleurocenuae	Nematoda			4		17	I		1	
Nematoda Nemertea	Enonio	Hoplonemertea	Tertastemmatidae	Prostoma			1		1	14		I	
	Enopla	Tricladida					I		6	14			
Platyhelminthes	Turbellaria		Dugesiidae	Dugesiidae					0	I	0		
Platyhelminthes	Turbellaria	Tricladida	Planariidae	Planariidae							2	1	2
Platyhelminthes	Turbellaria	Tricladida		Tricladida								I	3
				Tatal much an af in divid	407	400	405	007	400	004	400	475	004
				Total number of individ	197	199	185	227	198	204	182	175	231
				Number of taxa per sar	23	20	25	26	30	38	21	13	27
				Total number of taxa	44	7	•	•	85	44	•	0	0
				Number of EPT per sar	11	7	8	3	6	11	9	6	9
				%EPT-Cheum	74.11%	58.29%	51.35%	16.74%	11.62%	28.43%	36.81%	68.00%	32.03%
				%OC	7.61%	13.07%	6.49%	44.49%	12.63%	17.65%	14.29%	1.71%	19.48%
				NCBI	4.27162	5.2407	5.05649	6.16811	5.613939		5.3944505		5.0974
				%Clingers-CHEUM	62.94%	41.71%	42.70%	27.31%	59.09%	35.78%	28.02%	42.86%	
				%TNUTOL	21.83%	32.16%	33.51%	49.78%	66.16%	26.96%	52.75%	29.71%	52.38%
					71e	71f	71e	71f	71e	71f	71f	71e	71f
				Number of taxa per sar	4	4	6	4	6	6	4	2	4
				Number of EPT per sar	6	2	6	0	4	6	4	4	4
				%EPT-Cheum	6	6	6	0	0	2	4	6	2
				%OC	6	6	6	4	6	6	6	6	6

					RED024.7MT	WALL000.6MT	SPRIN009.8MT	BARTE001.4MT	SPRIN13.7T0.4MT	EFORK003.9MT	BMACAD004.9MT	SPRIN006.9MT	LOUIS001.8MT
Phylum	Class	Order	Family	Genus/Final Identificati	10/25/18	09/09/18	09/19/18	10/10/18	10/03/18	09/20/18	09/20/18	09/19/18	09/19/18
				NCBI	6	4	6	4	4	6	4	6	6
				%Clingers-CHEUM	6	4	4	2	6	4	2	4	6
				%TNUTOL	6	4	6	4	2	6	4	6	4
				Sum	40	30	40	18	28	36	28	34	32

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys

Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

DWR Station ID:	SDIIN 009.8MT	formation)	Jahit	tot Accomment Drug	+/1	
Monitoring Location				tat Assessment By: NC		
Monitoring Location			Date:		Time: 092-0	
HUC:				Log Number:		
HUC:			core		Duplicate Consensus	
	Optimal	Suboptimal		Marginal	Poor	
1 Eniformal	Over 70% of stream reach	Natural stable habitat		Natural stable habitat	Less than 20% stable	
1. Epifaunal	has natural stable habitat	covers 40-70% of stre	am	covers 20 -40% of	habitat; lack of habitat is	
Substrate/	suitable for colonization	reach. Three or more		stream reach or only 1-	obvious; substrate	
Available Cover	by fish and/or	productive habitats			unstable or lacking.	
	macroinvertebrates. Four	present. (If near 70%	and	present. (If near 40%		
	or more productive	more than 3 go to		and more than 2 go to		
	habitats are present.	optimal.)		suboptimal.)		
SCORE 19	20 19 18 17 16	15/14/13/12/11		10 9 8 7 6	5 4 3 2 1	
Comments	Cobble/Gravel, Alis	atox weed, Lv	シレ			
	Gravel, cobble, and	Gravel, cobble and		Gravel, cobble, and	Gravel, cobble, and	
2.Embeddedness	boulders 0-25%	boulders 25-50%		boulder s are 50-75%	boulders are more than	
of Riffles	surrounded by fine	surrounded by fine		surrounded by fine	75% surrounded by fine	
	sediment. Layering of	sediment. Niches in		sediment. Niche space	sediment. Niche space is	
	cobble provides diversity	bottom layers of cobb	le	in middle layers of	reduced to a single layer	
	of niche space. If near	compromised. If near		cobble is starting to fill	or is absent.	
	25% drop to suboptimal if	50% & riffles not	54.1	with fine sediment.		
	riffle not layered cobble.	layered cobble drop to	,			
2	00	marginal.				
SCORE	20 19 18 (17) 16	15 14 13 12 14		10 9 8 7 6	5 4 3 2 1	
Comments Soundy substicute little time sed.						
	All four velocity/depth	Only 3 of the 4 regime	es	Only 2 of the 4 habitat	Dominated by 1	
3. Velocity/	regimes present (slow-	present (if fast-shallow		regimes present (if fast-	velocity/depth regime.	
Depth Regime	deep, slow-shallow, fast-	is missing score lower		shallow or slow-	Others regimes too small	
	deep, fast-shallow).	If slow-deep missing		shallow are missing,	or infrequent to support	
		score 15.		score low).	aquatic populations.	
SCODE 1						
SCORE 15	20 19 18 17 16	(15) 14 13 12 11		10 9 8 7 6	5 4 3 2 1	
Comments		(15) 14 13 12 11 deep, but all]	thers present	5 4 3 2 1	
		deep, but all	5	theis present		
	Vori little slow-		61	Hers DCSent Sediment deposition	Heavy deposits of fine	
Comments	Sediment deposition	deep, but all Sediment deposition	m a	theis present	Heavy deposits of fine material, increased bar	
Comments 4. Sediment	Sediment deposition affects less than 5% of	Sediment deposition affects 5-30% of stream bottom. Slight	m a	Hers DCSent Sediment deposition affects 30-50% of stream bottom.	Heavy deposits of fine material, increased bar development; more than	
Comments 4. Sediment	Sediment deposition affects less than 5% of stream bottom in quiet	Sediment deposition affects 5-30% of stream	m	hers DCSent Sediment deposition affects 30-50% of	Heavy deposits of fine material, increased bar development; more than 50% of the bottom	
Comments 4. Sediment	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or		Hers present Sediment deposition affects 30-50% of stream bottom. Sediment deposits at	Heavy deposits of fine material, increased bar development; more than	
Comments 4. Sediment	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction,	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools	
Comments 4. Sediment	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to	
Comments 4. Sediment	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment	
Comments 4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment	
Comments 4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
Comments 4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bav S	
Comments 4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.		Sediment deposition affects $30-50\%$ of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. $10 \ 9 \ 8 \ 7 \ 6$ Sed, Stable Grav	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
Comments 4. Sediment Deposition <u>SCORE</u> Comments 5. Channel Flow	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 bedrack free Water covers > 75% o		Sediment deposition affects $30-50\%$ of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. $10 \ 9 \ 8 \ 7 \ 6$ Sed. Stable Grav Water covers $25-75\%$	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as	
Comments 4. Sediment Deposition SCORE	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 beden Hee Water covers > 75% of		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. 10 9 8 7 6	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as standing pools. Little or no	
Comments 4. Sediment Deposition <u>SCORE</u> Comments 5. Channel Flow	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 brock blk free Water covers > 75% of streambed or 25% of productive habitat is		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. 10 9 8 7 6 Sed, Stable Grav Water covers 25-75% of streambed and/or productive habitat is	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as	
Comments 4. Sediment Deposition <u>SCORE</u> Comments 5. Channel Flow	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 brock blk free Water covers > 75% of streambed or 25% of productive habitat is		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. 10 9 8 7 6 Sed, Stable Grav Water covers 25-75% of streambed and/or productive habitat is	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as standing pools. Little or no productive habitat due to	
Comments 4. Sediment Deposition <u>SCORE</u> Comments 5. Channel Flow	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 brock blk free Water covers > 75% of streambed or 25% of productive habitat is		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. 10 9 8 7 6 Sed, Stable Grav Water covers 25-75% of streambed and/or productive habitat is	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as standing pools. Little or no productive habitat due to	
Comments 4. Sediment Deposition <u>SCORE</u> Comments 5. Channel Flow Status.	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. 15 14 13 12 11 best blk free Water covers > 75% of streambed or 25% of productive habitat is exposed.		Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition. 10 9 8 7 6 Sed Cable Grav Water covers 25-75% of streambed and/or productive habitat is mostly exposed.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. 5 4 3 2 1 el bavs Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.	

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

	HABITAT ASSESSMENT	FIELD SHEET- MODER	ATE TO HIGH	GRADIENT STREAMS	(BACK)
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DWR Station ID		Date	Assessors	
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.
	not affect reach.	natural flow patterns.		
SCORE 5	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	Historic Chann	tiration . Stabili	ercl, bridge US o	les not impact
7. Frequency of re-oxygenation Zones. Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re- oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re- oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re- oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water of flat bedrock; little opportunity for re- oxygenation. Distance between areas divided by average stream width >25
SCORE	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1
Comments	Two rittles los	ated @ bridge	+ DS @ Sampl	Note that we can be an a strength the second second
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) (3)	2 1 0
Comments		14. AND AND DESIGNATION OF THE PARTY	Land the second s	
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB)	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 (5) 4 3	Less than 50% of the bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0
Comments	No shrub, littl	e industory		
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	LB. small immed	diate AG. RB-	rem w/ ag tol	lavin 9

Total Score 126 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15

(See Protocol E for detailed descriptions and rank information)						
DWR Station ID:	SAKINDOG. 9MT	2.0		tat Assessment By: NC		
Monitoring Location		3	Date:		Time: 1/15	
Monitoring Location				Log Number:		
HUC:		S Group:	Ecore		Duplicate D Consensus	
	Optimal	Suboptimal		Marginal	Poor	
	Over 70% of stream reach	Natural stable habita		Natural stable habitat	Less than 20% stable	
1. Epifaunal	has natural stable habitat	covers 40-70% of st	ream	covers 20 -40% of	habitat; lack of habitat is	
Substrate/	suitable for colonization	reach. Three or more	e	stream reach or only 1-	obvious; substrate	
Available Cover	by fish and/or	productive habitats		2 productive habitats	unstable or lacking.	
	macroinvertebrates. Four	present. (If near 70%	6 and	present. (If near 40%		
25	or more productive	more than 3 go to		and more than 2 go to		
	habitats are present.	optimal.)		suboptimal.)		
SCORE 15	20 19 18 17 16	(15) 14 13 12 11	1	10 9 8 7 6	5 4 3 2 1	
Comments	0.11 10.11	VD(mininal)	1500			
	and the second		100			
2 Emboddadar	Gravel, cobble, and	Gravel, cobble and		Gravel, cobble, and	Gravel, cobble, and	
2.Embeddedness	boulders 0-25%	boulders 25-50%		boulder s are 50-75%	boulders are more than	
of Riffles	surrounded by fine	surrounded by fine		surrounded by fine	75% surrounded by fine	
	sediment. Layering of	sediment. Niches in		sediment. Niche space	sediment. Niche space is	
	cobble provides diversity	bottom layers of cob		in middle layers of	reduced to a single layer	
	of niche space. If near	compromised. If nea	ar	cobble is starting to fill	or is absent.	
	25% drop to suboptimal if	50% & riffles not		with fine sediment.		
	riffle not layered cobble.	layered cobble drop	to			
		marginal.				
SCORE []	20 19 18 (17) 16	15 14 13 12 1	1	10 9 8 7 6	5 4 3 2 1	
Comments	the sedimen	t minimal	1,1	riffle aleo	5(~1095)	
	All four velocity/depth	Only 3 of the 4 regin	nes	Only 2 of the 4 habitat	Dominated by 1	
3. Velocity/	regimes present (slow-	present (if fast-shallo		regimes present (if fast-	velocity/depth regime.	
Depth Regime	deep, slow-shallow, fast-	is missing score lowe		shallow or slow-	Others regimes too small	
	deep, fast-shallow).	If slow-deep missing		shallow are missing,	or infrequent to support	
\sim		score 15.		score low).	aquatic populations.	
SCORE	20 19 18 17 16	15 14 13 12 1		10 9 8 7 6	5 4 3 2 1	
Comments	All 4 present.	Larac pool a	bal	e, slight run, r	ffle + ifflelvun	
	Sediment deposition	Sediment deposition				
4. Sediment	affects less than 5% of	affects 5-30% of stre		Sediment deposition affects 30-50% of	Heavy deposits of fine	
Deposition	stream bottom in quiet				material, increased bar	
Deposition	areas. New deposition on	bottom. Slight		stream bottom.	development; more than	
	-	deposition in pool or slow areas. Some new		Sediment deposits at	50% of the bottom	
	islands and point bars is absent or minimal.			obstruction,	changing frequently; pools	
	ausent of minimal.	deposition on islands		constrictions and bends.	almost absent due to	
		and point bars. Move to marginal if build-u		Moderate pool	substantial sediment	
		approaches 30%.	ip	deposition.	deposition.	
SCORE 14	20 19 18 17 16			10 0 0 7 (
Comments				10 9 8 7 6	5 4 3 2 1	
Comments	Noticable in t	soollslow are	ay.	Little noted of	n bars	
	Water reaches base of	Water covers > 75%	101000	Water covers 25-75%	Very little water in channel	
5. Channel Flow	both lower banks and	streambed or 25% of	0	of streambed and/or	and mostly present as	
Status.	streambed is covered by	productive habitat is	1	productive habitat is	standing pools. Little or no	
	water throughout reach.	exposed.	1	mostly exposed.	productive habitat due to	
	Minimal productive				lack of water.	
	habitat is exposed.	^				
SCORE ()	20 19 18 17 16	15 14 13 12 11	1	10 9 8 7 6	5 4 3 2 1	
Comments	Island + 9	ravel point b	als	5 20		
	tyung of T	ravel point b	air			

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

		Date	Assessors	
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow
SCORE	downstream structures do not affect reach. 20 19 18 17 16	natural flow patterns.	10 9 8 7 6	5 4 3 2 1
Comments	Historic tor a	29 + boidge		
7. Frequency of re-oxygenation Zones. Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re- oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re- oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re- oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water o flat bedrock; little opportunity for re- oxygenation. Distance between areas divided by average stream width >2.
SCORE 4	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	DS OF POC			
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE 5(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE 7 (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0
Comments				
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE $\frac{\varphi}{(LB)}$	bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9	covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-	covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be	bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominat (> 50%)
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9	covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 7 6	covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0
 9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE Ψ (LB) SCORE (μ (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone 	bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9	covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $\frac{8}{7}$ $\frac{6}{6}$ $\frac{8}{7}$ $\frac{6}{6}$ Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally	covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are	bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominat (> 50%) 2 1 0 2 1 0
 9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE φ (LB) SCORE (ρ (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank. 	bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $\frac{8}{7}$ $\frac{6}{6}$ Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are	covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 Average width of riparian zone 6-11 meters. Score high if areas less than 12	bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominat (> 50%) 2 1 0 2 2 2 1 0 2 2 1 0 0 2 2
 9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE Ψ (LB) SCORE (μ (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone 	bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $\frac{8}{7}$ (6) $\frac{6}{6}$ Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 5 4 3 5 4 5 4 3 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4	bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominat (> 50%) 2 1 0 2 1 0 2 1 0 2 1 0 2 1 0 2 2 0 2 1 0 2 1 0

Total Score 147 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT))
(See Protocol E for detailed descriptions and rank information)	

	etailed descriptions and rank in	iformation)			- <u>-</u>	
DWR Station ID:	WallODD. GMT		Habitat Assessment By: NC GL			
Monitoring Location	Name: TNWOUVOUG	SSO	Date: 9/19/18 Time: 10/10			
Monitoring Location	1: Off Hwy Q		Field	Log Number:	(, 0	
HUC:		S Group:	Ecore		Duplicate Consensus	
	Optimal	Suboptimal		Marginal	Poor	
	Over 70% of stream reach	Natural stable habita	+	Natural stable habitat	Less than 20% stable	
1. Epifaunal	has natural stable habitat	covers 40-70% of st				
	and the second			covers 20 -40% of	habitat; lack of habitat is	
Substrate/	suitable for colonization	reach. Three or more	2	stream reach or only 1-	obvious; substrate	
Available Cover	by fish and/or	productive habitats		2 productive habitats	unstable or lacking.	
	macroinvertebrates. Four	present. (If near 70%	6 and	present. (If near 40%		
	or more productive	more than 3 go to		and more than 2 go to		
	habitats are present.	optimal.)		suboptimal.)		
SCORE 19	20 19 18 17 16	15 (14) 13 12 1	1	10 9 8 7 6	5 4 3 2 1	
Comments	Cobbletgravel 11	iotwad/LWD				
	A second very second	Contraction of the second s				
2 Embedded	Gravel, cobble, and	Gravel, cobble and		Gravel, cobble, and	Gravel, cobble, and	
2.Embeddedness	boulders 0-25%	boulders 25-50%		boulder s are 50-75%	boulders are more than	
of Riffles	surrounded by fine	surrounded by fine		surrounded by fine	75% surrounded by fine	
	sediment. Layering of	sediment. Niches in		sediment. Niche space	sediment. Niche space is	
	cobble provides diversity	bottom layers of cob		in middle layers of	reduced to a single layer	
	of niche space. If near	compromised. If nea	ar	cobble is starting to fill	or is absent.	
	25% drop to suboptimal if	50% & riffles not		with fine sediment.		
	riffle not layered cobble.	layered cobble drop	to			
	,	marginal.				
SCORE	20 19 18 (17) 16		1	10 9 8 7 6	5 4 3 2 1	
Comments	~10 embed	ded = cobb	te (amaralo	and the second sec	
	All four velocity/depth	Only 3 of the 4 regin		Only 2 of the 4 habitat	Deminster II 1	
3. Velocity/	regimes present (slow-				Dominated by 1	
Depth Regime		present (if fast-shallo		regimes present (if fast-	velocity/depth regime.	
Depth Regime	deep, slow-shallow, fast-	is missing score low		shallow or slow-	Others regimes too small	
	deep, fast-shallow).	If slow-deep missing		shallow are missing,	or infrequent to support	
SCORE	20 19 18 17 16	score 15.		score low).	aquatic populations.	
Comments		(15) 14 13 12 1				
Comments	No Slaw-deep	rittle au	$\sim c$	omplex prima.		
	Sediment deposition	Sediment deposition		Sediment deposition	Heavy deposits of fine	
4. Sediment	affects less than 5% of	affects 5-30% of stre	am	affects 30-50% of	material, increased bar	
Deposition	stream bottom in quiet	bottom. Slight		stream bottom.	development; more than	
	areas. New deposition on	deposition in pool or		Sediment deposits at	50% of the bottom	
	islands and point bars is	slow areas. Some nev		obstruction,	changing frequently; pools	
	absent or minimal.	deposition on islands		constrictions and bends.	almost absent due to	
		and point bars. Mov		Moderate pool	substantial sediment	
		to marginal if build-u		deposition.	deposition.	
~		approaches 30%.			-F second	
SCORE	20 19 18 17 16	15 14 13 (12) 1	1	10 9 8 7 6	5 4 3 2 1	
Comments	Podes have obv		1	(0Ca)		
	Water reaches base of	Water covers > 75%		Water covers 25-75%	Very little water in channel	
5. Channel Flow	both lower banks and	streambed or 25% of		of streambed and/or	and mostly present as	
Status.	streambed is covered by	productive habitat is		productive habitat is	standing pools. Little or no	
	water throughout reach.	exposed.	1	mostly exposed.	productive habitat due to	
	Minimal productive				lack of water.	
	habitat is exposed.					
SCORE	20 19 18 17 16	15 14 13 12 1	1	10 9 8 7 6	5 4 3 2 1	
Comments	Meanderingin	allow atra		water in 90%	7	
	1 cander what	allow stice	mi	water in 90%	0	

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID		Date	Assessors	
	Ontimal		Marginal	Poor
	Optimal Channelization dradging	Suboptimal	Channelization,	Over 80% of reach
	Channelization, dredging	Channelization, dredging		
6. Channel	rock removal or 4-wheel	or 4-wheel activity up to	dredging or 4-wheel	channelized, dredged or
Alteration	activity (past or present)	40%. Channel has	activity 40-80% (or less	affected by 4-wheelers.
	absent or minimal; natural	stabilized. If larger	that has not stabilized.)	Instream habitat greatly
	meander pattern. NO	reach, channelization is	Artificial structures in	altered or removed.
	artificial structures in	historic and stable.	or out of reach may	Artificial structures have
	reach. Upstream or	Artificial structures in or	have slight affect.	greatly affected flow
	downstream structures do	out of reach do not affect		pattern.
	not affect reach.	natural flow patterns.		
SCORE 5	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	Old bridge rem	ains DS, pilinas	erecting issue w	1 debis collection
	Occurrence of re-	Occurrence of re-	Occasional re-	Generally all flat water or
7. Frequency of	oxygenation zones	oxygenation zones	oxygenation area. The	flat bedrock; little
re-oxygenation	relatively frequent; ratio	infrequent; distance	distance between areas	opportunity for re-
zones. Use	of distance between areas	between areas divided by	divided by average	oxygenation. Distance
frequency of riffle or	divided by average stream	average stream width is	stream width is over 15	between areas divided by
bends for category.	width <7:1.	7 - 15.	and up to 25.	average stream width >25
Rank by quality.			-	-
SCORE U	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	Primainly ri	Helvin win	And the second se	
	Banks stable; evidence of	Moderately stable;	Moderately unstable;	Unstable; many eroded
8. Bank Stability	erosion or bank failure	infrequent, small areas of	30-60 % of bank in	area; raw areas frequent
(score each bank)	absent or minimal; little	erosion mostly healed	reach has areas of	along straight sections
Determine left or right side by facing	potential for future	over. 5-30% of bank in	erosion; high erosion	and bends; obvious bank
downstream.	problems <5% of bank	reach has areas of	potential during floods,	sloughing; 60-100% of
	affected.	erosion. If approaching	If approaching 60%	bank has erosional scars.
		30% score marginal if	score poor if banks	
-		banks steep.	steep.	
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE S(RB)	Right Bank 10 9	8 7 6	5 4 (3)	2 1 0
Comments		on both bou	KS	
and the second	reavy crosion	and the second se		
	More than 90% of the	70-90% of the bank	50-70% of the bank	Less than 50% of the
	More than 90% of the bank covered by	70-90% of the bank covered by undisturbed	50-70% of the bank covered by undisturbed	bank covered by
	More than 90% of the	70-90% of the bank covered by undisturbed vegetation. One class	50-70% of the bank covered by undisturbed vegetation. Two	bank covered by undisturbed vegetation or
Protective (score each bank)	More than 90% of the bank covered by	70-90% of the bank covered by undisturbed vegetation. One class may not be well	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation	bank covered by undisturbed vegetation or more than 2 classes are
Protective (score each bank) includes vegetation	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs,	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well	bank covered by undisturbed vegetation or more than 2 classes are not well represented or
Protective (score each bank) includes vegetation from top of bank to base	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been
Protective (score each bank) includes vegetation	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB)	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 (7) (6)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0
(score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream <u>SCORE (LB)</u> <u>SCORE (RB)</u>	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $8 \qquad 7 \qquad 6 \qquad 8 \qquad 7 \qquad 8 \qquad 8 \qquad 7 \qquad 8 \qquad 8 \qquad 8 \qquad 8 \qquad 8$	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common ($30-50%$). 5 4 3 5 4 3	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB)	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 (7) (6) (< 30%) 8 (7) (6) (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 5 4 3 5 4 3	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 C. Mature Average width of riparian	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 7 6 8 7 6 8 7 6 8 7 6 8 7 6	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 5 4 3 5 4 3 5 4 3 5 4 3	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 Average width of riparian
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 7 6 8 7 7 7 7 6 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 CSENT Nathes Average width of riparian zone 6-11	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 2 1 0 2 1 0 2 6 meters. Score
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream <u>SCORE (LB)</u> <u>SCORE (RB)</u> Comments 10. Riparian Vegetative Zone	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters. Unpaved footpaths may	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) <u>8</u> 7 6 <u>8</u> 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 5 4 3 5 5 6 8 0 8 0 8 0 9	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 2 Average width of ripariar zone <6 meters. Score high if areas less than 6
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Compared to grow of the shore of	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) <u>8 (7) (6)</u> <u>8 (7) (7) (7) (7) (7) (7) (7) (7) (7) (7)</u>	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 CSENT	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 Average width of ripariar zone <6 meters. Score high if areas less than 6 meters are small or are
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters. Unpaved footpaths may	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 5 4 3 CSENT Wather Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 2 Average width of ripariar zone <6 meters. Score high if areas less than 6
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian Vegetative Zone Width	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Compared for the plant of the pl	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 7 6 8 7 7 8 7 6 8 7 7 8	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 CSENT Native Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank. SCORE (LB)	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Comment of Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $\underbrace{8 7 6}_{8 7 6}$ $\underbrace{7 6}_{8 7 6}$ $\underbrace{7 6}_{8 7 6}$ Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed. $\underbrace{8 7 6}_{8 7 6}$	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 CSENT Native Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed. 5 4 3	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed. 2 1 0
Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9 Right Bank 10 9 Compared for the plant of the pl	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) $\underbrace{8 7 6}_{8 7 6}$ 4 wode(stor y y y y y y y y y y	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). 5 4 3 5 4 3 5 4 3 csect Natree Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed. 5 4 3 csect $csect$	bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0 2 1 0 Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed. 2 1 0 2 1 0 2 1 0

Total Score 140 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

DWR Station ID:Outsoil 8MTHabitat Assessment By:GTUMonitoring LocationName:LouiseCreekDate:9-19-18Time:1045Monitoring Location:Making ford ColField Log Number:Time:1045HUC:WS Group:Ecoregion:QC:Duplicated ConstHUC:OptimalSuboptimalMarginalPoorOver 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.Natural stable habitats present. (If near 70% and more than 3 go to optimal.)PoorSCORE201918171615141312111098765432CommentsCommentsCobbled graved //leafpackDespice ack15141312111098765432	ble pitat is
Monitoring Location: Marking ford Cd Field Log Number: HUC: WS Group: Ecoregion: QC: □ Duplicate □ Conservation HUC: Optimal Suboptimal Marginal Poor 1. Epifaunal Substrate/ Over 70% of stream reach has natural stable habitat suitable for colonization or more productive habitats are present. Natural stable habitat productive habitats are present. Natural stable habitats are present. Natural stable habitats are present. If near 70% and more than 3 go to optimal.) Natural stable or lacking present. SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	ble pitat is
Monitoring Location: Natural ford Cd Field Log Number: HUC: WS Group: Ecoregion: QC: □ Duplicate □ Conservation Optimal Suboptimal Marginal Poor 1. Epifaunal Over 70% of stream reach Natural stable habitat Natural stable habitat Natural stable habitat covers 40-70% of stream Natural stable habitat covers 20 -40% of habitat; lack of habitat; Substrate/ suitable for colonization productive habitats productive habitats present. (If near 70% and present. (If near 40% and more than 2 go to obvious; substrate Available Cover 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	ble pitat is
HUC: WS Group: Ecoregion: QC: Duplicate Construction 0 Optimal Suboptimal Marginal Poor 1. Epifaunal Over 70% of stream reach Natural stable habitat Natural stable habitat covers 40-70% of stream Natural stable habitat covers 20 -40% of habitat; lack of habitat Substrate/ suitable for colonization reach. Three or more stream reach or only 1- obvious; substrate Available Cover by fish and/or productive habitats present. (If near 70% and present. (If near 40% and more than 2 go to and more than 2 go to habitats are present. optimal.) suboptimal.) suboptimal.) suboptimal. and more than 2 go to	ble pitat is
OptimalSuboptimalMarginalPoor1. EpifaunalOver 70% of stream reach has natural stable habitat suitable for colonization by fish and/or or more productive habitats are present.Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)Natural stable habitat covers 20 -40% of 	ble pitat is
1. Epifaunal Substrate/ Available Cover Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present. Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.) Natural stable habitat covers 20 -40% of stream reach or only 1- 2 productive habitats present. (If near 40% and more than 2 go to suboptimal.) Less than 20% sta habitat; lack of hal obvious; substrate unstable or lacking stream	oitat is
1. Epifaunal Substrate/ Available Coverhas natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)covers 20 -40% of stream reach or only 1- 2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)habitat; lack of hal obvious; substrate unstable or lacking1. Epifaunal Substrate/ Available Coverhas natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)covers 20 -40% of stream reach or only 1- 2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)habitat; lack of hal obvious; substrate unstable or lacking	oitat is
Substrate/ Available Cover suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present. reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.) stream reach or only 1- 2 productive habitats present. (If near 40% and more than 2 go to suboptimal.) obvious; substrate unstable or lacking obvious; substrate	
Available Cover by fish and/or macroinvertebrates. Four or more productive habitats are present. productive habitats present. (If near 70% and more than 3 go to optimal.) 2 productive habitats present. (If near 40% and more than 2 go to suboptimal.) unstable or lacking SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	
macroinvertebrates. Four or more productive habitats are present. present. (If near 70% and more than 3 go to optimal.) present. (If near 40% and more than 2 go to suboptimal.) SCORE 20 19 18 17 16 15 14 13 12 11 (10) 9 8 7 6 5 4 3 2	5.
or more productive habitats are present.more than 3 go to optimal.)and more than 2 go to suboptimal.)SCORE201918171615141312111098765432	6
habitats are present. optimal.) suboptimal.) SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	
habitats are present. optimal.) suboptimal.) SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2	
SCORE / 20 19 18 17 16 15 14 13 12 11 (10) 9 8 7 6 5 4 3 2	
	1
Coopies grand / real poek	
Gravel, cobble, and Gravel, cobble and Gravel, cobble, and Gravel, cobble, and	
2.Embeddedness boulders 0-25% boulders 25-50% boulder s are 50-75% boulders are more	
of Riffles surrounded by fine surrounded by fine 75% surrounded b	y fine
sediment. Layering of sediment. Niches in sediment. Niche space sediment. Niche s	pace is
cobble provides diversity bottom layers of cobble in middle layers of reduced to a single	
of niche space. If near compromised. If near cobble is starting to fill or is absent.	
25% drop to suboptimal if 50% & riffles not with fine sediment.	
riffle not layered cobble. layered cobble drop to	
marginal.	
SCORE 20 19 18 17 (16) 15 14 13 12 11 10 9 8 7 6 5 4 3 2	1
Comments ~20% embedded by silt/sand mixture	1
3. Velocity / All four velocity/depth regimes present (slow- present (if fast-shallow regimes present (if fast-velocity/depth	
Depth Regime deep, slow-shallow, fast- is missing score lower). shallow or slow- Others regimes too	
deep, fast-shallow). If slow-deep missing shallow are missing, or infrequent to sup	
score 15. score low). aquatic populations.	
	1
Comments No slow-deep + very little Fast deep	
Sediment deposition Sediment deposition Heavy deposits of fi	ne
4. Sediment affects less than 5% of affects 5-30% of stream affects 30-50% of material, increased l	
Deposition stream bottom in quiet bottom. Slight stream bottom. development; more	
areas. New deposition on deposition in pool or Sediment deposits at 50% of the bottom	inan
islands and point bars is slow areas. Some new obstruction, changing frequently	nools
absent or minimal. deposition on islands constrictions and bends. almost absent due to	
advent of minimal. and point bars. Move Moderate pool substantial sediment	
approaches 30%.	
	1
Comments deposition less than 5% but still prepent	
Water reaches base of Water covers > 75% of Water covers 25-75% Very little water in o	hannel
5. Channel Flow both lower banks and streambed or 25% of of streambed and/or and mostly present a	IS
Status. streambed is covered by productive habitat is productive habitat is standing pools. Litt	
water throughout reach. exposed. mostly exposed. productive habitat d	
Minimal productive lack of water.	
habitat is exposed.	
	1
	<u> </u>
Comments HD covers majority of steambed.	

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK) **DWR Station ID** Date Assessors Marginal Optimal **Suboptimal** Poor Channelization, dredging Channelization, dredging Channelization, Over 80% of reach or 4-wheel activity up to dredging or 4-wheel channelized, dredged or rock removal or 4-wheel 6. Channel activity 40-80% (or less affected by 4-wheelers. 40%. Channel has activity (past or present) Alteration that has not stabilized.) Instream habitat greatly absent or minimal; natural stabilized. If larger altered or removed. meander pattern. NO reach, channelization is Artificial structures in Artificial structures have artificial structures in historic and stable. or out of reach may reach. Upstream or Artificial structures in or have slight affect. greatly affected flow downstream structures do out of reach do not affect pattern. natural flow patterns. not affect reach. (15 / 14 , 13 12 11 10 SCORE 20 19 18 17 16 9 8 7 6 5 4 3 2 1 Historically Moved 1nl aa Comments Occurrence of re-Generally all flat water or Occurrence of re-Occasional re-7. Frequency of oxygenation zones oxygenation zones oxygenation area. The flat bedrock: little re-oxygenation relatively frequent; ratio infrequent; distance distance between areas opportunity for reoxygenation. Distance of distance between areas between areas divided by divided by average zones. Use divided by average stream average stream width is stream width is over 15 between areas divided by frequency of riffle or bends for category. average stream width >25. width <7:1. 7 - 15. and up to 25. Rank by quality. (15) 14 13 5 4 20 19 18 11 10 9 8 7 3 2 SCORE 17 16 12 6 1 r.the @ collection One upstram near bidge Comments 1 longer SITE Moderately stable: Moderately unstable; Unstable; many eroded Banks stable: evidence of 8. Bank Stability infrequent, small areas of 30-60 % of bank in area; raw areas frequent erosion or bank failure (score each bank) erosion mostly healed along straight sections reach has areas of absent or minimal; little Determine left or right and bends; obvious bank over. 5-30% of bank in erosion; high erosion potential for future side by facing sloughing; 60-100% of reach has areas of potential during floods, problems <5% of bank downstream. bank has erosional scars. erosion. If approaching If approaching 60% affected. 30% score marginal if score poor if banks steep. banks steep. SCORE 6 5 4 0 (LB) Left Bank 10 9 8 5 (RB) 5 SCORE **Right Bank** 10 9 8 7 6 4 3 2 0 Comments 70-90% of the bank 50-70% of the bank Less than 50% of the More than 90% of the 9. Vegetative bank covered by covered by undisturbed covered by undisturbed bank covered by Protective undisturbed vegetation. vegetation. One class vegetation. Two undisturbed vegetation or (score each bank) All 4 classes (mature trees, may not be well classes of vegetation more than 2 classes are includes vegetation understory trees, shrubs, represented. Disruption may not be well not well represented or from top of bank to base groundcover) are evident but not effecting represented. Non-native most vegetation has been of bank. Determine left represented and allowed cropped. Non-native full plant growth. Nonvegetation may be or right side by facing downstream to grow naturally. All natives are rare (< 30%) common (30-50%). vegetation may dominate plants are native. (> 50%) 2 SCORE (LB) Left Bank 10 0 9 8 6 5 4 3 9 5 4 0 SCORE (RB) Right Bank 10 3 8 6 all V JER amain ground cover **Comments** NO rea ban Sm of dr Average width of riparian Average width of riparian Average width of Average width of 10. Riparian zone > 18 meters. riparian zone 12-18 riparian zone 6-11 zone <6 meters. Score **Vegetative Zone** Unpaved footpaths may meters. Score high if meters. Score high if high if areas less than 6 areas < 18 meters are areas less than 12 meters are small or are score 9 if run-off potential Width (score each bank.) Zone meters are small or are minimally disturbed. is negligible. small or are minimally begins at top of bank. disturbed. minimally disturbed. SCORE (/ (LB) Left Bank 10 9 8 6 5 4 3 2 10 9 5 4 SCORE ()(RB) **Right Bank** 8 6 0 Comments

Total Score Total Score Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines , result of (circle): Natural Conditions or Human Disturbance Describe:

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS

STREAM NAME	LOCATION	
SITE ID # REACH ID	STREAM CLASS	
UTM N UTM E	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE TIME	REASON FOR SURVEY

	Habitat		Condition	Category	
	Parameter	Optimal	Suboptimal	Marginal	Poor
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
sampling reach	2. Embeddedness	Gravel, cobble, and boulder particles are 0- 25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25- 50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50- 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
ed in	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Parameters to be evaluated in sampling reach	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow- deep, slow-shallow, fast- deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast- shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
Irame	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Pa	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Condition Category Habitat Optimal Suboptimal Marginal Parameter Poor Banks shored with gabion Channelization or Some channelization Channelization may be 6. Channel dredging absent or Alteration present, usually in areas extensive; embankments or cement; over 80% of minimal; stream with of bridge abutments; or shoring structures the stream reach present on both banks; evidence of past channelized and normal pattern. channelization, i.e., and 40 to 80% of stream disrupted. Instream dredging, (greater than reach channelized and habitat greatly altered or past 20 yr) may be disrupted. removed entirely. present, but recent channelization is not present. 20 19 18 17 15 14 (13) 12 11 10 5 4 3 2 1 SCORE 16 - 9 8 7 6 0 Occurrence of riffles Occurrence of riffles Occasional riffle or bend; Generally all flat water or relatively frequent; ratio bottom contours provide 7. Frequency of infrequent; distance shallow riffles; poor of distance between riffles between riffles divided by some habitat; distance habitat; distance between Riffles (or bends) divided by width of the the width of the stream is between riffles divided by riffles divided by the stream <7:1 (generally 5 between 7 to 15. the width of the stream is width of the stream is a to 7); variety of habitat is ratio of >25. between 15 to 25. key. In streams where riffles are continuous, broader than sampling reach placement of boulders or other large, natural obstruction is important. 19 18 17 16 9 (8) 7 5 4 3 2 1 SCORE 20 15 14 13 12 11 10 6 0 Banks stable: evidence of Moderately stable; Moderately unstable: 30-Unstable: many eroded infrequent, small areas of 8. Bank Stability erosion or bank failure 60% of bank in reach has areas; "raw" areas (score each bank) absent or minimal; little erosion mostly healed areas of erosion; high frequent along straight potential for future over. 5-30% of bank in erosion potential during sections and bends; problems. <5% of bank Note: determine left reach has areas of erosion. floods obvious bank sloughing; Parameters to be evaluated or right side by affected. 60-100% of bank has facing downstream. erosional scars. SCORE (LB) (4)Left Bank 10 9 8 7 6 5 3 2 1 0 SCORE (RB) Right Bank 10 9 8 7 5 $\begin{pmatrix} 4 \end{pmatrix}$ 3 2 1 6 0 More than 90% of the 70-90% of the 50-70% of the Less than 50% of the 9. Vegetative streambank surfaces and streambank surfaces streambank surfaces streambank surfaces Protection (score immediate riparian zone covered by native covered by vegetation; covered by vegetation; covered by native disruption obvious; disruption of streambank each bank) vegetation, but one class vegetation, including of plants is not wellpatches of bare soil or vegetation is very high; trees, understory shrubs, represented; disruption closely cropped vegetation vegetation has been or nonwoody evident but not affecting common; less than oneremoved to macrophytes; vegetative half of the potential plant full plant growth potential 5 centimeters or less in disruption through to any great extent; more stubble height remaining. average stubble height. grazing or mowing than one-half of the minimal or not evident; potential plant stubble almost all plants allowed height remaining. to grow naturally. Left Bank 10 9 SCORE (LB) 8 7 (6)5 4 3 2 0 1 7 (6)5 0 SCORE Right Bank 10 9 8 4 3 2 (RB) Width of riparian zone Width of riparian zone Width of riparian zone 6-Width of riparian zone <6 10. Riparian >18 meters; human 12-18 meters: human 12 meters: human meters: little or no Vegetative Zone activities (i.e., parking activities have impacted activities have impacted riparian vegetation due to lots, roadbeds, clear-cuts, Width (score each zone only minimally. zone a great deal. human activities. bank riparian zone) lawns, or crops) have not impacted zone. Left Bank 10 3 2 SCORE (LB) 9 8 7 (6)5 4 1 0 (4) SCORE (RB) Right Bank 10 9 8 7 6 5 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

	etailed descriptions and rank in	formation)			
DWR Station ID:			Habi	tat Assessment By: NC	JC GTL
Monitoring Location	Name: Big McAaloo	Creek	Dates	9/20/18	Time: 1225
Monitoring Location	1: US Cholson Rd. T	Bridge	Field	Log Number:	
HUC:		S Group:	Ecore		Duplicate Consensus
	Optimal	Suboptimal	Leon	Marginal	Poor
	Over 70% of stream reach	Natural stable habita			
1. Epifaunal	Carlo and a second s	CERTIFICATION OF CONTRACT CONTRACTOR CONTRACTOR		Natural stable habitat	Less than 20% stable
	has natural stable habitat	covers 40-70% of st		covers 20 -40% of	habitat; lack of habitat is
Substrate/	suitable for colonization	reach. Three or mor	e	stream reach or only 1-	obvious; substrate
Available Cover	by fish and/or	productive habitats		2 productive habitats	unstable or lacking.
	macroinvertebrates. Four	present. (If near 70%	6 and	present. (If near 40%	
	or more productive	more than 3 go to		and more than 2 go to	
2	habitats are present.	optimal.)		suboptimal.)	
SCORE 1	20 19 18 17 16	15 14 13 (12)1	1	10 9 8 7 6	5 4 3 2 1
Comments	Gravel + cobble / 10		2600°		
		press of the state	2 DA C		
	Gravel, cobble, and	Gravel, cobble and		Gravel, cobble, and	Gravel, cobble, and
2.Embeddedness	boulders 0-25%	boulders 25-50%		boulder s are 50-75%	boulders are more than
of Riffles	surrounded by fine	surrounded by fine		surrounded by fine	75% surrounded by fine
	sediment. Layering of	sediment. Niches in		sediment. Niche space	sediment. Niche space is
	cobble provides diversity	bottom layers of cob	oble	in middle layers of	reduced to a single layer
	of niche space. If near	compromised. If ne		cobble is starting to fill	or is absent.
	25% drop to suboptimal if	50% & riffles not		with fine sediment.	
	riffle not layered cobble.	layered cobble drop	to		
. / .		marginal.	10		
SCORE	20 19 18 17 16		11	10 9 8 7 6	5 4 3 2 1
Comments		redded			
	The second state of the part of the second state of the second sta				
2 Valasitul	All four velocity/depth	Only 3 of the 4 regir		Only 2 of the 4 habitat	Dominated by 1
3. Velocity/	regimes present (slow-	present (if fast-shall		regimes present (if fast-	velocity/depth regime.
Depth Regime	deep, slow-shallow, fast-	is missing score low		shallow or slow-	Others regimes too small
	deep, fast-shallow).	If slow-deep missing		shallow are missing,	or infrequent to support
()		score 15.		score low).	aquatic populations.
SCORE 14	20 19 18 17 16	15 (14) 13 12	11	10 9 8 7 6	5 4 3 2 1
Comments	No deep tast.				
	Sediment deposition	Sediment deposition		Sediment deposition	Heavy deposits of fine
4. Sediment	affects less than 5% of	affects 5-30% of stre		affects 30-50% of	material, increased bar
Deposition	stream bottom in quiet	bottom. Slight		stream bottom.	development; more than
Deposition	areas. New deposition on	deposition in pool or		Sediment deposits at	50% of the bottom
	islands and point bars is	slow areas. Some ne	· · · · · ·	obstruction,	changing frequently; pools
	absent or minimal.	deposition on islands		constrictions and bends.	almost absent due to
	absent of minimar.	and point bars. Mov			
	×.			Moderate pool	substantial sediment
		to marginal if build-	up	deposition.	deposition.
SCORE 10	\sim	approaches 30%.			
SCOLE . ~	20 19 18 17 (16)		1	10 9 8 7 6	5 4 3 2 1
Comments	Deposition	in pools, m	ini	mal	
	Water reaches base of	Water covers > 75%	of	Water covers 25-75%	Very little water in channel
5. Channel Flow	both lower banks and	streambed or 25% of		of streambed and/or	and mostly present as
Status.	streambed is covered by	productive habitat is		productive habitat is	standing pools. Little or no
Status,	water throughout reach.	exposed.		mostly exposed.	productive habitat due to
	Minimal productive			in poord.	lack of water.
-	habitat is exposed.				nuck of water.
SCORE 5	20 19 18 17 16	15 14 13 12 1	1	10 9 8 7 6	5 4 3 2 1
Comments	Gravel has	S+ Island	SU	throughout ~s	small in Size
	Draver has	> + +slavo	21	throughows -	small in size

Division of Water Resources Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID		Date	Assessors	
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.
SCORE (5	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	Historically 1	or ag field		
Comments		and the second		C
7. Frequency of re-oxygenation Zones. Use frequency of riffle or bends for category. Rank by quality. SCORE	Occurrence of re- oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re- oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re- oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25. (10) 9 8 7 6	Generally all flat water of flat bedrock; little opportunity for re- oxygenation. Distance between areas divided by average stream width >2:
Comments	Few - small	riffles	0	
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 (3)	2 1 0
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments	Heavy erosic	in on each ba	n K. Neally Jerth	cal bonk
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream SCORE (LB) SCORE (RB)	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9 Right Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%). (5) 4 3 (5) 4 3	Less than 50% of the bank covered by undisturbed vegetation on more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0 2 1 0
	NO shrubs			GLINS
Comments			Average width of	Average width of riparian
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
10. Riparian Vegetative Zone Width (score each bank.) Zone	zone > 18 meters. Unpaved footpaths may score 9 if run-off potential	riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally	riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are	high if areas less than 6 meters are small or are

Total Score $// (\rho)$ Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines , result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information) DWR Station ID: Spr. 3.770-4MT Monitoring Location Name: Spr. ng Creek UNT Habitat Assessment By: A Date: 1013115 Time: 0947 Monitoring Location: Field Log Number: INS Hny-HUC: Ecoregion: WS Group: QC: Duplicate Consensus Optimal **Suboptimal** Marginal Poor Over 70% of stream reach Natural stable habitat Natural stable habitat Less than 20% stable 1. Epifaunal has natural stable habitat covers 40-70% of stream covers 20 -40% of habitat; lack of habitat is Substrate/ suitable for colonization reach. Three or more stream reach or only 1obvious; substrate **Available Cover** by fish and/or productive habitats 2 productive habitats unstable or lacking. macroinvertebrates. Four present. (If near 70% and present. (If near 40% or more productive more than 3 go to and more than 2 go to habitats are present. optimal.) suboptimal.) SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 6 5 4 **Comments** D + LWP Cobble Gravel Gravel, cobble, and Gravel, cobble and Gravel, cobble, and Gravel, cobble, and 2.Embeddedness boulders 0-25% boulders 25-50% boulder s are 50-75% boulders are more than of **Riffles** surrounded by fine surrounded by fine surrounded by fine 75% surrounded by fine sediment. Layering of sediment. Niches in sediment. Niche space sediment. Niche space is cobble provides diversity bottom layers of cobble in middle layers of reduced to a single laver of niche space. If near compromised. If near cobble is starting to fill or is absent. 25% drop to suboptimal if 50% & riffles not with fine sediment. riffle not layered cobble. layered cobble drop to marginal. SCORE 19 18 20 17 16 (15) 14 13 12 11 10 9 8 7 6 5 4 2 3 **Comments** N30% All four velocity/depth Only 3 of the 4 regimes Only 2 of the 4 habitat Dominated by 1 3. Velocity/ regimes present (slowpresent (if fast-shallow regimes present (if fastvelocity/depth regime. **Depth Regime** deep, slow-shallow, fastis missing score lower). shallow or slow-Others regimes too small If slow-deep missing deep, fast-shallow). shallow are missing, or infrequent to support score 15. score low). aquatic populations. SCORE 20 19, 18 17 16 15 14 13 12 11 10 9 8 6 5 4 2 3 NO Slow Comments dup Sediment deposition Sediment deposition Sediment deposition Heavy deposits of fine 4. Sediment affects less than 5% of affects 5-30% of stream affects 30-50% of material, increased bar Deposition stream bottom in quiet bottom. Slight stream bottom. development: more than areas. New deposition on deposition in pool or 50% of the bottom Sediment deposits at islands and point bars is slow areas. Some new obstruction. changing frequently; pools absent or minimal. deposition on islands constrictions and bends. almost absent due to and point bars. Move Moderate pool substantial sediment to marginal if build-up deposition. deposition. approaches 30%. 14 13 12 11 SCORE 20 19 18 17 16 15 10 9 8 7 6 5 4 2 3 1 <570 Comments To post tion Water reaches base of Water covers > 75% of Water covers 25-75% Very little water in channel both lower banks and streambed or 25% of of streambed and/or 5. Channel Flow and mostly present as streambed is covered by productive habitat is productive habitat is standing pools. Little or no Status. water throughout reach. exposed. mostly exposed. productive habitat due to Minimal productive lack of water. habitat is exposed. SCORE 20 19 18 17 16 15 14 13 12 11 10 9 5 8 7 6 4 3 2 1 E.C. **Comments** Narrows icantly 6

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

DWR Station ID	ABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK) OWR Station ID Date Assessors					
	Optimal	Suboptimal	Marginal	Poor		
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.		
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1		
Comments	Nerry I. Helle 10) rad clossin	29			
7. Frequency of re-oxygenation Zones. Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re- oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re- oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re- oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re- oxygenation. Distance between areas divided by average stream width >25.		
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1		
Comments	little wir	leach, Iona				
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
SCORE 4 (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0		
SCORE 4 (RB)	Right Bank 10 9	8 7 6	5 (4) 3	2 1 0		
Comments						
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native. Left Bank 10 9	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%) 8 72 6	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0		
SCORE (RB)	Right Bank 10 9	8 (7) 6	5 4 3	2 1 0		
Comments						
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.		
SCORE (LB) SCORE (RB)	Left Bank 10 9 Right Bank 10 9	8 <u>7</u> 6 8 (7) 6	5 4 3	2 1 0 2 1 0		
Comments		15m away				
			and the second			

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

Total Score 144 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources

Division of water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

	etailed descriptions and rank in	formation)						
	DWR Station ID: Bacte DO LUMT Habitat Assessment By: MC BTP							
Monitoring Location	Monitoring Location Name: Bartac Brangh				Time: 1000			
Monitoring Location	ad		Log Number:					
HUC:		S Group:	Ecore		Duplicate Consensus			
	Optimal	Suboptimal	Leon					
	Over 70% of stream reach			Marginal	Poor			
1 Enifounal		Natural stable habita		Natural stable habitat	Less than 20% stable			
1. Epifaunal	has natural stable habitat	covers 40-70% of st		covers 20 -40% of	habitat; lack of habitat is			
Substrate/	suitable for colonization	reach. Three or more	e	stream reach or only 1-	obvious; substrate			
Available Cover	by fish and/or	productive habitats		2 productive habitats	unstable or lacking.			
	macroinvertebrates. Four	present. (If near 70%	6 and	present. (If near 40%	-			
	or more productive	more than 3 go to		and more than 2 go to				
	habitats are present.	optimal.)		suboptimal.)				
SCORE 15	20 19 18 17 16	(15) 14 13 12 1	1	10 9 8 7 6	5 4 3 2 1			
Comments				the second s	5 4 3 2 1			
Comments	SWD, oyuhan	ging loors in	25	cobole/gravel	the second s			
	Gravel, cobble, and	Gravel, cobble and	0	Gravel, cobble, and	Gravel, cobble, and			
2.Embeddedness	boulders 0-25%	boulders 25-50%		boulder s are 50-75%	boulders are more than			
of Riffles	surrounded by fine	surrounded by fine		surrounded by fine	75% surrounded by fine			
	sediment. Layering of	sediment. Niches in		sediment. Niche space	sediment. Niche space is			
	cobble provides diversity	bottom layers of cob	bla	in middle layers of				
	of niche space. If near				reduced to a single layer			
		compromised. If near		cobble is starting to fill	or is absent.			
	25% drop to suboptimal if	50% & riffles not		with fine sediment.				
	riffle not layered cobble.	layered cobble drop	to					
		marginal.						
SCORE	20 19 18 17 16	15 14 13 12 1		10 9 8 7 6	5 4 3 2 1			
Comments	Time Sedime	nt around	Gra	avel which fi	ffle.			
	All four velocity/depth	Only 3 of the 4 regin	nes	Only 2 of the 4 habitat	Dominated by 1			
3. Velocity/	regimes present (slow-	present (if fast-shallo		regimes present (if fast-	velocity/depth regime.			
Depth Regime	deep, slow-shallow, fast-	is missing score lowe		shallow or slow-	Others regimes too small			
Depth Regime	deep, fast-shallow).	If slow-deep missing		shallow are missing,				
	deep, last-shallow).	score 15.			or infrequent to support			
SCORE 10	20 19 18 17 (16)	Constant of the second s		score low). 10 9 8 7 6	aquatic populations.			
Comments				O COL	5 4 3 2 1			
Comments			ow.	Ritflerrun / PO	0			
	Sediment deposition	Sediment deposition		Sediment deposition	Heavy deposits of fine			
4. Sediment	affects less than 5% of	affects 5-30% of stre	am	affects 30-50% of	material, increased bar			
Deposition	stream bottom in quiet	bottom. Slight		stream bottom.	development; more than			
-	areas. New deposition on	deposition in pool or		Sediment deposits at	50% of the bottom			
	islands and point bars is	slow areas. Some new		obstruction,	changing frequently; pools			
	absent or minimal.	deposition on islands		constrictions and bends.	almost absent due to			
	wooden of minimu.	and point bars. Mov		Moderate pool	substantial sediment			
		to marginal if build-u						
		approaches 30%.	¹ p	deposition.	deposition.			
SCORE 17	20 10 10 17 17			10 0 0				
SCORE	20 19 18 17 16	15 14 13 12 1		10 9 8 7 6	5 4 3 2 1			
Comments	~2570 in Slo	is water a	210	25				
	Water reaches base of	Water covers > 75%	of	Water covers 25-75%	Very little water in channel			
5. Channel Flow	both lower banks and			of streambed and/or	and mostly present as			
Status.	streambed is covered by			productive habitat is	standing pools. Little or no			
status.	water throughout reach.			mostly exposed.	productive habitat due to			
	Minimal productive			moony enposed.	lack of water.			
	habitat is exposed.				lack of water.			
SCORE 15		15 14 13 12 1	_	10 0 8 7 (
				10 9 8 7 6	5 4 3 2 1			
Comments	~2070 expo	sed. Enpr	ne	exposed nia	(CIFEL			
		and the second	and the second		the second s			

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

DWR Station ID	IENT FIELD SHEET- MO	Date	Assessors	
	Optimal	Suboptimal	Marginal	Poor
	Channelization, dredging	Channelization, dredging	Channelization,	Over 80% of reach
6. Channel	rock removal or 4-wheel	or 4-wheel activity up to	dredging or 4-wheel	channelized, dredged or
Alteration	activity (past or present)	40%. Channel has	activity 40-80% (or less	affected by 4-wheelers.
Alteration	absent or minimal; natural	stabilized. If larger	that has not stabilized.)	Instream habitat greatly
	meander pattern. NO	reach, channelization is	Artificial structures in	altered or removed.
	artificial structures in	historic and stable.	or out of reach may	Artificial structures have
	reach. Upstream or	Artificial structures in or	have slight affect.	greatly affected flow
	downstream structures do	out of reach do not affect		pattern.
	not affect reach.	natural flow patterns.		
SCORE 10	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	4 wheel pat	- present, rio	Iran added of	o stram bank
	Occurrence of re-	Occurrence of re-	Occasional re-	Generally all flat water or
7. Frequency of	oxygenation zones	oxygenation zones	oxygenation area. The	flat bedrock; little
re-oxygenation	relatively frequent; ratio	infrequent; distance	distance between areas	opportunity for re-
zones. Use	of distance between areas	between areas divided by	divided by average	oxygenation. Distance
frequency of riffle or	divided by average stream	average stream width is	stream width is over 15	between areas divided by
bends for category. Rank by quality.	width <7:1.	7 - 15.	and up to 25.	average stream width >25
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	Multiple rit	Mes in reach		
	Banks stable; evidence of	Moderately stable;	Moderately unstable;	Unstable; many eroded
8. Bank Stability	erosion or bank failure	infrequent, small areas of	30-60 % of bank in	area; raw areas frequent
(score each bank)	absent or minimal; little	erosion mostly healed	reach has areas of	along straight sections
Determine left or right	potential for future	over. 5-30% of bank in	erosion; high erosion	and bends; obvious bank
side by facing downstream.	problems <5% of bank	reach has areas of	potential during floods,	sloughing; 60-100% of
downstream.	affected.	erosion. If approaching	If approaching 60%	bank has erosional scars.
		30% score marginal if	score poor if banks	
9		banks steep.	steep.	
SCORE (LB)	Left Bank 10 (9)	8 7 6	5 4 3	2 1 0
SCORE (CRB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
Comments		in the second	steeted	I (1 500/ -64) -
0 Vegetative	More than 90% of the	70-90% of the bank	50-70% of the bank	Less than 50% of the bank covered by
9. Vegetative	bank covered by	covered by undisturbed	covered by undisturbed vegetation. Two	undisturbed vegetation or
Protective (score each bank)	undisturbed vegetation.	vegetation. One class	classes of vegetation	more than 2 classes are
includes vegetation	All 4 classes (mature trees, understory trees, shrubs,	may not be well represented. Disruption	may not be well	not well represented or
from top of bank to base	groundcover) are	evident but not effecting	represented. Non-native	most vegetation has been
of bank. Determine left	represented and allowed	full plant growth. Non-	vegetation may be	cropped. Non-native
or right side by facing downstream	to grow naturally. All	natives are rare (< 30%)	common (30-50%).	vegetation may dominate
-	plants are native.	hatives are fare (< 5076)	common (30-3070).	(> 50%)
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	Right Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (RB)				
SCORE (RB) Comments				on any statement of the second statement of the
Comments	Average width of riparian	Average width of	Average width of	
	Average width of riparian zone > 18 meters.	riparian zone 12-18	riparian zone 6-11	Average width of riparian zone <6 meters. Score
Comments	-	riparian zone 12-18 meters. Score high if	riparian zone 6-11 meters. Score high if	zone <6 meters. Score high if areas less than 6
Comments 10. Riparian	zone > 18 meters.	riparian zone 12-18 meters. Score high if areas < 18 meters are	riparian zone 6-11 meters. Score high if areas less than 12	zone <6 meters. Score high if areas less than 6 meters are small or are
Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone	zone > 18 meters. Unpaved footpaths may	riparian zone 12-18 meters. Score high if	riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are	zone <6 meters. Score high if areas less than 6
Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	riparian zone 12-18 meters. Score high if areas < 18 meters are	riparian zone 6-11 meters. Score high if areas less than 12	zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank. SCORE (LB)	zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed. 8 7 6	riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed. 5 4 3	zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

Total Score 145 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:

Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT) (See Protocol E for detailed descriptions and rank information)

Monitoring Location Name: $2 \downarrow 0 \downarrow c$ Date: $10 \Rightarrow c \uparrow c$ Time: $11 \Rightarrow$ Monitoring Location: $\Box \subseteq C \downarrow c \downarrow c$ Wis Group:Ecoregion:QC: \Box Duplicate \Box ConsensusUC:OptimalSubortateMatural stable habitatNatural stable habitatConsensusI. EpifaunalOver 70% of stream reachNatural stable habitatNatural stable habitatConsensusAvailable CoverVish and/orNatural stable habitatSubstratePoorAvailable CoverVish and/ormacroinvertbartes. FourProductive habitatsProsen. (If near 70% and more than 3 go to optimal.)Prosen. (If near 40% and more than 3 go to optimal.)SubstrateOpticate \Box OpticateOpticate \Box Opticate \Box OpticateOpticate \Box Opticate \Box <th< th=""><th></th><th>etailed descriptions and rank in</th><th>iormation)</th><th></th><th></th><th>- 1</th></th<>		etailed descriptions and rank in	iormation)			- 1				
Monitoring Location:Solution of the section is address of the section	and the second se	DWR Station ID: REDDJUINT Habitat Assessment By: NGZ GTL								
HUC:WS Group:*Ecoresian:QC:Duplicat C ConsensusOver 70% of stream reach has natural stable habitat suitable for colonization macroinverbartes. Four more productive habitats and more than 3 go to optimal.Marual stable habitat covers 40.70% of stream reach mere than 3 go to optimal.Marual stable habitat covers 40.70% of stream reach mere than 3 go to optimal.Marual stable habitat covers 40.70% of stream reach mere than 3 go to optimal.Marual stable habitat covers 40.70% of stream reach mere than 3 go to optimal.Marual stable habitat covers 40.70% of stream reach or only 1- present. (If near 40% and more than 2 go to suboptimal.)Depresent. (If near 40% and more than 2 go to suboptimal.)Stabstrate' substrate2.Embeddedness of RifflesGravel, cobble, and boulders 0.25% surrounded by fine sediment. Niches in infife not layered cobble, expresent. (If near 25% drop to suboptimal) if 15 14 13 12 (11)10 9 8 7 69 7 65 4 3 2 12 13. Velocity/ Depth Regime score201918 1413 12 (11)10 10 9 8 97 65 4 3 23 2 13. Velocity/ Depth Regime score201918 1413 12 (11)10 10 9 8 97 65 4 3 23 2 13. Velocity/ Depth Regime productive habita score 15.13 1413 12 (11)10 10 9 8 98 7 65 4 3 23 2 13. Velocity/ Depth Regime Deposition </th <th colspan="3"></th> <th colspan="4"></th>										
OptimalSuboptimalMarginalPoor1. Epifaunal Substrate/ Available CoverOver 70% of stream reach bas natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four productive habitats macroinvertebrates. Four or more productive habitats are present.Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats productive habitat productive habitats productive habitat productive habitats productive habitat productive habitat			Bridge							
I. Epifaunal Substrate/ Available CoverOver 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrats. Four or more productive habitat argensent.Natural stable habitat covers 40.40% of stream reach or only 1- 2 productive habitats present. (If near 70% and more than 2 go to suboptimal.)Less than 20% stable habitat lack of habitat is torious substrate unstable or lacking.SCORE2019(8)17161514121110987654321Comments $\Box (Q \in U \subseteq U \subseteq U)$ $\Box (Q \in U)$	HUC:	WS Group		Ecore		Duplicate Consensus				
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	Substrate/	[1] State 1 in the state of solution of the state of t	reach. Three or mor	e	stream reach or only 1-	obvious; substrate				
or more productive habitats are present.more than 3 go to optimal.)and more than 2 go to suboptimal.)SCORE2019(1)1716151413121110987654321CommentsCarle (Cold (C	Available Cover	by fish and/or	productive habitats		2 productive habitats	unstable or lacking.				
		macroinvertebrates. Four		6 and	present. (If near 40%					
SCORE2019(is)1716151411121110987654321CommentsGravel, cobble, and boulders 0-25% of RifflesGravel, cobble, and boulders 25-50% of niche space. If near 25% drop to suboptimali ffGravel, cobble and boulders 25-50% warrounded by fine surrounded by fine surrounded by fine surrounded by fine sediment. Layering of riffle not layered cobble.Gravel, cobble, and boulders 25-50% warrounded by fine sediment. Niche space cobble is starting to fill with fine sediment. Niche space ro is absent.Gravel, cobble, and boulders are nore than toolders are sol-75% of warrounded by fine sediment. Niche space cobble is starting to fill with fine sediment. Niche space to post starting to fill with fine sediment. Niche space to marginal.Only 3 of the 4 habitat regimes present (if fast- shallow or slow- shallow or slow- shallow are missing, score low).Dominated by 1 velocity/depth regime. Only 2 of the 4 habitat regimes present (if fast- shallow or slow- shallow or slow		or more productive	more than 3 go to		and more than 2 go to					
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3. Velocity/ Depth Regime regimes present (slow- deep, slow-shallow, fast- deep, fast-shallow). present (if fast-shallow, is missing score lower). If slow-deep missing score 15. regimes present (if fast- shallow or slow- shallow are missing, score low). velocity/depth regime. Others regimes to small or infrequent to support aquatic populations. SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 SCORE 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 Comments Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal. Sediment deposition slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%. Sediment deposition. Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition. Score 20 19 18 17 16 15 14 13 12 11 10 9 8<	Comments	Surrounded by	sand tsilt							
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Division of Water Resources QSSOP for Macroinvertebrate Stream Surveys Revision 6: DWR-PAS-011-QSSOP-08117 Effective Date: August 11, 2017 Appendix B: Page 6 of 15

Appendix B: Page 6 of 15 HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID		Date	Assessors	
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.
SCORE	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments	\bigcirc			
7. Frequency of re-oxygenation zones. Use frequency of riffle or bends for category. Rank by quality.	Occurrence of re- oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re- oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re- oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water o flat bedrock; little opportunity for re- oxygenation. Distance between areas divided by average stream width >2:
SCORE	20 19 18 17 16	15) 14 15 12 11	10 9 8 7 0	<u> </u>
Comments				
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE (LB)	Left Bank 10 (9)	8 7 6	5 4 3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
SCORE (RB)	Right Bank 10 9	8 7 6	5 4 3	
Comments				R
9. Vegetative Protective (score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non- natives are rare (< 30%)	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the bank covered by undisturbed vegetation of more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%) 2 1 0
	plants are native.			2 1 0
SCORE (LB)	Left Bank 10 9	8 7 6	5 4 3	
SCORE (LB) SCORE (RB)		8 7 6 8 7 6	5 4 3 5 4 3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
SCORE (LB)	Left Bank 10 9 Right Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE (LB) SCORE (RB)	Left Bank 10 9	8 7 6 Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed	5 4 3 Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	2 1 0 Average width of riparia zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.
SCORE (LB) SCORE (RB) Comments 10. Riparian Vegetative Zone Width (score each bank.) Zone	Left Bank 10 9 Right Bank 10 9 Average width of riparian zone > 18 meters. 18 Unpaved footpaths may score 9 if run-off potential	876Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally	5 4 3 Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are	2 1 0 Average width of riparia zone <6 meters. Score high if areas less than 6 meters are small or are

Total Score _____ Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance Describe:



CERTIFICATE OF ANALYSIS

N804270

Barge Design Solutions

Project Name: Water Testing

Bradley D. Simpson	Project / PO Number: N/A
615 Third Avenue South	Received: 09/20/2018
Nashville, TN 37210	Reported: 09/22/2018

Analytical Testing Parameters

Client Sample ID: Sample Matrix: Lab Sample ID:	EFORK003.9MT Water N804270-01				Collected B	-	client	/2018 10:40	
Microbiological Para	meters	Result	RL	Units	Note		bared	Analyzed	Analyst
Method: SM9223 B-19 E. Coli	997	1700	1	MPN/100 mL				09/20/18 1417	TRG

Client Sample ID:	REDO00.4MT								
Sample Matrix:	Water				Collected	By:	client		
Lab Sample ID:	N804270-02				Collection	Date:	09/20/	/2018 11:20	
Microbiological Para	meters	Result	RL	Units	Note	Prep	ared	Analyzed	Analyst
Method: SM9223 B-1	997								
E. Coli		25		MPN/100 mL				09/20/18 1417	TRG

Sample Matrix: Lab Sample ID:	Water N804270-03				Collected Collection		client 09/20/	/2018 12:35	
Microbiological Param	neters	Result	RL	Units	Note	Prep	ared	Analyzed	Analyst
Method: SM9223 B-19	97								
E. Coli		130	1	MPN/100 mL				09/20/18 1417	TRG

Definitions

RL: Reporting Limit

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included.

Reviewed and Approved By:

Brian Richard Project Manager brian.richard@microbac.com 09/22/2018 13:41

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					Lab Contact	Montgomery County	Project Name
			<u>4</u>	(614)-205-7225	Phone	(615) 252-4306	Phone
	F			Nick Carmean	Site Contact	Nashville, TN 37210	City/State/Zip
			<u>I</u>	(423) 723-8454	Phone	615 3rd Ave S, Suite 700	Muuless
Coc No.: Montenmen/Co2018 001	-			Matt Clabaugh	Project Manager	Barge Design	Company Name
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			8			Client Contact	
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		cord	Chain of Custody Record	Chain of C			

Temp 4.0°C

N804270-01 Sampled: 09/20/2018 10:40 Barge Design Solutions



CERTIFICATE OF ANALYSIS

N804555

Barge Design Solutions

Project Name: Water Testing

Bradley D. Simpson	Project / PO Number: N/A
615 Third Avenue South	Received: 10/10/2018
Nashville, TN 37210	Reported: 10/11/2018

Analytical Testing Parameters

Client Sample ID: Sample Matrix: Lab Sample ID:	RED000-4MT Water N804555-01				Collected Collection		client 10/10	/2018 11:10	
Microbiological Parar	neters	Result	RL	Units	Note	Prep	bared	Analyzed	Analyst
Method: SM9223 B-19	997								
E. Coli		34	1	MPN/100 mL				10/10/18 1546	TNB

Client Sample ID:	EFORK003.9MT							
Sample Matrix:	Water				Collected By:	client		
Lab Sample ID:	N804555-02				Collection Date:	10/10	/2018 12:00	
Microbiological Para	meters	Result	RL	Units	Note Pre	epared	Analyzed	Analyst
Method: SM9223 B-1	997							

Client Sample ID: Sample Matrix: Lab Sample ID:	BMCAD004.9MT Water N804555-03				Collected Collection	-	client 10/10	/2018 13:30	
Microbiological Para	neters	Result	RL	Units	Note	Prep	ared	Analyzed	Analyst
Method: SM9223 B-1	997								
E. Coli		150	1	MPN/100 mL				10/10/18 1546	TNB

Definitions

RL: Reporting Limit

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included.

Reviewed and Approved By:

Brian Richard Project Manager brian.richard@microbac.com 10/11/2018 17:55

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ł	ſ		Nick Carmean	Site Contact	Nashville, TN 37210	City/State/Zip
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CERTIFICATE OF ANALYSIS

N804562

Barge Design Solutions

Project Name: Montgomery County

Bradley D. Simpson	Project / PO Number: N/A
615 Third Avenue South	Received: 10/11/2018
Nashville, TN 37210	Reported: 10/15/2018

Analytical Testing Parameters

Client Sample ID:	RED000.4 MT							
Sample Matrix:	Water				Collected By:	client		
Lab Sample ID:	N804562-01				Collection Date	: 10/11	/2018 9:40	
Microbiological Para	meters	Result	RL	Units	Note F	repared	Analyzed	Analyst
Method: SM9223 B-19	997							
E. Coli		37	1	MPN/100 mL			10/11/18 1606	TNB

Client Sample ID:	EFORK003.9 MT							
Sample Matrix:	Water				Collected By:	clie	nt	
Lab Sample ID:	N804562-02				Collection Da	te: 10/	11/2018 11:15	
Microbiological Para	meters	Result	RL	Units	Note	Prepared	Analyzed	Analyst
Method: SM9223 B-1	997							

Result							
Result	RL	Units	Note	Prep	ared	Analyzed	Analyst
160	1	MPN/100 mL				10/11/18 1606	TNB
	160	160 1	160 1 MPN/100 mL	160 1 MPN/100 mL	160 1 MPN/100 mL	160 1 MPN/100 mL	160 1 MPN/100 mL 10/11/18 1606

Definitions

RL: Reporting Limit

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included.

Reviewed and Approved By:

Brian Richard Project Manager brian.richard@microbac.com 10/15/2018 13:22

Special Instructions: Phone Turnaround Time: <u>Standard Turnaround</u> Relinquished by: ビュティット レッッィ Possible Hazard Identification Address Femp upon delivery: Project Name City/State/Zip Company Name ask Name REDOOD, 4 MT EFORKOPSAMT BMCADOOH, 9MT Sample Identification and a Barge Design E.coli sample Montgomery County 615 3rd Ave S, Suite 700 (615) 252-4306 Nashville, TN 37210 8 Lyneh Benze Non-Hazardous: Water Please send results to nick.carmean@bargedesign.com Company Phone Phone Site Contact Project Manager Carrier Lab Contact 3atac Solutions 10/12/18 81/11/01 10/11/18 Sample Date Design (NC) Date/Time Hand deliver Matt Clabaugh Nick Carmean (614)-205-7225 (423) 723-8454 0/ii 0490 Sample Time 352 5115 1220 118 N804562-01 Barge Design Solutions **Received by** Sample Disposal Sample Matrix WS WS SM Containers Sample Sampled: 10/11/2018 09:40 Company Analyses E.coli 17 2+3 P - C × × × CoC No.: MontgomeryCo2018 Page: <u>j</u>of_ Date/Time Special Instructions 10-11-1 Ò 242 -001

Client Contact

Microbac Laboratories, Inc., 2631 Grandview Ave, Nashville, TN 37211

Chain of Custody Record

Jarg. 1.6°



CERTIFICATE OF ANALYSIS

N804590

Barge Design Solutions

Project Name: Water Testing

Bradley D. Simpson	Project / PO Number: N/A
615 Third Avenue South	Received: 10/16/2018
Nashville, TN 37210	Reported: 10/17/2018

Analytical Testing Parameters

Client Sample ID: Sample Matrix: Lab Sample ID:	RED000.4MT Water N804590-01				Collected By Collection D		client 10/16/2	2018 9:55	
Microbiological Para	neters	Result	RL	Units	Note	Prepa	ared	Analyzed	Analyst
Method: SM9223 B-19	997								
E. Coli		>2400		MPN/100 mL				10/16/18 1404	TNB
Client Comple ID:									
Client Sample ID: Sample Matrix:	EFORK 003.9MT Water				Collected By		client		

Sample Matrix.	VValor				Conecteu	Dy.	Cheft		
Lab Sample ID:	N804590-02				Collection	Date:	10/16/	2018 11:15	
Microbiological Para	meters	Result	RL	Units	Note	Prepa	red	Analyzed	Analyst
Method: SM9223 B-1	997								
E. Coli		2900	10	MPN/100 mL				10/16/18 1404	TNB

Client Sample ID: Sample Matrix: Lab Sample ID:	BMCAD004.9MT Water N804590-03				Collected By: Collection Date:	client 10/16	/2018 12:00	
Microbiological Para	meters	Result	RL	Units	Note P	epared	Analyzed	Analyst
Method: SM9223 B-1	997							
E. Coli		1200	1	MPN/100 mL			10/16/18 1404	TNB

Definitions

RL: Reporting Limit

Report Comments

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Reviewed and Approved By:

Brian Richard Project Manager brian.richard@microbac.com 10/17/2018 18:03

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Barge Design Solutions							
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	S	Containers	Matrix	Hand deliver	Carrier	E.coli sample	Task Name
	Analyza		Cample		Lab Contact	Montgomery County	Project Name
				(614)-205-7225	Phone	(615) 252-4305	Phone
				Nick Carmean	Site Contact	Nashville, TN 37210	City/State/Zip
Page: 1 of 1				(423) 723-8454	Phone	, Suite 700	Address
CoC No.: MontgomeryCo20181016 -001	1			Matt Clabaugh	Project Manager	Barge Design	Company Name
	1				act	Client Contact	
7211	le, TN 37211	w Ave, Nashvil	Grandvie	ries, Inc., 2631	Microbac Laboratories, Inc., 2631 Grandview Ave, Nashvil	M	
		cord	istody Red	Chain of Custody Record			



CERTIFICATE OF ANALYSIS

N804609

Barge Design Solutions

Project Name: Water Testing

Bradley D. Simpson	Project / PO Number: N/A
615 Third Avenue South	Received: 10/18/2018
Nashville, TN 37210	Reported: 10/22/2018

Analytical Testing Parameters

Method: SM9223 B-19 E. Coli	997	980	10	MPN/100 mL			10/18/18 1433	TNB
Microbiological Parar	neters	Result	RL	Units	Note Pr	epared	Analyzed	Analys
Lab Sample ID:	N804609-02				Collection Date:	10/18	/2018 10:20	
Sample Matrix:	Water				Collected By:	client		
Client Sample ID:	EFORK003.9MT							
E. Coli		780	10	MPN/100 mL			10/18/18 1433	TNB
Method: SM9223 B-19	997							
Microbiological Parar	neters	Result	RL	Units	Note Pr	epared	Analyzed	Analys
Lab Sample ID:	N804609-01				Collection Date:	10/18	/2018 9:32	
Sample Matrix:	Water				Collected By:	client		
Client Sample ID:	RED000.4MT							

Client Sample ID:	BMCAD004.9MT								
Sample Matrix:	Water				Collected	By:	client		
Lab Sample ID:	N804609-03				Collection	Date:	10/18	/2018 11:20	
Microbiological Parar	neters	Result	RL	Units	Note	Prep	bared	Analyzed	Analyst
Method: SM9223 B-19	997								
E. Coli		310	1	MPN/100 mL				10/18/18 1433	TNB

Definitions

RL: Reporting Limit

Report Comments

Samples were received in proper condition and the reported results conform to applicable accreditation standard unless otherwise noted.

The data and information on this, and other accompanying documents, represents only the sample(s) analyzed. This report is incomplete unless all pages indicated in the footnote are present and an authorized signature is included.

Reviewed and Approved By:

Brian Richard Project Manager brian.richard@microbac.com 10/22/2018 11:49

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	Analyses	Sample Containers	Matrix	Hand deliver	Carrier	E.coll sample	Task Name
					Lab Contact	Montgomery County	Project Name
				(614)-205-7225	Phone	(615) 252-4306	Phone
	ľ			Nick Carmean	Site Contact	Nashville, TN 37210	City/State/Zip
I	Page:		!	(423) 723-8454	Phone	615 3rd Ave S, Sulte 700	Address
CoC No.: MontgomeryCo20181018 -001	CoC N			Matt Clabaugh	Project Manager	Barge Design	Company Name
					itact	Client Contact	
	ille, TN 37211	ew Ave, Nashvi	1 Grandvie	ories, Inc., 263	Microbac Laboratories, Inc., 2631 Grandview Ave, Nashville, TN 37211		
		cord	Chain of Custody Record	Chain of (

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Appendix 2

Photographs



NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Page **1** of **10**

Photo: 1 **By:** N. Carmean **Date:** 19 Sept 2018 **Feature:** WALL000.6MT **Photo Location:** 36.4964, -87.2994

View downstream of Wall Branch from near macroinvertebrate sampling location.

Photo: 2 By: N. Carmean Date: 19 Sept 2018 Feature: WALL000.6MT Photo Location: 36.4964, -87.2994

View upstream of Wall Branch from near macroinvertebrate sampling location.



Photo: 3 **By:** N. Carmean **Date:** 16 Oct 2018 **Feature:** EFORK003.9MT **Photo Location:** 36.3996, -87.5276

Page **2** of **10**

Upstream view East Fork Creek near macroinvertebrate sampling location during elevated flows.

Photo: 4 **By:** N. Carmean **Date:** 16 Oct 2018 **Feature:** EFORK003.9MT **Photo Location:** 36.3996, -87.5276

Downstream view East Fork Creek near macroinvertebrate sampling location during elevated flows.

NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Page **3** of **10**

Photo: 5 By: N. Carmean Date: 19 Sept 2018 Feature: LOUIS001.8MT Photo Location: 36.3592, -87.3061

Upstream view Louise Creek near macroinvertebrate sampling location.

Photo: 6 By: N. Carmean Date: 19 Sept 2018 Feature: LOUIS001.8MT Photo Location: 36.3592, -87.3061

Downstream view Louise Creek near macroinvertebrate sampling location.

NPDES Phase II Permit Monitoring, Montgomery County, Tennessee

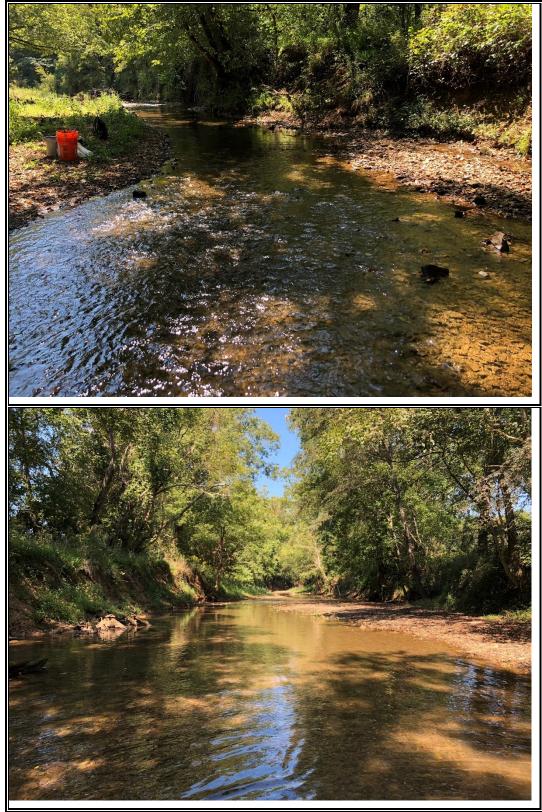


Photo: 7 **By:** N. Carmean **Date:** 20 Sept 2018 **Feature:** BMCAD004.9MT **Photo Location:** 36.4617, -87.2744

Upstream view Big McAdoo Creek near macroinvertebrate sampling location.

Photo: 8 By: N. Carmean Date: 20 Sept 2018 Feature: BMCAD004.9MT Photo Location: 36.4617, -87.2744

Downstream view Big McAdoo Creek near macroinvertebrate sampling location.

Photo Summary NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Photo: 9 **By:** N. Carmean **Date:** 10 Oct 2018 **Feature:** BARTE001.4MT **Photo Location:** 36.5020, -87.5177

Upstream view Bartee Branch near macroinvertebrate sampling location.

Photo: 10 **By:** N. Carmean **Date:** 10 Oct 2018 **Feature:** BARTE001.4MT **Photo Location:** 36.5020, -87.5177

Downstream view Bartee Branch near macroinvertebrate sampling location.

Page **5** of **10**

Photo Summary

NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Page **6** of **10**

Photo: 11 **By:** G. Lynch **Date:** 9 Sept 2018 **Feature:** RED000.4MT **Photo Location:** 36.5420, -88.3680

Downstream view Red River near water quality sample location.

Photo: 12 **By:** G. Lynch **Date:** 9 Sept 2018 **Feature:** RED000.4MT **Photo Location:** 36.5420, -88.3680

Upstream view Red River near water quality sample location.

Photo Summary NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Photo: 13 **By:** N. Carmean **Date:** 25 Oct 2018 **Feature:** RED024.7MT **Photo Location:** 36.5562, -87.1473

Upstream view Red River near macroinvertebrate sampling location.

Photo: 14 **By:** N. Carmean **Date:** 25 Oct 2018 **Feature:** RED024.7MT **Photo Location:** 36.5562, -87.1473

Downstream view Red River near macroinvertebrate sampling location.

NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Page **8** of **10**

Photo: 15 **By:** N. Carmean **Date:** 19 Sept 2018 **Feature:** SPRIN006.9MT **Photo Location:** 36.6154, -87.2876

Upstream view Spring Creek near macroinvertebrate sampling location.

Photo: 16 **By:** N. Carmean **Date:** 19 Sept 2018 **Feature:** SPRIN006.9MT **Photo Location:** 36.6154, -87.2876

Downstream view Spring Creek near macroinvertebrate sampling location.

NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Photo: 17 **By:** N. Carmean **Date:** 3 Oct 2018 **Feature:** SPRIN13.7T0.4MT **Photo Location:** 36.6361, -87.2113

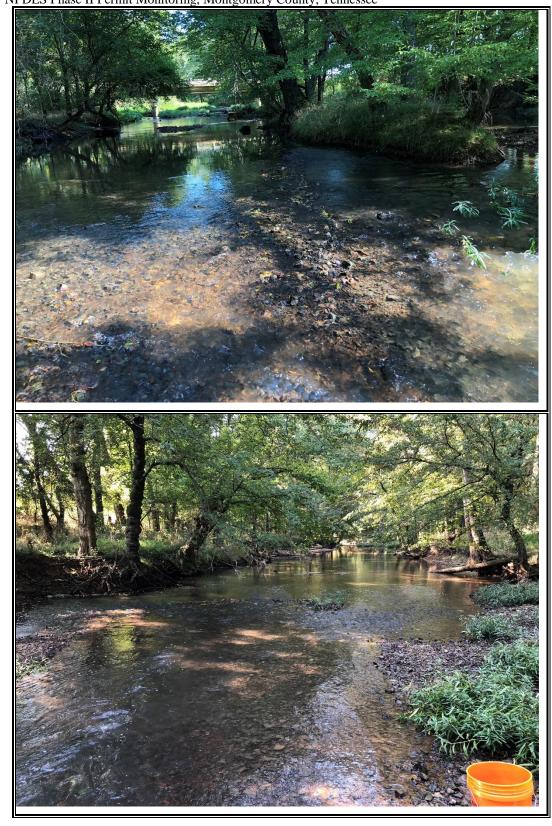
Page **9** of **10**

Upstream view Unnamed Trib to Spring Creek near macroinvertebrate sampling location.

Photo: 18 **By:** N. Carmean **Date:** 3 Oct 2018 **Feature:** SPRIN13.7T0.4MT **Photo Location:** 36.6361, -87.2113

Downstream view Unnamed Trib to Spring Creek near macroinvertebrate sampling location.

Photo Summary NPDES Phase II Permit Monitoring, Montgomery County, Tennessee



Page **10** of **10**

Photo: 19 **By:** N. Carmean **Date:** 19 Sept 2018 **Feature:** SPRIN009.8MT **Photo Location:** 36.6170, -87.2535

Upstream view Spring Creek near macroinvertebrate sampling location.

Photo: 20 **By:** N. Carmean **Date:** 19 Sept 2018 **Feature:** SPRIN009.8MT **Photo Location:** 36.6170, -87.2535

Downstream view Spring Creek near macroinvertebrate sampling location. Appendix 3

Scientific Collection Permit



TENNESSER	TENNES	SSEE WILDLIFE RESOURCES	AGENCY
WILDLIFE RESOURCES		ELLINGTON AGRICULTURAL CENTER P. O. BOX 40747 NASHVILLE, TENNESSEE 37204	
VENC	1696	0/12/2018	0/12/2010

Issue date:

9/13/2018

9/13/2019

Expiration date:

Pursuant to	authority		70-2-213
F ul Sualit to	autionity	JI 1.C.A.	10-2-213

Nicholas Carmean

and the following additional permittees:

Grant Lynch Nicholas Carmean

Scientific Collection Permit :

are granted permission to take the following species:

Any macroinvertebrate species collected. Crayfish will be released.

Restricted to the following locations:

Sampling will occur at two locations on the Ocoee River in Polk County. The locations are at River Miles 35.1 and 37.6. 11 locations will be sampled, all of which in Montgomery County, within the Lower Cumberland and Red River Watersheds. Sites are scattered around Clarksville, TN. DWR STATION IDs: WALL000.6MT, EFORK000.39MT, LOUIS001.8MT, BMCAD004.9MT, BARTE001.4MT, RED000.4MT, RED024.7MT, RED025.5MT, SPRIN00.69MT, SPRIN13.7T0.4MT, and SPRIN009.8MT.,

Restricted to the following collection methods:

In the current work plan, a kick net/riffle kick is the prescribed method. The 2017 TDEC SOP for macroinvertebrate collection will be followed as a guide.

Subject to the following rules:

Wildlife may not be held longer than 24 hours without prior approval. All containers and equipment utilized in the collection of amphibians and reptiles shall be decontaminated and disinfected for ranavirus and other pathogens. This permit is invalid unless accompanied by all applicable federal permits.

No species listed by TWRA as endangered, threatened, in need of management, or of greatest conservation need may be taken without approval; release these species immediately. Report the occurance of endangered or threatened species to TWRA within five days.

Prior to collecting in the field, you are required to notify the TWRA Regional Dispatcher with the name(s) of person(s) doing the collecting, where, when and what species you will be collecting. Contact information is attached.

arter

9/13/2018

Executive Director, Tennessee Wildlife Resources Agency

Date

The State of Tennessee AN EQUAL OPPORTUNITY EMPLOYER