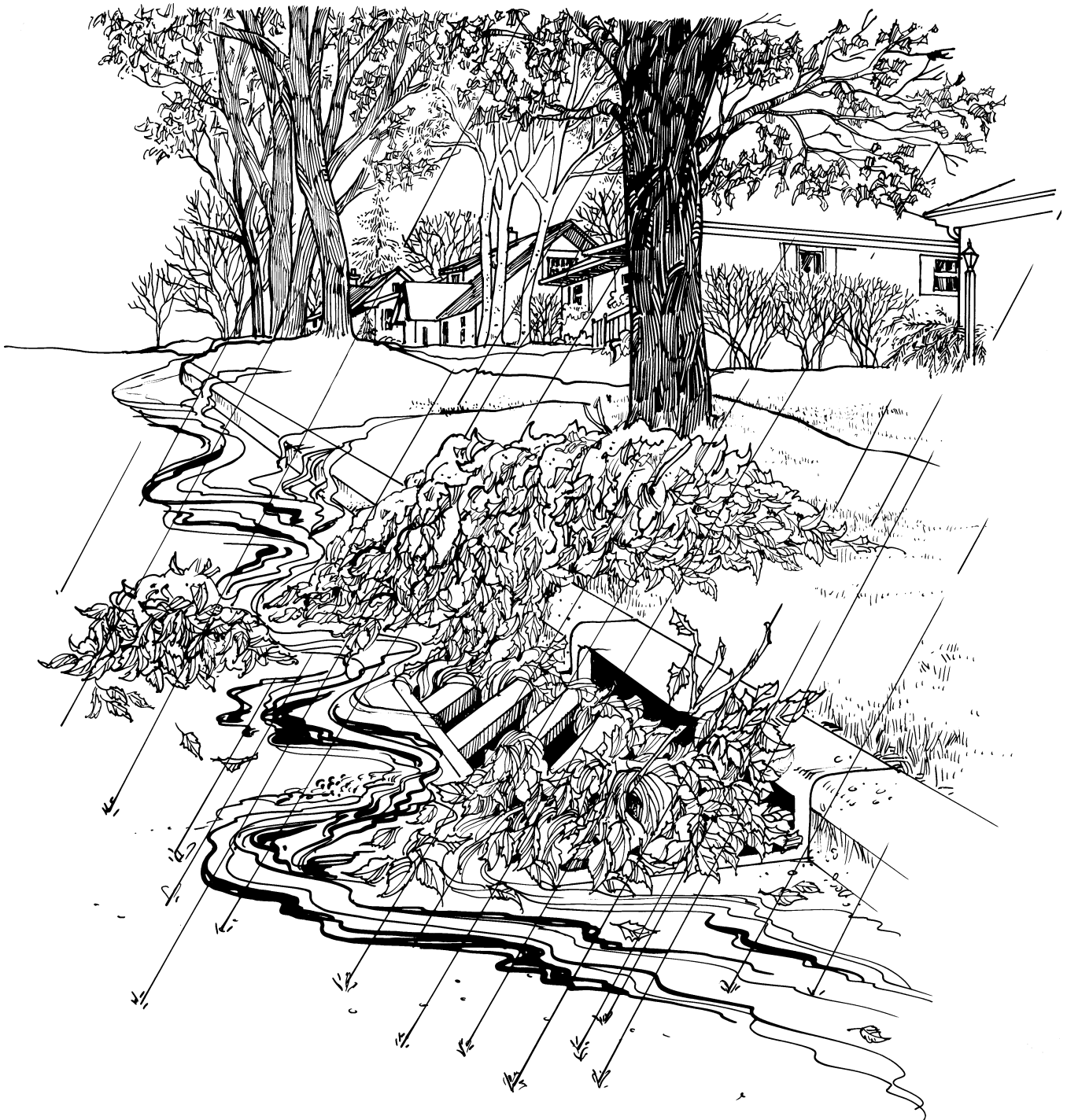


**CITY OF LEWISBURG
STORMWATER MANAGEMENT PROGRAM
2019 ANNUAL REPORT
JULY 2018 – JUNE 2019**





Tennessee Department of Environment and Conservation
Division of Water Resources
William R. Snodgrass Tennessee Tower,
312 Rosa L. Parks Avenue, 11th Floor, Nashville, Tennessee 37243
1-888-891-8332 (TDEC)

Phase II Small Municipal Separate Storm Sewer System (MS4) Annual Report

1. MS4 Information

Name of MS4: City of Lewisburg	MS4 Permit Number: TNS077615	
Contact Person: Joe Beard	Email Address: buck.beard@lewisburgtn.gov	
Telephone: (931) 359-1544	MS4 Program Web Address: www.lewisburgtn.gov	
Mailing Address: P.O. Box 1968		
City: Lewisburg	State: Tennessee	ZIP code: 37091

What is the current population of your MS4? 11,857

What is the reporting period for this annual report? July1 2018 to June 30 2019

2. Discharges to Waterbodies with Unavailable Parameters or Exceptional Tennessee Waters (Section 3.1)

- A. Does your MS4 discharge into waters with unavailable parameters (previously referred to as impaired) for pathogens, nutrients, siltation or other parameters related to stormwater runoff from urbanized areas as listed on TN's most current 303(d) list and/or according to the on-line state GIS mapping tool (tdeconline.tn.gov/dwr/)? If yes, attach a list. ☒ Yes ☐ No
- B. Are there established and approved TMDLs (<http://www.tn.gov/environment/article/wr-ws-tennessees-total-maximum-daily-load-tmdl-program>) with waste load allocations for MS4 discharges in your jurisdiction? If yes, attach a list. ☒ Yes ☐ No
- C. Does your MS4 discharge to any Exceptional Tennessee Waters (ETWs - http://environment-online.tn.gov:8080/pls/enf_reports/f?p=9034:34304:4880790061142)? If yes, attach a list. ☐ Yes ☒ No
- D. Are you implementing specific Best Management Practices (BMPs) to control pollutant discharges to waterbodies with unavailable parameters or ETWs? If yes, describe the specific practices: Construction Program ☒ Yes ☐ No

3. Public Education/Outreach and Involvement/Participation (Sections 4.2.1 and 4.2.2)

- A. Have you developed a Public Information and Education plan (PIE)? ☒ Yes ☐ No
- B. Is your public education program targeting specific pollutants and sources, such as Hot Spots? If yes, describe the specific pollutants and/or sources targeted by your public education program: Oil and Grease and Solids ☒ Yes ☐ No
- C. Do you have a webpage dedicated to your stormwater program? If yes, provide a link/URL: www.lewisburgtn.gov/codes-stormwater/stormwater ☒ Yes ☐ No
- D. Summarize how you advertise and publicize your public education, outreach, involvement and participation opportunities: website and newspaper
- E. Summarize the public education, outreach, involvement and participation activities you completed during this reporting period: Radio PSAs and Elementary Educational Program

Phase II Small Municipal Separate Storm Sewer System (MS4) Annual Report

- F. Summarize any specific successful outcome(s) (e.g., citizen involvement, pollutant reduction, water quality improvement, etc.) fully or partially attributable to your public education and participation program during this reporting period: Unknown

4. Illicit Discharge Detection and Elimination (Section 4.2.3)

- A. Have you developed and do you continue to update a storm sewer system map that shows the location of system outfalls where the municipal storm sewer system discharges into waters of the state or conveyances owned or operated by another MS4? ☒ Yes ☐ No
- B. If yes, does the map include inputs into the storm sewer collection system, such as the inlets, catch basins, drop structures or other defined contributing points to the sewershed of that outfall, and general direction of stormwater flow? ☒ Yes ☐ No
- C. How many outfalls have you identified in your storm sewer system? 296
- D. Do you have an ordinance, or other regulatory mechanism, that prohibits non-stormwater discharges into your storm sewer system? ☒ Yes ☐ No
- E. Have you implemented a plan to detect, identify and eliminate non-stormwater discharges, including illegal disposal, throughout the storm sewer system? If yes, provide a summary: Dry weather screening and commercial inspections ☒ Yes ☐ No
- F. How many illicit discharge related complaints were received this reporting period? 0
- G. How many illicit discharge investigations were performed this reporting period? 0
- H. Of those investigations performed, how many resulted in valid illicit discharges that were addressed and/or eliminated? N/A

5. Construction Site Stormwater Runoff Pollutant Control (Section 4.2.4)

- A. Do you have an ordinance or other regulatory mechanism requiring:
- Construction site operators to implement appropriate erosion prevention and sediment control BMPs consistent with those described in the TDEC EPSC Handbook? ☒ Yes ☐ No
- Construction site operators to control wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste? ☒ Yes ☐ No
- Design storm and special conditions for unavailable parameters waters or Exceptional Tennessee Waters consistent with those of the current Tennessee Construction General Permit (TNR100000)? ☒ Yes ☐ No
- B. Do you have specific procedures for construction site plan (including erosion prevention and sediment BMPs) review and approval? ☒ Yes ☐ No
- C. Do you have sanctions to enforce compliance? ☒ Yes ☐ No
- D. Do you hold pre-construction meetings with operators of priority construction activities and inspect priority construction sites at least monthly? ☒ Yes ☐ No
- E. How many construction sites disturbing at least one acre or greater were active in your jurisdiction this reporting period? 13
- F. How many active priority and non-priority construction sites were inspected this reporting period? 95
- G. How many construction related complaints were received this reporting period? 0

6. Permanent Stormwater Management at New Development and Redevelopment Projects (Section 4.2.5)

- A. Do you have a regulatory mechanism (e.g. ordinance) requiring permanent stormwater pollutant removal for development and redevelopment projects? If no, have you submitted an Implementation Plan to the Division? ☐ Yes ☒ No
☒ Yes ☐ No
- B. Do you have an ordinance or other regulatory mechanism requiring:
- Site plan review and approval of new and re-development projects? ☒ Yes ☐ No
- A process to ensure stormwater control measures (SCMs) are properly installed and maintained? ☒ Yes ☐ No
- Permanent water quality riparian buffers? If yes, specify requirements: 30 and 60 foot based on drainage area as per MS4 Permit. ☒ Yes ☐ No
- C. What is the threshold for development and redevelopment project plans plan review (e.g., all projects, projects disturbing greater than one acre, etc.)? all commercial and residential over 1 acre
- D. How many development and redevelopment project plans were reviewed for this reporting period? 4
- E. How many development and redevelopment project plans were approved? 4
- F. How many permanent stormwater related complaints were received this reporting period? 0
- G. How many enforcement actions were taken to address improper installation or maintenance? 0
- H. Do you have a system to inventory and track the status of all public and private SCMs installed on development and redevelopment projects? ☐ Yes ☒ No
- I. Does your program include an off-site stormwater mitigation or payment into public stormwater fund? If yes, specify. ☐ Yes ☒ No

7. Stormwater Management for Municipal Operations (Section 4.2.6)

- A. As applicable, have stormwater related operation and maintenance plans that include information related to maintenance activities, schedules and the proper disposal of waste from structural and non-structural stormwater controls been developed and implemented at the following municipal operations:
- Streets, roads, highways? ☒ Yes ☐ No
- Municipal parking lots? ☒ Yes ☐ No
- Maintenance and storage yards? ☒ Yes ☐ No
- Fleet or maintenance shops with outdoor storage areas? ☒ Yes ☐ No
- Salt and storage locations? ☒ Yes ☐ No
- Snow disposal areas? ☐ Yes ☒ No
- Waste disposal, storage, and transfer stations? ☒ Yes ☐ No
- B. Do you have a training program for employees responsible for municipal operations at facilities within the jurisdiction that handle, generate and/or store materials which constitute a potential pollutant of concern for MS4s? ☒ Yes ☐ No
- If yes, are new applicable employees trained within six months, and existing applicable employees trained and/or retrained within the permit term? ☒ Yes ☐ No

8. Reviewing and Updating Stormwater Management Programs (Section 4.4)

- A. Describe any revisions to your program implemented during this reporting period including but not limited to:
 Modifications or replacement of an ineffective activity/control measure. N/A
 Changes to the program as required by the division to satisfy permit requirements. N/A
 Information (e.g. additional acreage, outfalls, BMPs) on newly annexed areas and any resulting updates to your program. N/A
- B. In preparation for this annual report, have you performed an overall assessment of your stormwater management program effectiveness? If yes, summarize the assessment results, and any modifications and improvements scheduled to be implemented in the next reporting period. Program effective, however changes are being made to the Ordinance to clear up some issues. Post Construction water quality requirements that were not being implemented are being removed. ☒ Yes ☐ No

9. Enforcement Response Plan (Section 4.5)

- A. Have you implemented an enforcement response plan that includes progressive enforcement actions to address non-compliance, and allows the maximum penalties specified in TCA 68-221-1106? If no, explain. ☒ Yes ☐ No
- B. As applicable, identify which of the following types of enforcement actions (or their equivalent) were used during this reporting period; indicate the number of actions, the minimum measure (e.g., construction, illicit discharge, permanent stormwater management), and note those for which you do not have authority:

<u>Action</u>	<u>Construction</u>	<u>Permanent Stormwater</u>	<u>Illicit Discharge</u>	<u>In Your ERP?</u>	
Verbal warnings	<u>#6</u>	<u>#0</u>	<u>#0</u>	☒ Yes	☐ No
Written notices	<u>#1</u>	<u>#0</u>	<u>#0</u>	☒ Yes	☐ No
Citations with administrative penalties	<u>#0</u>	<u>#0</u>	<u>#0</u>	☒ Yes	☐ No
Stop work orders	<u>#0</u>	<u>#0</u>	<u>#0</u>	☒ Yes	☐ No
Withholding of plan approvals or other authorizations	<u>#0</u>	<u>#0</u>	<u>#0</u>	☐ Yes	☒ No
Additional Measures	<u>#0</u>	<u>#0</u>	<u>#0</u>	Describe: <u> </u>	

- C. Do you track instances of non-compliance and related enforcement documentation? ☐ Yes ☒ No
- D. What were the most common types of non-compliance instances documented during this reporting period?
Improper Maintenance of Sedimentation Controls

10. Monitoring, Recordkeeping and reporting (Section 5)

- A. Summarize any analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period. Collection and Evaluation Completed, Report Attached
- B. Summarize any non-analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period. No activities conducted in this period

Phase II Small Municipal Separate Storm Sewer System (MS4) Annual Report

- C. If applicable, are monitoring records for activities performed during this reporting period submitted with this report. ☒ Yes ☐ No

11. Certification

This report must be signed by a ranking elected official or by a duly authorized representative of that person. See signatory requirements in sub-part 6.7.2 of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Jim Bingham, Mayor

Printed Name and Title

Signature

Date

Annual reports must be submitted by September 30 of each calendar year (Section 5.4) to the appropriate Environmental Field Office (EFO), identified in the table below:

EFO	Street Address	City	Zip Code	Telephone
Chattanooga	1301 Riverfront Pkwy, Suite 206	Chattanooga	37402	(423) 634-5745
Columbia	1421 Hampshire Pike	Columbia	38401	(931) 380-3371
Cookeville	1221 South Willow Ave.	Cookeville	38506	(931) 520-6688
Jackson	1625 Hollywood Drive	Jackson	38305	(731) 512-1300
Johnson City	2305 Silverdale Road	Johnson City	37601	(423) 854-5400
Knoxville	3711 Middlebrook Pike	Knoxville	37921	(865) 594-6035
Memphis	8383 Wolf Lake Drive	Bartlett	38133	(901) 371-3000
Nashville	711 R S Gass Boulevard	Nashville	37216	(615) 687-7000

ATTACHMENT 1
ORGANIZATIONAL CHART



City of Lewisburg, Tennessee

P.O. Box 1968—131 East Church St.

Lewisburg, TN 37091

(931) 359-1544

www.lewisburgtn.com

www.lewisburgtnecd.blogspot.com

Organizational Chart for Codes & Stormwater Department

Lewisburg City Council



Lewisburg City Manager



Codes & Stormwater Department – Public Works Department

Codes & Stormwater Department Partners

Community Development Board

Planning and Zoning Commission

Board of Zoning Appeals

Joint Economic and Community Development Board

Industrial Development Board

Three-Star Beautification Committee

Tennessee Association of Floodplain Managers

FEMA, EPA & TDEC

St. John Engineering

TN ECD Community Planning Division

ATTACHMENT 2

APPROVED TMDLS WITH WASTE LOAD ALLOCATIONS
FOR
MS4 DISCHARGES

TOTAL MAXIMUM DAILY LOAD (TMDL)
for
Fecal Coliform
in the
Upper Duck River Watershed (HUC 06040002)
Bedford, Coffee, Marshall, & Maury Counties, Tennessee

Prepared by:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

April 22, 2004

TOTAL MAXIMUM DAILY LOAD (TMDL)
for
Low Dissolved Oxygen & Nutrients
in the
Upper Duck River Watershed (HUC 06040002)
Bedford, Coffee, Marshall, & Maury Counties, Tennessee

Prepared by:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

July, 12, 2005



TOTAL MAXIMUM DAILY LOAD (TMDL)
For
Siltation and Habitat Alteration
In The
Upper Duck River Watershed (HUC 06040002)
Bedford, Coffee, Franklin, Giles, Lincoln, Marshall, Maury,
Moore, Rutherford, and Williamson Counties, Tennessee

FINAL

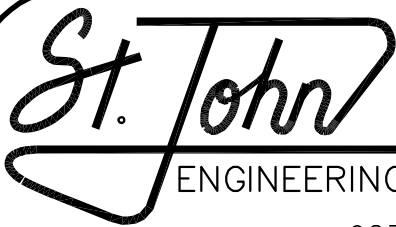
Prepared by:

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
6th Floor L & C Tower
401 Church Street
Nashville, TN 37243-1534

July 24, 2006

ATTACHMENT 3

ANALYTICAL MONITORING REPORT



ENGINEERING, LLC

ENGINEERING • PLANNING • ENVIRONMENTAL CONSULTING

923 JACKSON STREET, MANCHESTER, TN 37355

PHONE: (931) 728-2638 FAX: (931) 728-6357

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2018 STREAM MONITORING ASSESSMENT FOR LEWISBURG MS4 COMPLIANCE IN LEWISBURG, TENNESSEE

1.0 INTRODUCTION

Section 5.1 of the NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems requires the City of Lewisburg to perform analytical monitoring on certain streams within the city's jurisdiction. Specifically, the city is required to monitor all stream segments within the jurisdiction that have unavailable parameters for siltation, habitat alteration, or pathogens. Those streams with unavailable parameters for siltation and/or habitat alteration require biological stream sampling and habitat assessment utilizing the Semi-Quantitative Single Habitat (SQSH) Method. Those streams with unavailable parameters for pathogens require bacteriological stream sampling utilizing methods identified in the Division of Water Resources' Quality System Standard Operating Procedures for Chemical and Bacteriological Sampling of Surface Water. The city is required by the Permit to sample all affected stream segments within the five-year permit period.

2.0 ASSESSMENT DESCRIPTION

The City of Lewisburg contains two stream segments that have unavailable parameters for siltation and/or habitat alteration. The stream segments are Big Rock Creek and Snell Branch. Therefore, analytical monitoring was conducted on both of these stream segments, as required by the MS4 General Permit. The methods followed for the monitoring and all monitoring results are described within this report. Appendix A of this report contains a site location map showing the sampling locations on both stream segments.

3.0 SITE DESCRIPTIONS

3.1 Big Rock Creek

Big Rock Creek originates south of Lewisburg near Cornersville, Tennessee. Big Rock Creek flows through a significant portion of the city limits, running generally from south to north.

The stream segment ID for the segment running through Lewisburg is TN06040002012_2000. This stream segment is listed as impaired for nutrients, sedimentation, and dissolved oxygen. Therefore, biological monitoring was performed on this stream segment. The monitoring activities were performed just upstream of the bridge that crosses the

Nashville Highway. The monitoring station ID is BROCK015.7ML. This point of Big Rock Creek has a drainage area of approximately 28 square miles. Big Rock Creek is located in Ecoregion 71i. This area of Big Rock Creek was relatively secluded. The stream at this location is approximately 30-40 feet wide and 6-24 inches deep. There was one concrete capped sewer line crossing located at the lower end of the stream reach. Appendix B contains photographs of this Big Rock Creek stream segment.

3.2 Snell Branch

Snell Branch originates just west of the city limits of Lewisburg. Snell Branch runs through a significant portion of the city limits, running generally from west to east. Snell Branch enter Big Rock Creek just east of the city limits of Lewisburg.

The stream segment ID for the segment running through Lewisburg is TN06040002012_07000. This stream segment is listed as impaired for sedimentation and Alteration in Streamside Cover. Therefore, biological monitoring was performed on this stream segment. The monitoring activities were performed just downstream of the 5th Avenue bridge. The monitoring station ID is SNELL001.1ML. This point of Snell Branch has a drainage area of approximately 2.2 square miles. Snell Branch is located in Ecoregion 71i. This area of Snell Branch is located in the middle of town and has been impacted by agricultural practices removing nearly all streamside vegetation. The stream at this location is approximately 2-6 feet wide and 2-6 inches deep. Appendix B contains photographs of this Snell Branch stream segment.

4.0 SAMPLING PROCEDURES

4.1 Big Rock Creek

The Big Rock Creek sampling consisted of a biological assessment and habitat assessment of the stream reach. The habitat assessment was conducted immediately prior to the biological sampling. Water quality measurements were also taken for pH, conductivity, and temperature. The biological assessment consisted of a macroinvertebrate survey. All assessments and sample collection were conducted in accordance with the 2011 TDEC SOP for Macroinvertebrate Stream. Biological samples were collected with a two-person square meter kick net with a 500-micron mesh. Samples were collected in riffle and run areas of the stream reach. Samples were collected in a labeled, plastic jar filled with 91% alcohol and were shipped to Aquatic Resources Laboratory in Nashville for invertebrate identification. All biological sampling of Big Rock Creek was conducted on July 18, 2018. Stream Data Field Sheets and Habitat

Assessment Data Sheets that were completed during the assessment are contained in Appendix C of this report.

4.2 Snell Branch

The Snell Branch sampling also consisted of a biological assessment and habitat assessment. The same procedures were followed for this monitoring as for the Big Rock Creek monitoring. This assessment and monitoring were also conducted on July 18, 2018.

5.0 SAMPLING RESULTS

5.1 Big Rock Creek

Biological Monitoring

The Tennessee Division of Water Resources has developed a macroinvertebrate index, based on seven biometrics for use in semi-quantitative macroinvertebrate surveys (Arnwine and Denton, 2001). The index is based on ecoregional reference data and calibrated by bioregion. The calibrated scoring criteria can be used in all streams that fit the sample criteria for that region and have at least 80% of their upstream drainage within the same bioregion.

Using the raw benthic data from the semi-quantitative subsample, a numerical value was calculated for each of the seven biometrics. The numeric values are then compared to the values in the biocriteria tables for the applicable bioregion. The tables contain a score for a given range of numeric values for each biometric. The scores are all a 0, 2, 4 or 6 for each of the seven biometrics. Therefore, Tennessee Macroinvertebrate Index (TMI) scores can theoretically range from 0 to 42. The matrix scores were recorded on the Macroinvertebrate Assessment Report form. This form is contained in Appendix D of this report. The total cumulative score for the seven biometrics was then compared to the target TMI for the Bioregion. A summary of the seven biometrics is as follows:

1) TR (Taxa Richness)

The taxa richness score is based on the total number of distinct genera found in the sample. For Bioregion 71i, less than 8 genera in the sample receives a score of 0 and more than 23 genera receives a score of 6. The Big Rock Creek sampling site received a score of 4 for containing 20 genera.

2) EPT (Ephemeroptera Plecoptera Tricoptera Richness)

The EPT score is based on the total number of genera in the sample that are in the orders of Ephemeroptera, Plecoptera, and Tricoptera. For Bioregion 71i, less than 2 genera in the sample receives a score of 0 and more than 7 genera receives a score of 6. The Big Rock Creek sampling site received a score of 6 for containing 8 EPT genera.

3) % EPT-Cheum (EPT Abundance excluding *Cheumatopsyche*)

This biometric is based on the total number of EPT individuals collected excluding the *Cheumatopsyche* individuals as a percentage of all individuals in the sample. For Bioregion 71i, less than 12.1% receives a score of 0 and more than 36.3% receives a score of 6. The Big Rock Creek sample received a score of 2 for having a value of 23.3%.

4) %OC (Percent oligochaetes and chironomids)

This biometric is based on the number of oligochaetes and chironomids individuals as a percentage of all individuals collected. For Bioregion 71i, more than 78.1% receives a score of 0 and less than 34.2% receives a score of 6. The Big Rock Creek sample received a score of 6 for having a value of 5.2%.

5) NCBI (North Carolina Biotic Index)

This biometric uses tolerance values assigned in the North Carolina Biotic Index to calculate an average tolerance value for the specimens collected in the sample. A value of 0 to 10 is assigned to each organism based on their tolerance of water pollution. The higher the value assigned, the more tolerant they are to pollution within the stream. The value for the sample is calculated as a weighted average of all individuals contained in the sample. For Bioregion 71i, a value of more than 8.53 receives a score of 0 and a value of less than 5.60 receives a score of 6. The Big Rock Creek sample received a score of 6 for having a value of 4.83.

6) % Clingers

Clingers are organisms that build fixed retreats or have adaptations to attach to surfaces in flowing water. This biometric is based on the percentage of individuals in the sample that are considered clingers. For Bioregion 71i, a value of less than 16.2% receives a score of 0 and a value of more than 48.3% receives a score of 6.

The Big Rock Creek sample received a score of 4 for a value of 45.4%.

7) % TNUTOL (TN Nutrient Tolerant Organisms)

This biometric is based on the percentage of individuals in the sample that are *Cheumatopsyche*, *Stenelmis*, *Polypedilum*, *Cricotopus*, *Cricotopus/Orthocladius*, *Lirceus*, *Caenis*, *Elimia*, *Nais*, *Dero*, and undetermined immature *Tubificidae*. For Bioregion 71i, a value of greater than 79.0% receives a score of 0 and a value of less than 37.2% receives a score of 6. The Big Rock Creek sample received a score of 6 for a value of 28.6%.

The TMI Score for the Big Rock Creek sample collected in Lewisburg was 34. The target TMI score for Bioregion 71g is 32. Therefore, the stream segment passes biocriteria by having a TMI score of at least 32. A table of all taxa identified within the sample is contained in Appendix D of this report.

While the stream segment passes biocriteria, it is worth noting that only 77 specimens were able to be collected in several kick attempts within the reach. It is also worth noting that there were many more *Cambaridae* and *Pleuroceridae* observed in the stream reach than were collected. If an attempt had been made to simply collect these specimens to complete the desired sample size, it would have been relatively easy to do so. As a point of interest, a theoretical TMI score was figured for a sample that easily could have contained an additional 50 *Cambaridae* and 50 *Pleuroceridae* specimens. The TMI score in this theoretical scenario would have been 30 rather than 34. The score would have been two points lower for the % EPT-Cheum criteria and two points lower for the % Clingers criteria. The stream segment would not have passed for biocriteria.

Due to the low number of specimens collected and the high numbers of other specimens observed as mentioned above, the results for this monitoring are considered suspect. Future monitoring of the stream will be necessary to get a good feel for the actual status of the stream segment.

5.2 Snell Branch

Using the raw benthic data from the semi-quantitative subsample, a numerical value was calculated for each of the seven biometrics. The numeric values are then compared to the values in the biocriteria tables for the applicable bioregion. The matrix scores were recorded on the Macroinvertebrate Assessment Report form. This form is contained in Appendix D of this report. The total cumulative score for the seven

biometrics was then compared to the target TMI for the Bioregion. A summary of the seven biometrics is as follows:

1) TR (Taxa Richness)

The taxa richness score is based on the total number of distinct genera found in the sample. For Bioregion 71i, less than 8 genera in the sample receives a score of 0 and more than 23 genera receives a score of 6. The Snell Branch sampling site received a score of 6 for containing 29 genera.

2) EPT (Ephemeroptera Plecoptera Tricoptera Richness)

The EPT score is based on the total number of genera in the sample that are in the orders of Ephemeroptera, Plecoptera, and Tricoptera. For Bioregion 71i, less than 2 genera in the sample receives a score of 0 and more than 7 genera receives a score of 6. The Snell Branch sampling site received a score of 6 for containing 9 EPT genera.

3) % EPT-Cheum (EPT Abundance excluding *Cheumatopsyche*)

This biometric is based on the total number of EPT individuals collected excluding the *Cheumatopsyche* individuals as a percentage of all individuals in the sample. For Bioregion 71i, less than 12.1% receives a score of 0 and more than 36.3% receives a score of 6. The Snell Branch sample received a score of 2 for having a value of 20.9%.

4) % OC (Percent oligochaetes and chironomids)

This biometric is based on the number of oligochaetes and chironomids individuals as a percentage of all individuals collected. For Bioregion 71i, more than 78.1% receives a score of 0 and less than 34.2% receives a score of 6. The Snell Branch sample received a score of 6 for having a value of 9.3%.

5) NCBI (North Carolina Biotic Index)

This biometric uses tolerance values assigned in the North Carolina Biotic Index to calculate an average tolerance value for the specimens collected in the sample. A value of 0 to 10 is assigned to each organism based on their tolerance of water pollution. The higher the value assigned, the more tolerant they are to pollution within the stream. The value for the sample is calculated as a weighted average of all individuals contained in the

sample. For Bioregion 71i, a value of more than 8.53 receives a score of 0 and a value of less than 5.60 receives a score of 6. The Snell Branch sample received a score of 6 for having a value of 4.51.

6) % Clingers

Clingers are organisms that build fixed retreats or have adaptations to attach to surfaces in flowing water. This biometric is based on the percentage of individuals in the sample that are considered clingers. For Bioregion 71i, a value of less than 16.2% receives a score of 0 and a value of more than 48.3% receives a score of 6. The Snell Branch sample received a score of 4 for a value of 47.7%.

7) % TNUTOL (TN Nutrient Tolerant Organisms)

This biometric is based on the percentage of individuals in the sample that are *Cheumatopsyche*, *Stenelmis*, *Polypedilum*, *Cricotopus*, *Cricotopus/Orthocladius*, *Lirceus*, *Caenis*, *Elimia*, *Nais*, *Dero*, and undetermined immature *Tubificidae*. For Bioregion 71i, a value of greater than 79.0% receives a score of 0 and a value of less than 37.2% receives a score of 6. The Snell Branch sample received a score of 4 for a value of 37.2%.

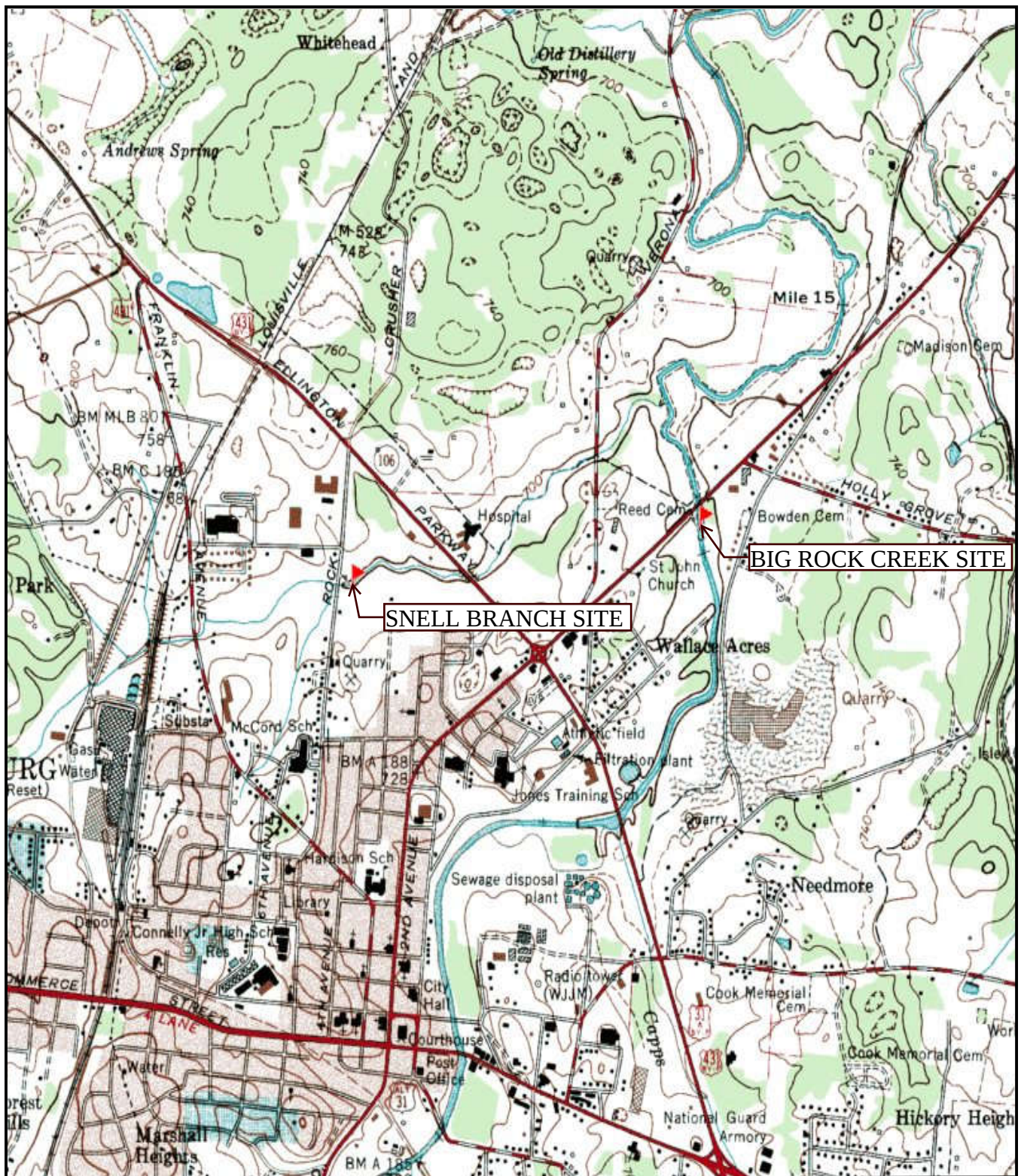
The TMI Score for the Snell Branch sample collected in Lewisburg was 34. The target TMI score for Bioregion 71g is 32. Therefore, the stream segment passes biocriteria by having a TMI score of at least 32. A table of all taxa identified within the sample is contained in Appendix D of this report.

6.0 CONCLUSION

The results of the monitoring discussed in this report indicate that Snell Branch is passing biocriteria and habitat expectations for the watershed. The results also indicate that Big Rock Creek is suspect of potentially not passing biocriteria and that more study of the stream segment is necessary to clearly understand its status. Stream monitoring within these segments will continue as required by the Small MS4 permit.

All of the monitoring conducted for the completion of this report was conducted by or overseen by Jim Patterson of St. John Engineering, LLC. Mr. Patterson is the Environmental Manager at St. John Engineering, LLC and has 25 years of experience in water quality monitoring and compliance.

APPENDIX A
STREAM SAMPLING LOCATION MAP



St. John ENG

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ENVIRONMENTAL CONSULTING

Location Map

DWN BY:	JRP	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY:	JRP	N.T.S.	8/31/2018	301-01.01	1

APPENDIX B

BIG ROCK CREEK
AND
SNELL BRANCH PHOTOGRAPHS



ENGINEERING, LLC
ENGINEERING • PLANNING •
ENVIRONMENTAL CONSULTING

923 JACKSON STREET
MANCHESTER, TN 37355
PHONE: (931) 728-2638 – FAX: (931) 728-6357
WWW.STJOHNENGINEERING.COM

Big Rock Creek Photo

BIG ROCK CREEK REACH - UPSTREAM
LEWISBURG, TENNESSEE

DWN BY:	JRP	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY:	JRP	N.T.S.	8/31/2018	301-01.01	1



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PHONE: (931) 728-2638 – FAX: (931) 728-6357
WWW.STJOHNENGINEERING.COM

Big Rock Creek Photo

BIG ROCK CREEK - SUBSTRATE
LEWISBURG, TENNESSEE

DWN BY:	JRP	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY:	JRP	N.T.S.	8/31/2018	301-01.01	2



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Snell Branch - Photo

SNELL BRANCH REACH - DOWNSTREAM
LEWISBURG, TENNESSEE

DWN BY:	JRP	SCALE:		DATE:		PROJECT-NO		FIGURE-NO	
CHKD. BY:	JRP		N.T.S.		8/31/2018		301-01.01		3



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Snell Branch Photo

SNELL BRANCH - SUBSTRATE
LEWISBURG, TENNESSEE

DWN BY:	JRP	SCALE:	DATE:	PROJECT-NO	FIGURE-NO
CHKD. BY:	JRP	N.T.S.	8/31/2018	301-01.01	4

APPENDIX C

HABITAT ASSESSMENT AND FIELD DATA SHEETS

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

(See Protocol E for detailed descriptions and rank information)

STATION ID: <u>BROCK 015.7ML</u>		HABITAT ASSESSED BY: <u>Jim Patterson / Ryan Patterson</u>	
STREAM NAME: <u>Big Rock Creek</u>		DATE: <u>7/18/18</u> TIME: <u>7:30</u>	
STATION LOCATION: <u>Nashville Highway</u>		ECOREGION: <u>715</u> QC: Consensus Duplicate	
WBID/HUC: <u>TN06040002012-2000</u> GROUP: <u>2000</u>		ASSOCIATED LOG #:	

	Optimal	Suboptimal	Marginal	Poor
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% 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
Comments				
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.	Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.	Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.	Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime. Others regimes too 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
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.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
5. Channel Flow Status.	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.	Water covers > 75% of streambed or 25% of productive habitat is exposed.	Water covers 25-75% of streambed and/or productive habitat is mostly exposed.	Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

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

Station ID	Date										Initials				
	Optimal					Suboptimal					Marginal				
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.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6
Comments															
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.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6
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.				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3		
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%).				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3		
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.				
SCORE (LB)	Left Bank	10	9			8	7	6			5	4	3		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3		
Comments															

Total Score 165

Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW

If score is below guidelines , result of (circle): Natural Conditions or Human Disturbance

Describe

WPC STREAM SURVEY FIELD SHEET (Front)

STREAM SURVEY INFORMATION

Station ID: <u>BROCK 015.7 ML</u>	Assessors: <u>Jim Patterson & Ryan Patterson</u>	
Stream Name: <u>Big Rock Creek</u>	Date: <u>7/18/18</u>	Time: <u>7:30</u>
Station Location: <u>Nashville Hwy.</u>	Stream Order: <u>3rd</u>	RM: <u>15.7</u>
County: <u>Marshall</u>	Drainage Area (sq mi): <u>28</u>	Watershed Group #
WBID/HUC: <u>TN06040002012-2000</u>	Ecoregion: <u>715</u>	U/S Eco:
Latitude DEC/DEG: <u>35.465570</u>	TOPO:	Gaz. Page:
Longitude DEC/DEG: <u>-86.775416</u>	Drainage (Basin)	

PROJECT/PURPOSE (circle): Watershed 303(d) Antideg Reference Other (describe) Point MS4

SAMPLES COLLECTED

Biorecon EFO Log #	Periphyton EFO Log #
SQKICK EFO Log # <u>✓</u>	Fish EFO Log #
SQBANK EFO Log #	Other Log #

CHEM/BACTI (circle): None Routine Nutrients Metals Bacti Other

FIELD MEASUREMENTS Meters Used: <u>YSI Pro 1030</u>	
pH (su) <u>7.71</u>	Dissolved Oxygen (ppm)
Conductivity (umhos) <u>2.2</u>	
Temperature (°C) <u>25.2</u>	

Meter problems/comments:

Previous 48 hrs precipitation: Unknown None Slight Moderate Heavy Flooding

Ambient Weather: Sunny Cloudy Breezy Rain Snow Air temp (°F):

WATERSHED CHARACTERISTICS Approx. % of Watershed Observed:

Upstream surrounding land use (estimated %):

Pasture <u>10</u>	Residential <u>35</u>	Industry <u>2</u>
Crops	Commercial <u>30</u>	Mining
Forest	Urban <u>23</u>	Impoundment

PHYSICAL STREAM CHARACTERISTICS Approx Length of Stream Assessed (m):

Surrounding land use (estimated %):

XXXX	RDB	LDB	XXXX	RDB	LDB	XXXX	RDB	LDB	OTHERS	RDB	LDB
Pasture <u>80</u>	<u>90</u>		Residential			Industry					
Crops			Commercial <u>20</u>	<u>10</u>		Mining					
Forest			Urban			Wetland					

Observed Human Disturbance to Stream: S (slight) M (moderate) H (high) Blank = not observed

ATV/OHV	Construction	Livestock	Residential
Industrial	Impoundment	STP/WWTP	Riparian Loss
Logging	Row Crop	Mining	Water withdrawal
Urban:	Road/Hwy	Dredging	
Other (describe): <u>Utility crossings and bridge directly below reach</u>			

% Canopy Cover: Estimated reach average: Open (0-10) Partly Shaded (11-43) Mostly Shaded (46-80) Shaded (> 80)

Measured mid reach: U/S D/S LB RB Total/384*100

Sediment Deposits: None <u>Slight</u> Moderate High Excessive Blanket
Sediment Type: Sludge Mud Sand <u>Silt</u> None Other
Turbidity: <u>Clear</u> Slight Moderate High Opaque Color
Surface Sheen/foam: Bacteria Nutrient Surfactant Other
Algae Present? <u>None</u> Slight Moderate High Choking Type: Diatom Green Filamentous Blue-green

Comments:

WPC STREAM SURVEY FIELD SHEET (Back)

Station ID	Date	Assessors	
		Riffle	Run
Depth (m)	0.2		0.5
Width (m)	30		30
Reach Length (m)	20		30

Staff Gauge/Bench Ht	
Flow (cfs)	
High Water Mark (m)	
Bank Height (m)	

Flow Conditions: Dry Isolated Pools Low Moderate High Bankfull Flooding Other _____
 Gradient (sample reach): Flat Low Moderate High Cascade Other _____
 Size (stream width): V. small (< 1.5m) Small (1-5.3 m) Med. (3-10 m) Large (10-25 m) V. Lrge (> 25m)

Substrate Percent (visual estimates):

	Riffle	Run	Pool		Riffle	Run	Pool
Boulder (> 10")	20		10	Clay (Slick)			
Cobble (2.5-10")	10			Silt			
Gravel (0.1-2.5")	70		90	Detritus (CPOM)			
Bedrock				Muck-Mud (FPOM)			
Sand (Gritty)				Marl (Shell frags.)			

Field Based Assessment	Info from other field sheets (optional)
Biorecon Score if Applicable _____ Indicate level: Family Genus	BR TR _____ EPT _____ INTOL _____
If SQSH not collected does benthic community appear impaired? Yes No	Habitat Score HG _____ LG _____

Describe basis for determination including possible sources of impairment: _____

Additional Stream Information _____

Photos? Yes No ID and Description 2 Upstream, Substrate

Stream Sketch: (include flow direction, reach distance, distance from bridge, nearest road, sampling points, tribs, outfalls, livestock access, riparian area, potential impacts, etc. Use additional sheet if needed).

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

(See Protocol E for detailed descriptions and rank information)

STATION ID: <u>SNEL001.1 ML</u>		HABITAT ASSESSED BY: <u>Jim Patterson & Ryan Patterson</u>		
STREAM NAME: <u>Snell Branch</u>		DATE: <u>7/18/18</u> TIME: <u>10:40</u>		
STATION LOCATION: <u>5th Ave North</u>		ECOREGION: <u>71</u> QC: Consensus Duplicate		
WBID/HUC: <u>TN06040002012-0700</u> GROUP:		ASSOCIATED LOG #:		
	Optimal	Suboptimal	Marginal	Poor
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% 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
Comments				
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.	Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.	Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.	Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime. Others regimes too 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
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.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
5. Channel Flow Status.	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.	Water covers > 75% of streambed or 25% of productive habitat is exposed.	Water covers 25-75% of streambed and/or productive habitat is mostly exposed.	Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

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

Station ID	Date										Initials									
	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																				
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																				
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	8	7	6	5	4	5	4	3	2	1	2	1	0		
SCORE (RB)	Right Bank	10	9	8	7	8	7	6	5	4	5	4	3	2	1	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 or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%)				
SCORE (LB)	Left Bank	10	9	8	7	8	7	6	5	4	5	4	3	2	1	2	1	0		
SCORE (RB)	Right Bank	10	9	8	7	8	7	6	5	4	5	4	3	2	1	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)	Left Bank	10	9	8	7	8	7	6	5	4	5	4	3	2	1	2	1	0		
SCORE (RB)	Right Bank	10	9	8	7	8	7	6	5	4	5	4	3	2	1	2	1	0		
Comments																				

Total Score 149

Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW

If score is below guidelines , result of (circle): Natural Conditions or Human Disturbance

Describe

WPC STREAM SURVEY FIELD SHEET (Front)

STREAM SURVEY INFORMATION		
Station ID: <u>SNE0001.1 ML</u>	Assessors: <u>Jim Patterson & Ryan Patterson</u>	
Stream Name: <u>Snell Branch</u>	Date: <u>7/18/18</u>	Time: <u>10:40</u>
Station Location: <u>5th Ave North</u>	Stream Order: <u>2nd</u>	RM: <u>1.1</u>
County: <u>Marshall</u>	Drainage Area (sq mi): <u>2.2</u>	Watershed Group #
WBID/HUC: <u>TN06040002012-0700</u>	Ecoregion: <u>71i</u>	U/S Eco:
Latitude DEC/DEG: <u>35.462773</u>	TOPO:	Gaz. Page:
Longitude DEC/DEG: <u>-86.790596</u>	Drainage (Basin)	

PROJECT/PURPOSE (circle): Watershed 303(d) Antideg Reference Other (describe) Permit MS4

SAMPLES COLLECTED	
Biorecon EFO Log # _____	Periphyton EFO Log # _____
SQKICK EFO Log # _____	Fish EFO Log # _____
SQBANK EFO Log # _____	Other Log # _____

CHEM/BACTI (circle): None Routine Nutrients Metals Bacti Other _____

FIELD MEASUREMENTS		Meters Used: <u>YSI Pro 1030</u>
pH (su)	<u>8.05</u>	Dissolved Oxygen (ppm)
Conductivity (umhos)	<u>0.5</u>	
Temperature (°C)	<u>26.5</u>	

Meter problems/comments: _____

Previous 48 hrs precipitation: Unknown None Slight Moderate Heavy Flooding

Ambient Weather: Sunny Cloudy Breezy Rain Snow Air temp (°F): _____

WATERSHED CHARACTERISTICS Approx. % of Watershed Observed:

Upstream surrounding land use (estimated %):					
Pasture	<u>20</u>	Residential	<u>30</u>	Industry	
Crops		Commercial	<u>50</u>	Mining	
Forest		Urban		Impoundment	

PHYSICAL STREAM CHARACTERISTICS Approx Length of Stream Assessed (m):

Surrounding land use (estimated %):											
	RDB	LDB		RDB	LDB		RDB	LDB	OTHERS	RDB	LDB
Pasture	<u>95</u>	<u>95</u>	Residential			Industry					
Crops			Commercial	<u>5</u>	<u>5</u>	Mining					
Forest			Urban			Wetland					

Observed Human Disturbance to Stream: S (slight) M (moderate) H (high) Blank = not observed

ATV/OHV		Construction		Livestock		Residential	
Industrial		Impoundment		STP/WWTP		Riparian Loss	☒
Logging		Row Crop		Mining		Water withdrawal	
Urban:		Road/Hwy	☒	Dredging			
Other (describe): _____							

% Canopy Cover: Estimated reach average Open (0-10) Partly Shaded (11-45) Mostly Shaded (46-80) Shaded (> 80)

Measured mid reach: _____ U/S _____ D/S _____ LB _____ RB _____ Total/384*100

Sediment Deposits:	None	<u>Slight</u>	Moderate	High	Excessive	Blanket
Sediment Type:	Sludge	Mud	Sand	<u>Silt</u>	None	Other _____
Turbidity:	<u>Clear</u>	Slight	Moderate	High	Opaque	Color _____
Surface Sheen/foam:	Bacteria	Nutrient	Surfactant	Other _____		
Algae Present?	None	Slight	<u>Moderate</u>	High	Choking	Type: Diatom <u>Green</u> Filamentous Blue-green

Comments:

WPC STREAM SURVEY FIELD SHEET (Back)

Station ID	Date		Assessors	
	Riffle	Run	Pool	
Depth (m)	0.1	0.3		Staff Gauge/Bench Ht
Width (m)	1	1		Flow (cfs)
Reach Length (m)	80	20	20	High Water Mark (m)
				Bank Height (m)

Flow Conditions: Dry Isolated Pools Low Moderate High Bankfull Flooding Other _____
Gradient (sample reach): Flat Low Moderate High Cascade Other _____
Size (stream width): V. small (< 1.5m) Small (1-5.3 m) Med. (3-10 m) Large (10-25 m) V. Lrge (> 25m)

Substrate Percent (visual estimates):

	Riffle	Run	Pool		Riffle	Run	Pool
Boulder (> 10")				Clay (Slick)			
Cobble (2.5-10")		10		Silt			
Gravel (0.1-2.5")	20	20		Detritus (CPOM)			
Bedrock	80	70		Muck-Mud (FPOM)			
Sand (Gritty)				Marl (Shell frags.)			

Field Based Assessment	Info from other field sheets (optional)
Biorecon Score if Applicable _____ Indicate level: Family Genus	BR TR _____ EPT _____ INTOL _____
If SQSH not collected does benthic community appear impaired? Yes No	Habitat Score HG _____ LG _____

Describe basis for determination including possible sources of impairment: _____

Additional Stream Information _____

Photos? Yes No **ID and Description** 2, Downstream + Substrate

Stream Sketch: (include flow direction, reach distance, distance from bridge, nearest road, sampling points, tribs, outfalls, livestock access, riparian area, potential impacts, etc. Use additional sheet if needed).

APPENDIX D

MACROINVERTEBRATE ASSESSMENT REPORTS
AND
TAXA LISTINGS

MACROINVERTEBRATE ASSESSMENT REPORT

Station ID: <u>Brock 015.7 ML</u>	Date Collected: <u>7/18/18</u>
Stream: <u>Big Rock Creek</u>	Ecoregion(s) <u>715</u>
Location: <u>Nashville Highway</u>	Project <u>301-01.01</u>
HUC/ADB Segment: <u>TN06040002012-2000</u>	Watershed Group:
Sampled By: <u>JRP</u>	ID By: <u>Todd Askegaard</u> Scored By: <u>Patterson</u>

If new station send additional information requested on header of stream survey field sheet to PAS

DRAINAGE AREA (circle one): ≤ 2 square miles > 2 square miles

SAMPLE TYPE (circle one) BIORECON SQBANK SQKICK

BIORECON	LAB LOG #		EFO LOG #	
METRIC	FAMILY LEVEL		GENUS LEVEL	
	Value	Score	Value	Score
Taxa Richness				
EPT Richness				
Intolerant Taxa				

BR INDEX SCORE: Family _____ Genus _____ SOP date _____

COMMENTS:

SQSH	LAB LOG #		EFO LOG #
METRIC	VALUE		SCORE
Total individuals in subsample	<u>77</u>		<u>NA</u>
Taxa Richness	<u>20</u>		<u>4</u>
EPT Richness	<u>8</u>		<u>6</u>
% EPT-Cheum	<u>23.3</u>		<u>2</u>
% OC	<u>5.2</u>		<u>6</u>
NCBI	<u>4.83</u>		<u>6</u>
% Clingers	<u>45.4</u>		<u>4</u>
% TNUTOL	<u>28.6</u>		<u>6</u>

TMI SCORE 34 SOP Date _____

COMMENTS:

Passes but is suspicious due to low # of species caught

HABITAT ASSESSMENT SCORE 165 RR/HIGH GRAD. (or) _____ GP/LOW GRAD.

HABITAT GUIDELINES FOR SUBREGION (Circle one) ABOVE BELOW

MACROINVERTEBRATE ASSESSMENT REPORT

Station ID: <u>SNELL 001.1 ML</u>	Date Collected: <u>7/18/18</u>
Stream: <u>Snell Branch</u>	Ecoregion(s) <u>715</u>
Location: <u>5th Avenue North</u>	Project <u>301-01.01</u>
HUC/ADB Segment: <u>TN06040002012-0700</u>	Watershed Group:
Sampled By: <u>JRP</u>	ID By: <u>Todd Askeyeard</u>
	Scored By: <u>Patterson</u>

If new station send additional information requested on header of stream survey field sheet to PAS

DRAINAGE AREA (circle one): ≤ 2 square miles > 2 square miles

SAMPLE TYPE (circle one) BIORECON SQBANK SQKICK

BIORECON	LAB LOG #		EFO LOG #	
METRIC	FAMILY LEVEL		GENUS LEVEL	
	Value	Score	Value	Score
Taxa Richness				
EPT Richness				
Intolerant Taxa				

BR INDEX SCORE: Family _____ Genus _____ SOP date _____

COMMENTS:

SQSH	LAB LOG #		EFO LOG #
METRIC	VALUE		SCORE
Total individuals in subsample	<u>172</u>		<u>NA</u>
Taxa Richness	<u>29</u>		<u>6</u>
EPT Richness	<u>9</u>		<u>6</u>
% EPT-Cheum	<u>20.9</u>		<u>2</u>
% OC	<u>9.3</u>		<u>6</u>
NCBI	<u>4.51</u>		<u>6</u>
% Clingers	<u>47.7</u>		<u>4</u>
% TNUTOL	<u>37.2</u>		<u>4</u>

TMI SCORE 34 SOP Date _____

COMMENTS:

Passes for Bioregion 715

HABITAT ASSESSMENT SCORE 149 RR/HIGH GRAD. (or) _____ GP/LOW GRAD.

HABITAT GUIDELINES FOR SUBREGION (Circle one) ABOVE BELOW

Bioregion 71i Season: January - December Target TMI = 32 Scoring calibrated to 160-240 organism sample		Method = SQKICK Drainage > 2 sq miles Genus Level Identification		
Metric	6	4	2	0
Taxa Richness (TR)	> 23	16 – 23	8 – 15	< 8
EPT Richness (EPT)	> 7	5 – 7	2 – 4	< 2
% EPT-Cheum	> 36.3	24.3 – 36.3	12.1 – 24.2	< 12.1
% OC	< 34.2	34.2 – 56.1	56.2 – 78.1	> 78.1
NCBI	< 5.60	5.60 – 7.06	7.07 – 8.53	> 8.53
% Clingers	> 48.3	32.3 – 48.3	16.2 – 32.2	< 16.2
% TNutol	< 37.2	37.2 – 58.0	58.1 – 79.0	> 79.0

Bioregion 71i Season: January - December Target TMI = 32 Scoring calibrated to 160-240 organism sample		Method = SQKICK Drainage ≤ 2 sq mile Genus Level Identification		
Metric	6	4	2	0
Taxa Richness (TR)	> 15	11–15	5 – 10	< 5
EPT Richness (EPT)	> 6	4 – 6	2 – 3	< 2
% EPT-Cheum	> 43.4	29.0 – 43.4	14.5 – 43.4	< 14.5
% OC	< 31.9	31.9 – 54.5	54.6 – 77.3	> 77.3
NCBI	< 5.72	5.72 – 7.14	7.15 – 8.57	> 8.57
% Clingers	> 41.1	27.5 – 41.1	13.7 – 27.4	< 13.7
% TNutol	< 46.5	46.5 – 64.2	64.3 – 82.1	> 82.1

Bioregion 71i Season: January - December Target TMI = 32 Scoring calibrated to 160-240 organism sample		Method = SQBANK Drainage > 2 sq miles Genus Level Identification		
Metric	6	4	2	0
Taxa Richness (TR)	> 32	22 – 32	11 – 21	< 11
EPT Richness (EPT)	> 5	4 – 5	2 – 3	< 2
% EPT-Cheum	> 30.7	20.5 – 30.7	10.3 – 20.4	< 10.3
% OC	< 30.0	30.0 – 53.3	53.4 – 76.6	> 76.6
NCBI	< 6.89	6.89 – 7.92	7.93 – 8.96	> 8.96
% Clingers	> 21.5	14.4 – 21.5	7.2 – 14.3	< 7.2
% TNutol	< 34.5	34.5 – 56.3	56.4 – 78.1	> 78.1

Phylum	Class	Order	Family	Taxon	BROCK015.7ML 18-Jul-18	Weighted NCBI	Clingers	TNUTOL
Platyhelminthes	Tubellaria	Tricladida	Planariidae	Cura				
Annelida	Clitellata			Megadrili				
Annelida	Clitellata	Tubificida	Naididae	Branchiura	1	6.1		
Arthropoda	Crustacea	Amphipoda	Crangonyctidae	Crangonyx				
Arthropoda	Crustacea	Decapoda	Cambaridae	Faxonius	2	15		
Arthropoda	Crustacea	Decapoda	Cambaridae	Cambaridae	3	22.5		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acerpenna	2	7.4		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis				
Arthropoda	Insecta	Ephemeroptera	Baetidae	Procloeon	1	6.6		
Arthropoda	Insecta	Ephemeroptera	Caenidae	Caenis	1	7.41		X
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	2	6.3	X	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenacron				
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenonema	9	31.05	X	
Arthropoda	Insecta	Ephemeroptera	Isonychiidae	Isonychia				
Arthropoda	Insecta	Ephemeroptera	Leptohyphidae	Tricorythodes	2	10.12		
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Choroterpes	1	0	X	
Arthropoda	Insecta	Odonata	Coenagrionidae	Argia	6	49.02		
Arthropoda	Insecta	Hemiptera	Belostomatidae	Belostomatidae				
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	1	6.22	X	X
Arthropoda	Insecta	Trichoptera	Philopotamidae	Chimarra				
Arthropoda	Insecta	Coleoptera	Elmidae	Dubiraphia				
Arthropoda	Insecta	Coleoptera	Elmidae	Optioservus				
Arthropoda	Insecta	Coleoptera	Elmidae	Stenelmis	20	102	X	X
Arthropoda	Insecta	Coleoptera	Hydrophilidae	Helochares				
Arthropoda	Insecta	Coleoptera	Psephenidae	Ectopria				
Arthropoda	Insecta	Coleoptera	Psephenidae	Psephenus				
Arthropoda	Insecta	Coleoptera	Scirtidae	Scirtes	2	13.6		
Arthropoda	Insecta	Diptera	Chironomidae	Chironomus				
Arthropoda	Insecta	Diptera	Chironomidae	Conchapelopia				
Arthropoda	Insecta	Diptera	Chironomidae	Microtendipes	2	11.06	X	
Arthropoda	Insecta	Diptera	Chironomidae	Natarsia	1	9.95		
Arthropoda	Insecta	Diptera	Chironomidae	Nilotanytus				
Arthropoda	Insecta	Diptera	Chironomidae	Stictochironomus				
Arthropoda	Insecta	Diptera	Chironomidae	Thienemannimyia grp	1	6.2		
Arthropoda	Insecta	Diptera	Sciaridae	Sciaridae	2			
Arthropoda	Insecta	Diptera	Tipulidae	Tipula				
Mollusca	Bivalvia	Veneroida	Corbiculidae	Corbicula	2	12.24		
Mollusca	Gastropoda	Neotaenioglossa	Pleuroceridae	Pleurocera (Elimia)	16	39.36		
				Total number of individuals	77	362.13	35	22

Phylum	Class	Order	Family	Taxon	SNELL001.1ML 18-Jul-18	Weighted NCBI	Clingers	TNUTOL
Platyhelminthes	Tubellaria	Tricladida	Planariidae	Cura	5	30.5		
Annelida	Clitellata			Megadrili	6	50.1		
Annelida	Clitellata	Tubificida	Naididae	Branchiura				
Arthropoda	Crustacea	Amphipoda	Crangonyctidae	Crangonyx				
Arthropoda	Crustacea	Decapoda	Cambaridae	Faxonius	5	37.5		
Arthropoda	Crustacea	Decapoda	Cambaridae	Cambaridae	5	37.5		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Acerpenna				
Arthropoda	Insecta	Ephemeroptera	Baetidae	Baetis	1	4.51		
Arthropoda	Insecta	Ephemeroptera	Baetidae	Proclleon	1	6.6		
Arthropoda	Insecta	Ephemeroptera	Caenidae	Caenis	15	111.15		X
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Maccaffertium				
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenacron	4	14.32	X	
Arthropoda	Insecta	Ephemeroptera	Heptageniidae	Stenonema	1	3.45	X	
Arthropoda	Insecta	Ephemeroptera	Isonychiidae	Isonychia	4	13.8		
Arthropoda	Insecta	Ephemeroptera	Leptohyphidae	Tricorythodes				
Arthropoda	Insecta	Ephemeroptera	Leptophlebiidae	Choroterpes	8	0	X	
Arthropoda	Insecta	Odonata	Coenagrionidae	Argia	4	32.68		
Arthropoda	Insecta	Hemiptera	Belostomatidae	Belostomatidae	1	6.9		
Arthropoda	Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	12	74.64		X
Arthropoda	Insecta	Trichoptera	Philopotamidae	Chimarra	2	5.52		
Arthropoda	Insecta	Coleoptera	Elmidae	Dubiraphia	1	5.93	X	
Arthropoda	Insecta	Coleoptera	Elmidae	Optioservus	1	2.36	X	
Arthropoda	Insecta	Coleoptera	Elmidae	Stenelmis	20	102	X	X
Arthropoda	Insecta	Coleoptera	Hydrophilidae	Helochares	1	4		
Arthropoda	Insecta	Coleoptera	Psephenidae	Ectopria				
Arthropoda	Insecta	Coleoptera	Psephenidae	Psephenus	44	103.4	X	
Arthropoda	Insecta	Coleoptera	Scirtidae	Scirtes				
Arthropoda	Insecta	Diptera	Chironomidae	Chironomus	1	9.63		
Arthropoda	Insecta	Diptera	Chironomidae	Conchapelopia	1	4.5		
Arthropoda	Insecta	Diptera	Chironomidae	Microtendipes	3	16.59	X	
Arthropoda	Insecta	Diptera	Chironomidae	Natarsia				
Arthropoda	Insecta	Diptera	Chironomidae	Nilotanytus	1	3.9		
Arthropoda	Insecta	Diptera	Chironomidae	Stictochironomus	1	6.52		
Arthropoda	Insecta	Diptera	Chironomidae	Thienemannimyia grp	3	18.6		
Arthropoda	Insecta	Diptera	Sciaridae	Sciaridae				
Arthropoda	Insecta	Diptera	Tipulidae	Tipula	3	21.99		
Mollusca	Bivalvia	Veneroida	Corbiculidae	Corbicula	1	6.12		
Mollusca	Gastropoda	Neotaenioglossa	Pleuroceridae	Pleurocera (Elimia)	17	1.82		X
				Total number of individuals	172	776.53	82	64