Habitat and Macroinvertebrate Assessment Report

Wolf Run Watershed
Fayette County, Kentucky

Prepared for
Lexington-Fayette Urban County Government
Division of Environmental Quality

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I. INTRODUCTION

This report summarizes results for benthic macroinvertebrate collections and habitat assessments in the Wolf Run watershed. The survey was conducted under a Section 319(h) Nonpoint Source Implementation Program Cooperative Agreement (#C9994861-09) awarded by the Commonwealth of Kentucky, Energy and Environment Cabinet, Department for Environmental Protection, Division of Water (KDOW) to Lexington-Fayette Urban County Government (LFUCG) based on an approved work plan. The survey was conducted according to the preapproved Quality Assurance Project Plan (QAPP, Third Rock 2011).

The benthic macroinvertebrate sampling was intended to evaluate the macroinvertebrate communities in the tributaries and headwaters of Wolf Run for comparison to the data collected over multiple years near the mouth of the watershed.

Habitat assessments were intended to supplement the biological and physicochemical data when determining the overall health of the stream reaches and stream-use designation. Additionally, the habitat assessments were intended to provide a baseline to document physical changes that occur over time and to identify potential areas for BMP implementation.

Benthic macroinvertebrates were collected by Third Rock Consultants, LLC (Third Rock) from seven sites within the Wolf Run watershed. Third Rock biologists also performed habitat assessments at these sites. Trained volunteers from the Friends of Wolf Run (FOWR), performed habitat assessments on 22 reaches within the watershed.

II. METHODS

A. Macroinvertebrates

Sampling for benthic macroinvertebrates was conducted according to KDOW's *Methods for Sampling Benthic Macroinvertebrate Communities in Wadeable Waters* (KDOW 2009b). A total of seven sites were sampled in the watershed as shown in Exhibit 1, page 2. Six of these sites are headwater sites (<5 mi^2 upstream watershed) and were sampled under the 319(h) grant funding. Site W1, is a wadeable site (>5 mi^2 upstream watershed) and was sampled under LFUCG's MS4 permit. Descriptions of the seven sampling sites are found in Table 1.

TABLE 1 – MACROINVERTEBRATE SAMPLING SITE DESCRIPTION

Site Name	Stream	Location	Latitude	Longitude
W1	Wolf Run	Old Frankfort Pike	38.067303	-84.554182
W2	McConnell Br	Prestons Cave	38.057333	-84.542169
W4	Vaughn's Br	Valley Park	38.054904	-84.549624
W5A	Cardinal Run	Parkers Mill Rd	38.043212	-84.557131
W6	Wolf Run	Wolf Run Park	38.045274	-84.550661
W11	Big Elm Trib.	Harrodsburg Rd	38.031245	-84.526027
W12	Wolf Run	Lafayette Pkwy	38.022932	-84.528581

Sampling was performed within the index periods for wadeable and headwater streams. The index period for wadeable streams is May 1 to September 30, and W1 was collected on May 12, 2011. For headwater streams, the index period is February 15 to May 31, and the six headwater sites were sampled on May 17 and 18, 2011. Sampling did not occur during periods of excessively high or low flow or within two weeks of a known scouring flow event.

Collection events consisted of a composited semi-quantitative sample and a composited multi-habitat sample. Semi-quantitative samples were collected from a known area in the most productive in-stream habitat (*i.e.,* riffle) to analyze the population composition of the macroinvertebrate community. In both headwater and wadeable streams, semi-quantitative sampling consisted of taking four 0.25 m^2 kick net samples from mid-riffle or the thalweg.

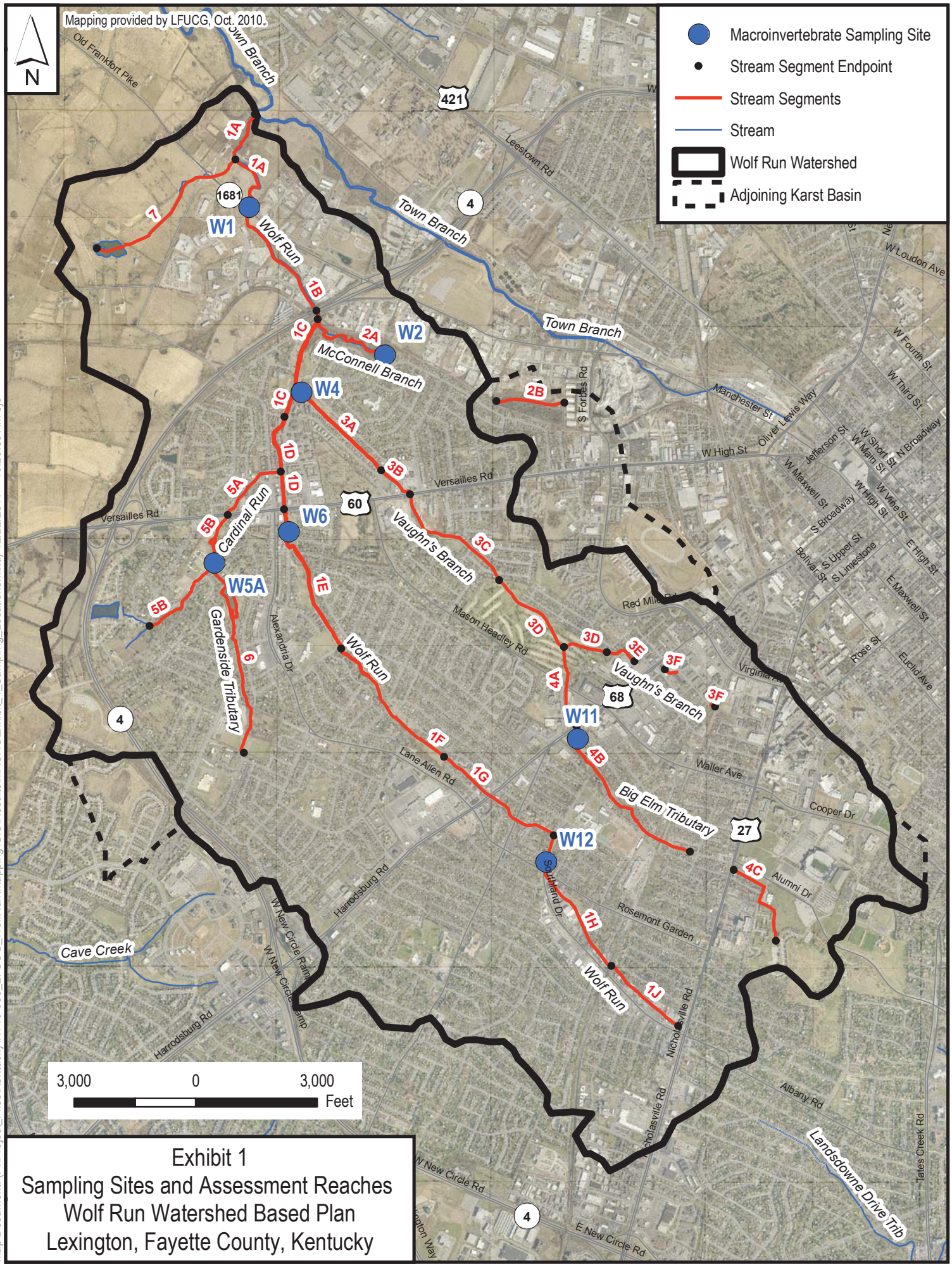

Exhibit 1
Sampling Sites and Assessment Reaches
Wolf Run Watershed Based Plan
Lexington, Fayette County, Kentucky

Map Document: (P:\Project_Files\Kentucky\KY10-030_LFUCG_WolfRun\Mapping\GIS\Results\MACROExhibit_1_Sampling_Locations.mxd) 12/22/2011 -- 10:20:58 AM sje

This was be accomplished using a 0.25 m^2, 600µm mesh kick net, dislodging benthos by vigorously disturbing the 0.25 m^2 (20 x 20 in.) of substrate in front of the net. Large rocks were hand washed into the net. The contents of the net were then washed, and all four samples were composited to yield a one m^2 semi-quantitative sample. The composited sample was partially field processed using a US No. 30 sieve (600µm) and wash bucket. Large stones, leaves and sticks were individually rinsed and inspected for organisms and then discarded. Small stones and sediment were removed by elutriation using the wash bucket and US No. 30 sieve. For headwater sites, two kick net samples were allocated to each of two distinct riffles (at minimum) that were separated by at least one pool or run. This was done to help reduce between-riffle variability.

Multi-habitat samples were collected to identify taxa present in stream habitats not sampled by the semi-quantitative sample (*i.e.,* root wads, undercut banks). This method sampled a variety of non-riffle habitats with the aid of an 800 x 900µm mesh triangular or D-frame dip net. A summary of the collection techniques used for wadeable and headwater streams is shown in Table 2 below and further described in the following sections.

In order to keep in-stream habitat intended for benthic macroinvertebrate sampling intact and undisturbed until the single and multi-habitat samples were collected, field personnel avoided walking through areas designated for collection of benthic macroinvertebrates until sampling was completed.

TABLE 2 – SUMMARY OF SAMPLING METHODS FOR MACROINVERTEBRATES

Technique	Sampling Device	Habitat	Replicates Composited for Wadeable Sites	Replicates Composited for Headwater Sites
Semi-Quantitaive				
1m^2 kicknet / seine	Kicknet / seine and wash bucket	Riffle	4 x 0.25m^2	4 x 0.25m^2
Multi-Habitat Sweep				
Undercut banks / roots	D-frame or triangular dip net and wash bucket	All applicable	3	3
Sticks / Wood			N/A	3
Emergent vegetation			3	N/A
Bedrock / slabrock			3	N/A
J. americana beds			3	N/A
Leaf packs		Riffle – Run – Pool	3	3
Silt, sand, fine gravel	US #10 Sieve	Margins	3	3
Aufwuchs sample	300 µm nitrex sampler / mesh	Riffle – Run - Pool	3	N/A
Rock pick	Fine-tipped forceps and wash bucket		15 total (5 each)	5 small boulders
Wood sample			3 to 6 linear meters	2 linear meters

After sampling was completed, all sampling gear was thoroughly cleaned to remove all benthic macroinvertebrates so that specimens would not be carried to the next site. The equipment was examined prior to sampling at the next site to ensure that no benthic macroinvertebrates were present. Habitat assessments were performed at each of the macroinvertebrates sites by Third Rock staff (as detailed in the following section).

Macroinvertebrate samples were delivered to Third Rock for identification according to *Laboratory Procedures for Macroinvertebrate Processing and Taxonomic Identification and Reporting* (KDOW 2009a). After identification, macroinvertebrate sampling results were evaluated through calculation of several community metrics prescribed by KDOW 2008. Results of community metrics at each station were combined to compute a Macroinvertebrate Bioassessment Index (MBI) score, ranging from 0 (worst) to 100 (best). MBI scores were compared to scoring criteria developed by KDOW to arrive at water quality ratings of Very Poor, Poor, Fair, Good, or Excellent.

B. Habitat Assessments

In order to delegate the habitat assessment responsibilities amongst volunteers, the watershed was divided into 24 stream segments as shown in Exhibit 1, page 2 and listed in Table 3.

TABLE 3 – HABITAT ASSESSMENT STREAM SEGMENTS

Segment ID	Stream	Stream Segment
1A	Wolf Run	Mouth to Old Frankfort Pike
1B	Wolf Run	Old Frankfort Pike to New Circle Rd
1C	Wolf Run	New Circle Rd. to Cambridge Dr
1D	Wolf Run	Cambridge Dr to Versailles Rd
1E	Wolf Run	Versailles Rd to Appomattox Rd
1F	Wolf Run	Appomattox Rd to Faircrest Dr
1G	Wolf Run	Faircrest Dr to Lafayette Pkwy
1H	Wolf Run	Lafayette Pkwy to railroad tracks north of Southland Dr
1J	Wolf Run	Railroad tracks to Nicholasville Rd
2A	McConnell Branch	Wolf Run to Preston's Cave Spring
2B	McConnell Branch	McConnell Springs Branch through Stormwater Structure
3A	Vaughn's Branch	Wolf Run to Oxford Circle
3B	Vaughn's Branch	Oxford Circle to Versailles Rd
3C	Vaughn's Branch	Versailles Rd to Summerville Rd/Golf Course Fence
3D	Vaughn's Branch	Picadome Golf Course
3E	Vaughn's Branch	Picadome Golf Course Fence to Gibson Ave Culvert
3F	Vaughn's Branch	Simpson Ave to railroad tracks
4A	Big Elm Tributary	Sinkhole on Picadome Golf Course to Harrodsburg Rd
4B	Big Elm Tributary	Harrodsburg Rd to railroad tracks via Bob-O-Link Dr
4C	Big Elm Tributary	Nicholasville Rd to behind Central Baptist Hospital
5A	Cardinal Run	Wolf Run to Versailles Rd
5B	Cardinal Run	Versailles Rd to End of Chinquapin Ln
6A	Gardenside Tributary	Upstream of Parkers Mill Rd
7	Unnamed Tributary	Wolf Run under Alexandria Dr and Old Frankfort Pike to pond

All volunteers involved in the assessments participated in two training sessions on the performance of habitat assessments according to the US EPA's *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour *et al.* 1999) and KDOW protocol (KDOW 2008) prior to conducting the assessments for this study. The initial training on May 15, 2011 was led by staff at Bluegrass Community and Technical College and provided certification in Watershed Watch Phase II Habitat Assessment protocols. PowerPoint presentations used in this training are available at http://www.lrww.org/training/.

On May 23, 2011, Third Rock biologists led a subsequent training session on the use of the rapid bio-assessment habitat form and the QAPP protocols. During the second training session, volunteers performed habitat assessments at sites W2 and W6 and compared their assessments to those generated by Third Rock biologists in order to improve the consistency of scoring by the volunteers during the survey effort.

During habitat assessments, a visual assessment of 10 habitat parameters was used to characterize the stream "micro scale" habitat, the "macro scale" features, and the riparian and bank structure features that are most often influential in affecting the other parameters. Each of the parameters will be evaluated on a "Condition Category" scale from 0 to 20. The categories within this scale include "Optimal" for scores from 20 to 16, "Suboptimal" for scores from 15 to 11, "Marginal" for scores from 10 to 6, and "Poor" for scores from 5 to 0. The score for each parameter was summed to produce a final habitat score (maximum 200).

For parameters 1 to 5, a composite of the entire biological sampling reach is evaluated. These parameters include: 1) epifaunal substrate/ available cover, 2) embeddedness, 3) velocity/depth regime, 4) sediment deposition, and 5) channel flow status. For parameters 6 to 10, an area beginning approximately 100-m upstream of the sampling reach through the sampling reach was evaluated as a composite. These parameters include: 6) channel alteration, 7) frequency of riffles (or bends), 8) bank stability, 9) bank vegetative protection, and 10) riparian vegetative width. For parameters 8 to 10, each bank was scored independently from 10 to 0, facing downstream to determine left and right banks. At each sampling site, results were recorded on the High-Gradient Habitat Assessment Field Data Sheet. Photographs were taken to document upstream and downstream conditions at each site.

Results were entered into an excel database by the Friends of Wolf Run Sampling Coordinator and submitted to Third Rock for quality review and incorporation into a final report. Habitat assessment results were compared to scoring criteria developed by KDOW for the region to arrive at habitat ratings of Poor, Fair, or Good.

III. RESULTS

A. Macroinvertebrates

MBI scores for the six sites sampled under the 319(h) grant as well as the MS4 permit site located at W1 are shown in Exhibit 2, page 6. The MBI scores and metrics for each site are presented in Table 4, page 7. Data sheets for each site are contained in Appendix A.

Macroinvertebrate sampling results indicate moderately increasing MBI scores as one moves progressively down through the watershed, from the headwaters to higher order, wadeable streams. However, the scoring criteria for wadeable streams are also higher than headwater streams indicating that such increases are expected.

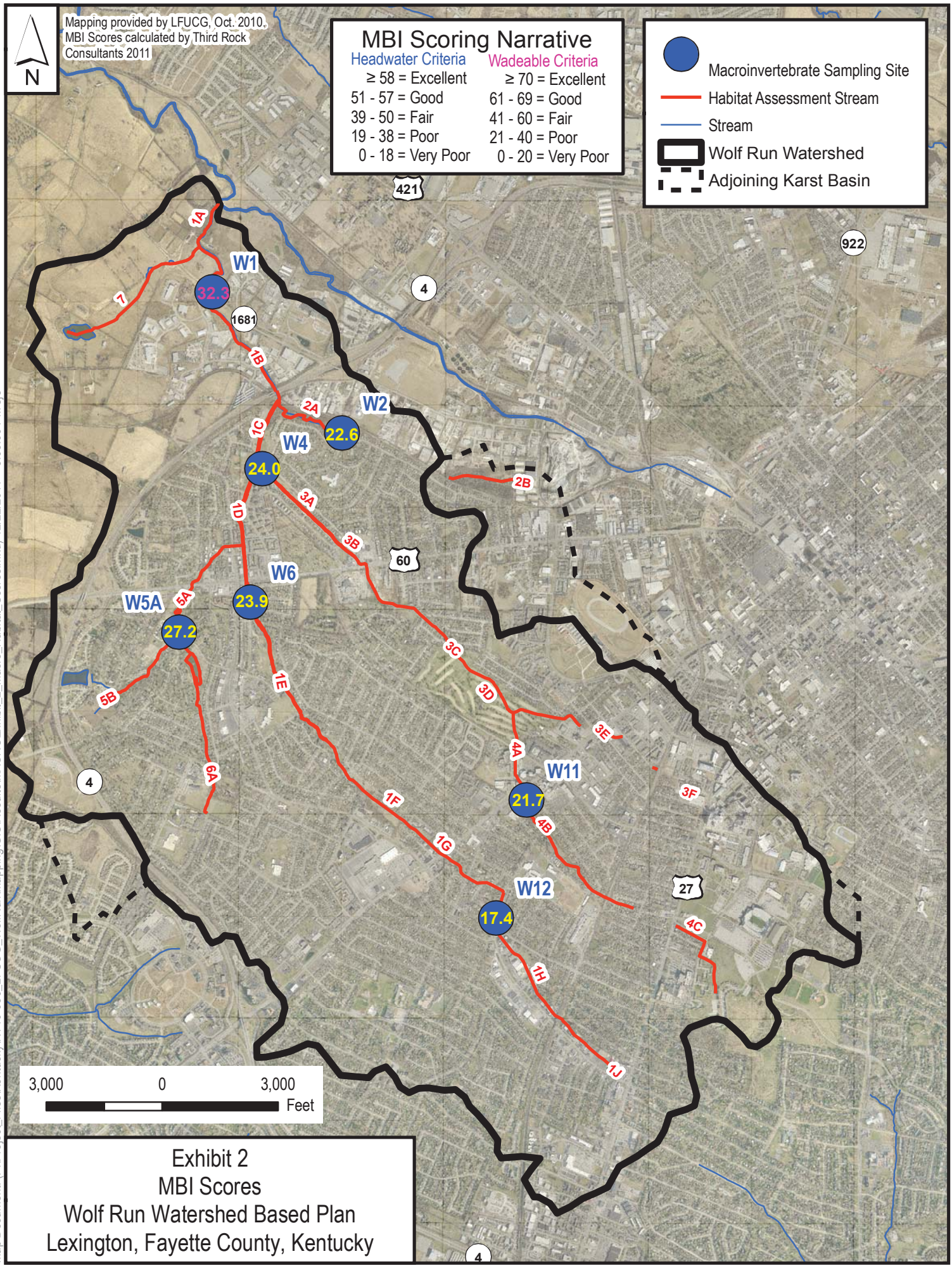

Exhibit 2
MBI Scores
Wolf Run Watershed Based Plan
Lexington, Fayette County, Kentucky

Map Document: (P:\Project_Files\Kentucky\KY10-030_LFUCG_WolfRun\Mapping\GIS\Results\MACROExhibit_2_Macro_Habitat_Scores.mxd) 12/22/2011 -- 9:03:06 PM sje

TABLE 4 – MBI SCORES AND METRICS

Site ID	Taxa Richness	EPT Richness	mHBI	%EPT	%Ephemeroptera	% Chironomidae + Oligochaeta	%Clingers	MBI Score	MBI Rating
W1	17	1	5.88	0	NA	13.9	14	32	Poor
W2	14	1	7.47	0.3	0	4	2	23	Poor
W4	14	2	7.35	0.9	0.9	0.9	2	24	Poor
W5A	30	2	5.99	0.3	0	34.6	12	27	Poor
W6	14	2	6.5	0.7	0.3	11.8	2	24	Poor
W11	8	0	7.27	0	0	0	3	22	Poor
W12	13	0	6.97	0	0	49.1	8	17	Very Poor

Macroinvertebrate biotic indices (MBI) calculated for six of the seven sampling stations in the Wolf Run watershed resulted in classifications of "poor." The one exception was W12, which received a classification of "very poor," scoring just below the threshold of 19 for a "poor" rating. The minimum MBI score for a "fair" rating is 41 for wadeable streams, such as W1, and 39 for headwater locations in the Bluegrass Bioregion. This indicates that considerable improvement will be necessary to achieve a "fair" rating.

The low MBI scores observed in the Wolf Run watershed are the result of several conditions, most of which are re-occurring at each of the seven sampling stations. All stations were extremely low in the number of pollution intolerant EPT (ephemeroptera, plecoptera, and trichoptera) taxa. No station had more than two genera of EPT (W11 and W12 had zero genera) and %EPT ranged from 0 to 0.9%. With the exception of W5A, all stations were also relatively low in overall genus taxa richness, which ranged from eight to 14 taxa. The exception, W5A, had 30 total taxa. However, the higher taxa richness observed at this station was primarily the result of an increase in diversity of pollution tolerant taxa such as chironomidae and annelida, as well as several tolerant members of mollusca. The abundance of clingers (taxa requiring stable substrates to cling to, such as gravel, boulders, root wads, etc) was very low, which is frequently an indicator of unstable substrate or high levels of siltation or embeddedness. The pollution tolerant isopod, *Lirceus fontinalis*, and the tolerant *Cricotopus/Orthocladius* members of Chironomidae were the most abundant organisms, respectively, collected from each station.

B. Habitat Assessment

1. Third Rock Assessments at Macroinvertebrate Sites

Results from habitat assessments performed by Third Rock biologists at the seven macroinvertebrate sites are presented in Table 5, page 8. Habitat assessment field data sheets are included in Appendix B. Photographs were taken in the field of each sampling reach, and included photographs of specific habitat features. A photo log of each site is included in Appendix C.

TABLE 5 – HABITAT SCORES AND WATER CHEMISTRY RESULTS AT MACROINVERTEBRATE SITES

Site ID	W1	W2	W4	W5A	W6	W11	W12
Date	5/12/2011	5/17/2011	5/17/2011	5/17/2011	5/17/2011	5/17/2011	5/18/2011
Temp (°C)	17.3	14.2	12.7	13.4	12.1	11.9	13.3
pH (SU)	7.8	7.1	7.9	7.9	7.9	7.9	7.8
DO (mg/L)	10.8	7.7	9.9	10.4	11	9.7	10.2
DO (% sat)	-	75.5	96	103	105	93	100
Cond (µS/cm)	703	647	605	541	553	917	870
Turb (NTU)	-	0	0	0	0	0	0
Habitat Score	113	149	122	117	125	130	100
Habitat Rating	Poor	Fair	Poor	Poor	Poor	Poor	Poor

All habitat scores rated "poor" except for W2 at the mouth of Prestons Cave, which was rated "fair."

Instream water chemistry measurements, measured at the time of assessment, are presented in Table 5. Dissolved oxygen levels ranged from 7.7 mgL^{-1} (W2) to 11 mgL^{-1} (W6), all above the chronic Kentucky Water Quality Standards (> 5.0 mgL^{-1}). Water temperature ranged from 11.9 degrees Celsius (°C) (W11) to 17.3°C (W1), and pH was similar among all stations, ranging from 7.1 to 7.9 standard units. Specific conductance levels were elevated at all stations ranging from 541 µS/cm (W5A) to 917 µS/cm (W11). Specific conductance levels were highest at headwater stations W11 and W12, generally decreasing in lower reaches of the watershed. Turbidity levels were zero at all stations measured.

2. Volunteer Assessments

Eight volunteers performed 33 assessments on 22 of the 24 reaches between May 23 to October 10, 2011. All segments except 3B, Vaughn's Branch from Oxford Circle to Versailles Rd, and 7, the unnamed tributary near Wolf Run at the intersection of Alexandria Dr and Old Frankfort Pike, were assessed.

When combined with the reaches assessed during the macroinvertebrate sample collection, a total of 33 reaches were assessed. Duplicate assessments were conducted on seven reaches in the watershed. The habitat assessment scores at each of the 33 reaches are depicted on Exhibit 3, page 9, with average results shown for reaches in which assessments were duplicated. Table 6, page 10 shows a summary of the results for each reach. Where more than one reach was assessed in given area, a numeric value was assigned from downstream to upstream to distinguish the results. Individual assessment results are tabulated in Appendix D. Photographs taken by volunteers are contained on a CD in Appendix E.

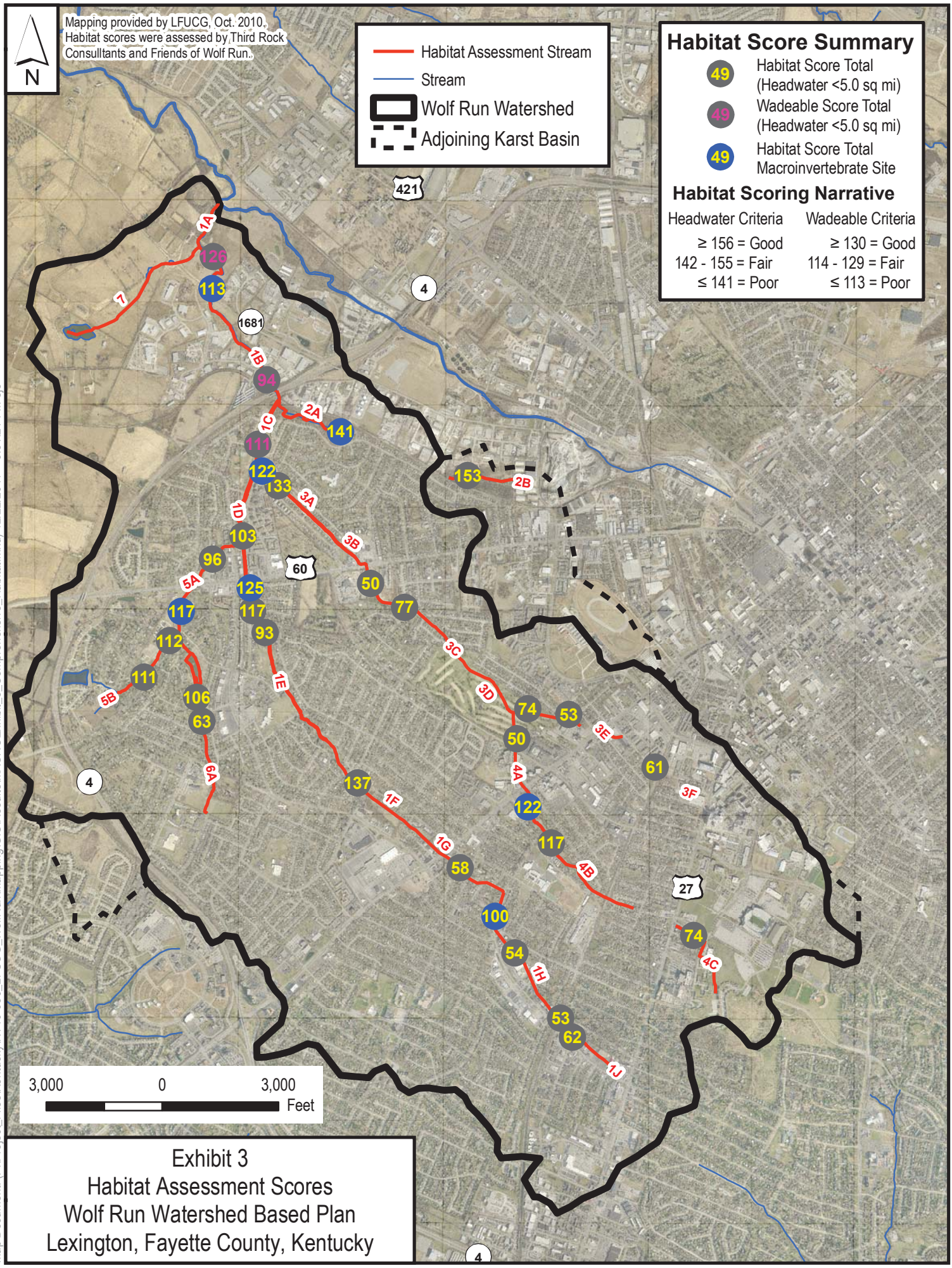

Exhibit 3
Habitat Assessment Scores
Wolf Run Watershed Based Plan
Lexington, Fayette County, Kentucky

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TABLE 6 – HABITAT ASSESSMENT SUMMARY

Segment ID	Stream	Location	Sampler	EpiFauSub	Embeddedness	Vel-DepRegime	SedDep	ChanFlowS	ChanAlter	FreqOfRiffles	BankSta-LB	BankSta-RB	BankVegP-LB	BankVegP-RB	RipVegZW-LB	RipVegZW-RB	Total	Headwater / Wadeable	Rating
1A1	Wolf Run	Nuti Property upstream of Mouth	K Cooke	7	7	9	15	17	9	18	9	9	8	8	5	5	126	W	Fair
1A2	Wolf Run	Wolf Run near site (W1)	Third Rock	15	10	13	10	17	15	17	5	3	2	2	2	2	113	W	Poor
1B	Wolf Run	Upstream of Commerce Drive	K Cooke	7	3	9	7	17	2	12	7	7	7	7	4	5	94	W	Poor
1C	Wolf Run	Valley Park downstream to Vaughns Br	J Anderson	6	12	10	13	18	8	12	5	3	8	8	4	4	111	W	Poor
1D	Wolf Run	Cambridge Drive to New Circle Rd.	K Cooke	6	12	9	12	10	8	12	8	8	6	6	3	3	103	H	Poor
1E1	Wolf Run	Downstream of Roanoake (W4)	Third Rock	12	13	12	11	15	15	14	8	7	8	7	1	2	125	H	Poor
1E2	Wolf Run	Sample site W6 at labyrinth upstream	B Bell / W Havens	8.5	13.5	10	13.5	17	12	17.5	4.5	5.5	3.5	5	2	4	116.5	H	Poor
1E3	Wolf Run	Above swim hole behind Wolf Run Park	B Bell / W Havens	8.5	10.5	6.5	13.5	17.5	12.5	1.5	3.5	4.5	5	5.5	2	2	93	H	Poor
1F	Wolf Run	Furlong Drive Greenway	K Cooke	12	15	12	13	14	8	18	7	9	7	7	8	7	137	H	Poor
1G1	Wolf Run	Clays Mill Greenway, Clays Mill Rd	K Cooke / B Hutcheson	2.5	10.5	2	7.5	1	1.5	10.5	5.5	3.5	5	3	4	1.5	58	H	Poor
1G2	Wolf Run	Downstream of Rosemont Garden (W12)	Third Rock	11	11	10	16	17	5	6	9	9	1	3	1	1	100	H	Poor
1H	Wolf Run	Behind Good Food co-op	J Anderson	2	5	1	20	6	0	0	10	10	0	0	0	0	54	H	Poor
1J1	Wolf Run	Near Railroad Crossing and tunnel	J Anderson	3	5	6	4	6	8	3	3	3	7	2	2	1	53	H	Poor
1J2	Wolf Run	Parallel to Southland Dr.	J Anderson	1	5	1	19	16	0	0	10	10	0	0	0	0	62	H	Poor
2A	McConnell Br	Prestons Cave Spring Park (W2)	Third Rock / J Watts	11	8	12	9	15.5	18	17.5	7	8.5	8	8.5	8.5	9	140.5	H	Poor
2B	McConnell Br	McConnell Springs Park	K Cooke	18	6	15	8	15	18	19	9	9	9	9	9	9	153	H	Fair
3A1	Vaughns Br	Conf with Wolf Run	Third Rock	8	14	10	13	15	15	18	5	7	5	7	2	3	122	H	Poor
3A2	Vaughn's Br	Sample site W4 and upstream	B Bell / W Havens	14	14	11	17	13	15.5	17.5	3.5	6.5	6	6	4.5	4	132.5	H	Poor
3C1	Vaughn's Br	Pine Meadow Park	j Anderson	5	5	2	2	3	2	1	5	4	9	3	8	1	50	H	Poor
3C2	Vaughn's Br	Behind Cardinal Hill Hospital	J Anderson	13	11	1	9	3	14	0	2	2	9	9	2	2	77	H	Poor
3D	Vaughn's Br	Picadome Golf Course	J Anderson	3	14	8	14	7	15	3	2	2	3	3	0	0	74	H	Poor
3E	Vaughn's Br	Next to Ky Clinic from fence to underground	J Anderson	1	16	1	15	8	2	1	2	5	1	1	0	0	53	H	Poor
3F	Vaughn's Br	Simpson Ave Stormwater Structure	K Cooke	6	7	4	7	7	1	9	7	7	2	2	1	1	61	H	Poor
4A	Big Elm Trib	Picadome Golf Course	K Cooke	5	5	0	8	0	8	8	5	2	5	2	1	1	50	H	Poor
4B1	Big Elm Trib	Behind Bob-o-link Dr behind Fire Station (W11)	Third Rock / B Radcliffe	14.5	11.5	9	14	11	12.5	16.5	6	6.5	6.5	7	4.5	2	121.5	H	Poor
4B2	Big Elm Trib	Near LaFayette High School	B Radcliffe	14	11	10	11	11	10	17	6	6	7	7	2	5	117	H	Poor
4C	Big Elm Trib	University to Nicholasville Rd	B Radcliffe	7	7	5	12	17	5	7	7	2	3	1	1	0	74	H	Poor
5A1	Cardinal Run	Devonport Dr. bridge to behind apts.	J Anderson	10	8	9	11	13	10	15	2	4	7	5	1	1	96	H	Poor
5A2	Cardinal Run	Below Parkers Mill Rd (W5A)	Third Rock	10	12	10	14	18	16	17	4	5	4	5	1	1	117	H	Poor
5B1	Cardinal Run	Cross Keys and Parkers Mill Rd.	K Cooke / B Hutcheson	11.5	7	13.5	13.5	14	8.5	16	6	5	7.5	7.5	1	0.5	111.5	H	Poor
5B2	Cardinal Run	Chinquapin Lane	B Hutcheson	14	7	10	6	14	15	9	8	5	8	5	8	2	111	H	Poor
6A1	Gardenside Trib	Cross Keys Park Upstream of Pond	B Hutcheson	14	9	8	9	14	13	17	4	4	5	5	2	2	106	H	Poor
6A2	Gardenside Trib	Darien Drive	B Hutcheson	7	9	7	6	12	0	4	8	8	1	1	0	0	63	H	Poor

Note: Yellow highlighting indicates results are averages of duplicate assessments performed on the reach.

Minor adjustments were made to the volunteer data submitted to adjust for consistency in naming, GPS coordinates, and to ensure whole numbers were recorded for each habitat parameter. Where a result was not recorded, site photographs and scores for similar reaches were used to evaluate the parameter.

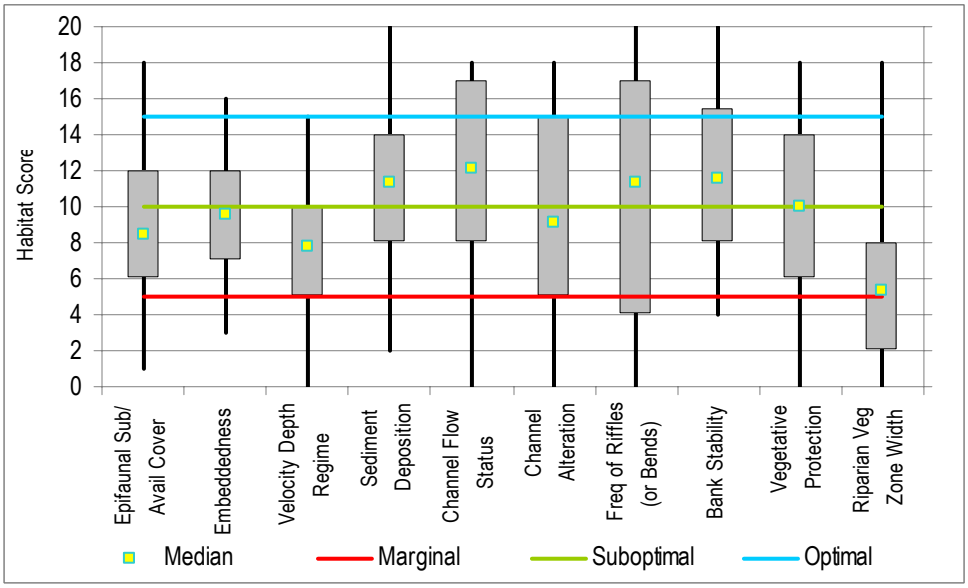
The averages of the duplicate reaches with the +/- values between assessors are presented in Table 7. On average, assessors differed within two points on individual parameters and nine points between total scores. The correspondence between duplicate assessment reaches indicates that results are comparable between assessors.

The range of results for each parameter is shown in the box plot chart in Figure 1, page 12. Sediment deposition, channel flow status, frequency of riffles, and bank stability were "Suboptimal" based on median scores for the watershed. Median results for epifaunal substrate/available cover, embeddedness, velocity depth regime, channel alteration, bank vegetative protection, and riparian zone width were "Marginal."

TABLE 7 – AVERAGES AND DIFFERENCE BETWEEN DUPLICATE REACHES

Sampler	B Bell / W Havens			K Cooke/ B Hutcheson		Third Rock/ J Watts	Third Rock/ B Radcliffe	Average Difference in Scores
Segment ID	1E2	1E3	3A2	1G1	5B1	2A	4B1	
Epifaunal Sub	8.5+/-0.5	8.5+/-0.5	14+/-1	2.5+/-0.5	11.5+/-2.5	11+/-1	14.5+/-1.5	2
Embeddedness	13.5+/-0.5	10.5+/-0.5	14+/-1	10.5+/-1.5	7+/-0	8+/-4	11.5+/-2.5	3
Velocity Depth	10+/-0	6.5+/-0.5	11+/-0	2+/-0	13.5+/-0.5	12+/-1	9+/-1	1
Sediment Dep	13.5+/-1.5	13.5+/-1.5	17+/-0	7.5+/-0.5	13.5+/-0.5	9+/-4	14+/-1	3
Channel Flow	17+/-1	17.5+/-0.5	13+/-0	1+/-1	14+/-2	15.5+/-1.5	11+/-2	2
Channel Alt	12+/-1	12.5+/-1.5	15.5+/-1.5	1.5+/-0.5	8.5+/-0.5	18+/-0	12.5+/-0.5	2
Freq of Riffles	17.5+/-0.5	1.5+/-0.5	17.5+/-0.5	10.5+/-3.5	16+/-0	17.5+/-1.5	16.5+/-0.5	2
Bank Stab-LB	4.5+/-0.5	3.5+/-0.5	3.5+/-1.5	5.5+/-1.5	6+/-0	7+/-1	6+/-1	2
Bank Stab-RB	5.5+/-0.5	4.5+/-0.5	6.5+/-0.5	3.5+/-0.5	5+/-1	8.5+/-0.5	6.5+/-1.5	1
Bank Veg Pro-LB	3.5+/-0.5	5+/-0	6+/-0	5+/-0	7.5+/-0.5	8+/-0	6.5+/-0.5	0
Bank Veg Pro-RB	5+/-0	5.5+/-0.5	6+/-0	3+/-0	7.5+/-0.5	8.5+/-0.5	7+/-0	0
Rip Veg Wid-LB	2+/-0	2+/-0	4.5+/-0.5	4+/-0	1+/-0	8.5+/-0.5	4.5+/-2.5	1
Rip Veg Wid-RB	4+/-1	2+/-0	4+/-0	1.5+/-0.5	0.5+/-0.5	9+/-0	2+/-0	1
Total Habitat	116.5+/-1.5	93+/-5	132.5+/-0.5	58+/-7	111.5+/-0.5	140.5+/-8.5	121.5+/-8.5	9

FIGURE 1 – WOLF RUN WATERSHED HABITAT PARAMETER SCORES



Note: Lines indicate the maximum and minimum results. Bars indicate the middle 50% of results. Values above the lines labeled "Marginal", "Suboptimal", and "Optimal" score in these respective categories. Values les than 5 are "Poor".

Total habitat scores ranged from 50 to 153. Out of the 33 reaches assessed, only two were "fair" with all others "poor." The "fair" scores were assessed within McConnell Springs Park (2A) and at the mouth of Wolf Run (1A1). Downstream of Prestons Cave (2B), scores were at the threshold between "fair" and "poor" with marginal sediment deposition and embeddedness scores causing the poor rating at that location. Wolf Run at the Furlong Drive Greenway (1F), where the riparian width is wider, also approaches a "fair" rating.

The lowest scores (50) were assessed at Vaughn's Branch at Pine Meadow Park (3C1) and at Big Elm Tributary on the Picadome Golf Course flowing into the sinkhole (4A). Each of these streams have poor scores across all parameters. Other extremely low sites are located in the headwaters of Wolf Run (1G1, 1H, 1J) and Vaughn's Branch (3E, 3F).

As noted previously, several factors contributed to the poor habitat scores in the watershed. The riparian zone width was routinely the lowest overall parameter indicating that remediation activities focusing on expanding the width of the vegetated area beside the stream will provide the greatest benefit throughout the watershed. Low scores for epifaunal substrate/available cover, embeddedness, and velocity depth regime together suggest that little habitat is available for macroinvertebrates due to an lack of pools and available cobble habitat in the stream. Restoration activities focused on creating pools, increasing base flows, and increasing the instream habitat will aid in improving the macroinvertebrate community within the watershed.

REFERENCES

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Third Rock Consultants. 2011. "Quality Assurance Project Plan: Wolf Run Watershed Based Plna: EPA 319(h) Grant No. C9994861-09". Prepared for Lexington-Fayette Urban County Government Department of Environmental Quality and Kentucky Department for Environmental Protection Division of Water. Revision 1. May 10, 2011.

APPENDICES

APPENDIX A – MACROINVERTEBRATE DATASHEETS

THIRDROCK CONSULTANTS

Macroinvertebrate Sample Chain of Custody
Project Information Sheet

Client Name: LFUCG Project Administrator: Gerry Fister/ Steve Evans Project Number: Ky 10-030 Due Date: ~~7/31/11~~ Nov. 4 mlw 10/27/11

Sampling Site Location: Wolf Run & trib's. County: Fayette State: Ky

[redacted]: Headwater [redacted]: Bluegrass Total Number of Samples: 12 Total Number of Containers: 12

Reporting Requirements: ✓ Laboratory Data Sheet; ✓ Excel Spreadsheet; ✓ MBI Calculations via ___ e-Submittal; ___ Hardcopy; ✓ Both

Samples Relinquished By: [signature] Date/Time: 5-18-11 1132 Sample Received By: Jamie Fister Date/Time: 5-18-11 / 1132

Samples Relinquished By: ___ Date/Time: ___ Sample Received By: ___ Date/Time: ___

Comments/Special Instructions: Regular KDOW Protocols, Sub-sampling to 300 allowed for Kicknet Samples

Sample Reference ID	Qualitative or Quantitative	Collected By	Collection Date	[redacted]	Preservative	# of Containers Per Sample	Analysis Required (KDOW Protocol, ID Level; etc.)
W-2	Quant	BR/DM	5-17-11	KN	Ethanol	1	KDOW, SS-300 allowed
W-2	Qual	↓	↓	MH	↓	↓	↓
W-4	Quant	↓	↓	KN	↓	↓	↓
W-4	Qual	↓	↓	MH	↓	↓	↓
W-5A	Quant	↓	↓	KN	↓	↓	↓
W-5A	Qual	↓	↓	MH	↓	↓	↓
W-6	Quant	↓	↓	KN	↓	↓	↓
W-6	Qual	↓	↓	MH	↓	↓	↓
W-11	Quant	↓	5-18-11		↓	↓	↓

- Continue on Reverse for More Samples -

[redacted]: Headwater Stream; Wadeable Stream; Large River; Lotic; Other ___
[redacted]: Bluegrass; Mountain; Pennyroyal; Mississippi Valley-Interior River Lowlands; Other ___
KN KickNet; **TK** Traveling Kick; **MH** Multihabitat; **S** Surber; **HD** Hester-Dendy Multiplate; **HDD** HD Deep; **HDS** HD Shallow; **OT** Other___; **NA** Not Available

MacLIMS: Client Setup/Login By mlw Date 10-27-11; Reported By mlw Date 11-2-11; Invoiced By GF Date ___ 5/20/10

Continued from Reverse Side

Sample Reference ID	Qualitative or Quantitative	Collected By	Collection Date	[redacted]	Preservative	# of Containers Per Sample	Analysis Required (KDOW Protocol, ID Level; etc.)
W-11	Qual	B/R/DM	5-18-11	MH	Ethanol	1	KDOW protocol
W-12	Quant	↓	↓	KN	↓	↓	↓
W-12	Qual	↓	↓	MH	↓	↓	↓

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-2 QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Bert Remley	No. Grids of 30 Picked:	2
		No. Organisms Picked:	332

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
				Rheotanytarsus exiguus gr	3
				Tanytarsus sp	9
				Thienemannimyia gr	1
AMPHIPODA					
Crangonyx sp	12				
ISOPODA					
Lirceus fontinalis	299				
DECAPODA					
		TRICHOPTERA			
		Hydroptila sp	1		
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	1
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
				OTHER TAXA	
				Number of Individuals	326

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-2 QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Tammie Fister	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Naididae				Cricotopus trifascia	
				Cricotopus/Orthocladius gr	
				Micropsectra sp	
				Parametriocnemus sp	
AMPHIPODA				Stictochironomus sp	
Crangonyx sp					
ISOPODA					
Lirceus fontinalis					
DECAPODA					
		TRICHOPTERA			
		Hydroptila sp			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Sphaerium sp	
		COLEOPTERA			
				OTHER TAXA	
				Turbellaria	
				Number of Individuals	-

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-4 QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	1
		No. Organisms Picked:	345

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Erpobdellidae	2			Cricotopus/Orthocladius gr	3
Naididae	8				
AMPHIPODA					
Crangonyx sp	10				
ISOPODA					
Lirceus fontinalis	303				
DECAPODA					
Cambaridae	1	TRICHOPTERA			
EPHEMEROPTERA					
Baetis flavistriga	3				
				DIPTERA (OTHER)	
				Simulium sp	2
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
		Ectopria (L) 1	1		
		Stenelmis (L) 2	2		
				OTHER TAXA	
				Turbellaria	7
				Number of Individuals	342

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-4 QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Tammie Fister	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Naididae				Cricotopus/Orthocladius gr	
AMPHIPODA					
Crangonyx sp					
ISOPODA					
Lirceus fontinalis					
DECAPODA					
Cambaridae		TRICHOPTERA			
		Hydroptila sp			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Elimia sp	
				Gyraulus sp	
		COLEOPTERA			
		Ectopria (L)			
				OTHER TAXA	
				Turbellaria	
				Number of Individuals	-

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-5A QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	1
		No. Organisms Picked:	334

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Erpobdellidae (Immature)	1			Chironomidae (Damaged)	1
Naididae	2			Cricotopus/Orthocladius gr	91
				Micropsectra sp	2
				Microtendipes pedellus gr	1
AMPHIPODA				Parametriocnemus sp	3
Crangonyx sp	4			Tanytarsus sp	1
				Thienemanniella xena	3
ISOPODA					
Lirceus fontinalis	135				
DECAPODA					
Cambaridae	1	TRICHOPTERA			
		Cheumatopsyche sp	2		
EPHEMEROPTERA		Hydroptila sp	1		
				DIPTERA (OTHER)	
				Simulium sp	20
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
		Optioservus (L) 4	4		
		Stenelmis (A) 3 (L) 6	9		
				OTHER TAXA	
				Turbellaria	20
				Number of Individuals	301

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-5A QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Tammie Fister	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Erpobdellidae				Chironomus sp	
Helobdella triserialis				Cricotopus/Orthocladius gr	
Helobdella stagnalis				Larsia sp	
Naididae				Micropsectra sp	
AMPHIPODA				Parametriocnemus sp	
Crangonyx sp				Thienemannimyia gr	
ISOPODA					
Lirceus fontinalis					
DECAPODA					
Cambaridae		TRICHOPTERA			
		Hydroptila sp			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Elimia sp	
Calopteryx maculata				Gyraulus sp	
Enallagma sp				Physella sp	
Ischnura sp		COLEOPTERA		Physidae	
		Dubiraphia (L)		Sphaerium sp	
		Stenelmis (A) (L)			
				OTHER TAXA	
				Turbellaria	
				Number of Individuals	-

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-6 QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	1
		No. Organisms Picked:	335

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Erpobdellidae	1			Cricotopus/Orthocladius gr	34
Naididae	2				
AMPHIPODA					
Crangonyx sp	5				
ISOPODA					
Lirceus fontinalis	224				
DECAPODA					
		TRICHOPTERA			
		Hydroptila sp	1		
EPHEMEROPTERA					
Baetis tricaudatus	1				
				DIPTERA (OTHER)	
				Simulium sp	33
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
		Stenelmis (A) 1 (L) 3	4		
				OTHER TAXA	
				Number of Individuals	305

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-6 QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Brenda McGregor	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Naididae				Cricotopus/Orthocladius gr	
AMPHIPODA					
Crangonyx sp					
ISOPODA					
Lirceus fontinalis					
DECAPODA					
		TRICHOPTERA			
EPHEMEROPTERA					
Baetis flavistriga					
				DIPTERA (OTHER)	
				Simulium sp	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Elimia sp	
				Gyraulus sp	
				Pisidium sp	
		COLEOPTERA		Sphaerium sp	
		Stenelmis (A)			
				OTHER TAXA	
				Turbellaria	
				Number of Individuals	-

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-11 QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	1
		No. Organisms Picked:	316

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
AMPHIPODA					
Crangonyx sp	6				
ISOPODA					
Lirceus fontinalis	275				
DECAPODA					
		TRICHOPTERA			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	2
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
		Stenelmis (A) 4 (L) 2	6		
				OTHER TAXA	
				Number of Individuals	289

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-11 QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Brenda McGregor	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Erpobdellidae				Micropsectra sp	
				Rheocricotopus glabricollis	
AMPHIPODA					
Crangonyx sp					
ISOPODA					
Lirceus fontinalis					
DECAPODA					
		TRICHOPTERA			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Sphaerium sp	
		COLEOPTERA			
				OTHER TAXA	
				Number of Individuals	-

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-12 QT	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Kick Net
Sorter:	Sarah Chandler	Sample Sorting:	Subsample
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	1
		No. Organisms Picked:	320

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Naididae	52			Cricotopus/Orthocladius gr	169
				Thienemanniella xena	2
AMPHIPODA					
ISOPODA					
Lirceus fontinalis	93				
DECAPODA					
		TRICHOPTERA			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
				Simulium sp	26
		MEGALOPTERA			
				MOLLUSCA	
ODONATA					
		COLEOPTERA			
				OTHER TAXA	
				Turbellaria	6
				Number of Individuals	348

THIRDROCK CONSULTANTS
Lexington, Kentucky

MACROINVERTEBRATE LABORATORY DATA SHEET

Third Rock Pjt #:	KY10-030	Client Name:	TRC In-House LFUCG-WR
Water Body:	Wolf Run and Tributaries	State/County:	KY / Fayette
Sample ID:	W-12 QL	Collection Date:	5/17/2011
Collector:	Bert Remley	Sampling Method:	Multihabitat
Sorter:	Brenda McGregor	Sample Sorting:	Pick-All
Taxonomist:	Chelsey Olson	No. Grids of 30 Picked:	30
		No. Organisms Picked:	NA

Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.	Family or Taxon / Genus	No. Orgs.
ANNELIDA		PLECOPTERA		DIPTERA (CHIRONOMIDAE)	
Naididae				Chironomus sp	
				Cricotopus/Orthocladius gr	
				Dicrotendipes neomodestus	
				Tanytarsus sp	
AMPHIPODA					
ISOPODA					
Lirceus fontinalis					
DECAPODA					
		TRICHOPTERA			
EPHEMEROPTERA					
				DIPTERA (OTHER)	
		MEGALOPTERA			
				MOLLUSCA	
ODONATA				Lymnaea sp	
Enallagma sp				Physella sp	
				Sphaerium sp	
		COLEOPTERA			
				OTHER TAXA	
				Turbellaria	
				Number of Individuals	-

Third Rock Consultants, LLC
Macroinvertebrate Sample Sorting Efficiency Form

Client Name: LFUCG
Sample ID: W-5 QT
Third Rock Project #: KY-10-030

Original Sorter: S. Chandler	Resorted By: T Fister
Date Sorted: 10-21-11	Date Resorted: 10-21-11
# of Grids Sorted: 15 of 30 of 2	# of Grids Sorted: 15 of 30 of 1
# of Organisms Originally Sorted: 334	# Additional Organisms Recovered: 1

# organisms originally sorted		# additional organisms recovered		# organisms originally sorted		% Sorting Efficiency
334	÷ (	1	+	334	) =	99.7

Additional Organisms Located

Taxon	Number
Liceus sp.	1
Total:	1

Comments: LFUCG
KY-10-030
W-5 QT
BR, 5-17-11

pass QC

Updated 4/29/10

Third Rock Consultants, LLC
Macroinvertebrate Sample Taxonomic & Enumeration Efficiency Form

Client Name: LFUCG – Wolf Run
Sample ID: W-5A QT
Third Rock Project #: KY10-030

Original Taxonomist: Chelsey Olson	Second Taxonomist: Bert Remley
Original Date Completed: 10/28/11	Review Date Completed: 11/1/11
# Organisms Enumerated (*Taxonomist 1*): 296	# Organisms Enumerated (*Taxonomist 2*): 307
Percent Difference in Enumeration (PDE) =1.8	
(296 – 307) ÷ (296 + 307) x 100 = % Difference in Enumeration (PDE) n_1 = *# organisms counted by Taxonomist 1* n_2 = *# organisms counted by Taxonomist 2*	
Percent Taxonomic Disagreement (PTD) =4.6	
PTD = [1 – (293 ÷ 307)] X 100 $Comp_{pos}$ = *number of taxonomic agreements (see Taxonomic Comparison Form)* N = *total number of organisms*	
Comments:Pass QA/QC, discussed immature Cheumatopscyhe, Optioservus vs Stenelmis	

Third Rock Consultants, LLC
Macroinvertebrate Sample Taxonomy Precision Form

Client Name: LFUCG - Wolf Run
Sample ID: W-5A QT
Third Rock Project #: KY10-030

Taxon	Taxonomist 1	Taxonomist 2	# Agreements
Crangonyx sp	4	6	4
Optioservus sp	2	4	2
Stenelmis sp	7	6	6
Stenelmis sp	3	3	3
Cambaridae	1	1	1
Chironomidae	1	0	0
Cricotopus/Orthocladius gr	91	93	91
Micropsectra sp	2	2	2
Microtendipes pedellus gr	1	1	1
Parametriocnemus sp	3	3	3
Tanytarsus sp	1	1	1
Thienemanniella xena	3	3	3
Simulium sp	20	21	20
Lirceus fontinalis	135	138	135
Erpobdellidae	1	1	1
Hydroptila sp	1	1	1
Turbellaria	20	19	19
Cheumatopsyche	0	2	0
Naididae	0	2	0
Totals:	**296**	**307**	**293**

APPENDIX B – HABITAT ASSESSMENT FIELD DATA SHEETS

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Wolf Run	**LOCATION: Old Frankfort Pike**
STREAM WDTH (FT): 25 DEPTH (FT): 0.3- 1.5	**PERENNIAL ☒ INTERMITTENT ☐ EPHEMERAL ☐**
STATION #: WR-S2 / W1 RIVERMILE:	**COUNTY: Fayette STATE: KY**
LAT: LONG:	**RIVER BASIN: Kentucky – Wolf Run Watershed**
CLIENT: LFUCG	**PROJECT NO. KY11-051**
INVESTIGATORS/CREW: E. Hartowicz	

FORM COMPLETED BY: **E. Hartowicz**	**DATE: 5/12/2011** **TIME: 1130**	**REASON FOR SURVEY:** **Macroinvertebrate survey for LFUCG MS4 Permit**

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 15	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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: 10	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: 17	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 113

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: McConnell Branch	LOCATION: Preston Cave
STREAM WDTH (FT): 12 DEPTH (FT): 1.5	PERENNIAL ☒ INTERMITTENT ☐ EPHEMERAL ☐
STATION #: W2 RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/17/2011	REASON FOR SURVEY:
B. Remley	TIME: 1130	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 12	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 12	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 13	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
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: 13	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: 17	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 149

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Vaughns Branch	LOCATION: Above confluence with Wolf Run
STREAM WDTH (FT): 15 DEPTH (FT): 0.67	PERENNIAL ☒ INTERMITTENT ☐ EPHEMERAL ☐
STATION #: W4 RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/17/2011	REASON FOR SURVEY:
B. Remley	TIME: 0200	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 8	20 19 18 17 16	15 14 13 12 11	10 9 **8** 7 6	5 4 3 2 1 0
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.
SCORE: 14	20 19 18 17 16	15 **14** 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 10	20 19 18 17 16	15 14 13 12 11	**10** 9 8 7 6	5 4 3 2 1 0
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: 13	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: 15	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 122

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Cardinal Run	LOCATION: Below Parkers Mill Rd
STREAM WDTH (FT): 6 DEPTH (FT): 1	PERENNIAL ☒ INTERMITTENT ☐ EPHEMERAL ☐
STATION #: W5A RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/17/2011	REASON FOR SURVEY:
B. Remley	TIME: 0430	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 12	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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: 14	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: 18	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 117

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Wolf Run	LOCATION: Downstream of Roanoake
STREAM WDTH (FT): 20 DEPTH (FT): 1.5	PERENNIAL ☒ INTERMITTENT ☐ EPHEMERAL ☐
STATION #: W6 RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/17/2011	REASON FOR SURVEY:
B. Remley	TIME: 0300	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 12	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 13	20 19 18 17 16	15 14 **13** 12 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 12	20 19 18 17 16	15 14 13 **12** 11	10 9 8 7 6	5 4 3 2 1 0
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: 11	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: 15	20 19 18 17 16	**15** 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 117

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Big Elm Tributary	LOCATION: South of Harrodsburg Rd
STREAM WDTH (FT): 20 DEPTH (FT): 1.5	PERENNIAL ☐ INTERMITTENT ☒ EPHEMERAL ☐
STATION #: W11 RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/18/2011	REASON FOR SURVEY:
B. Remley	TIME: 0900	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 14	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 10	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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: 15	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: 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

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

Parameters to be evaluated in sampling reach

TOTAL SCORE: 124

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 1

STREAM NAME: Wolf Run	LOCATION: Downstream of Rosemont Garden
STREAM WDTH (FT): 10 DEPTH (FT): 0.83	PERENNIAL ☐ INTERMITTENT ☒ EPHEMERAL ☐
STATION #: W11 RIVERMILE:	COUNTY: Fayette STATE: KY
LAT: LONG:	RIVER BASIN: Kentucky – Wolf Run Watershed
CLIENT: LFUCG	PROJECT NO. KY10-030
INVESTIGATORS/CREW: B. Remley / D. Miller	

FORM COMPLETED BY:	DATE: 5/18/2011	REASON FOR SURVEY:
B. Remley	TIME: 1100	Macroinvertebrate survey for 319(h) grant

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category: 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 not new fall and not 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: 11	20 19 18 17 16	15 14 13 12 **11**	10 9 8 7 6	5 4 3 2 1 0
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.
SCORE: 11	20 19 18 17 16	15 14 13 12 **11**	10 9 8 7 6	5 4 3 2 1 0
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).
SCORE: 10	20 19 18 17 16	15 14 13 12 11	**10** 9 8 7 6	5 4 3 2 1 0
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: 16	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: 17	20 19 18 **17** 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET — HIGH GRADIENT STREAMS, PAGE 2

Parameters to be evaluated in sampling reach

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

TOTAL SCORE: 100

APPENDIX C – PHOTO LOG

W-2 Algae

W-2 Downstream

W-2 Left Descending Bank

W-2 Riffle

W-2 Right Descending Bank

W-2 Root wad

W-2 Run

W-2 Spring

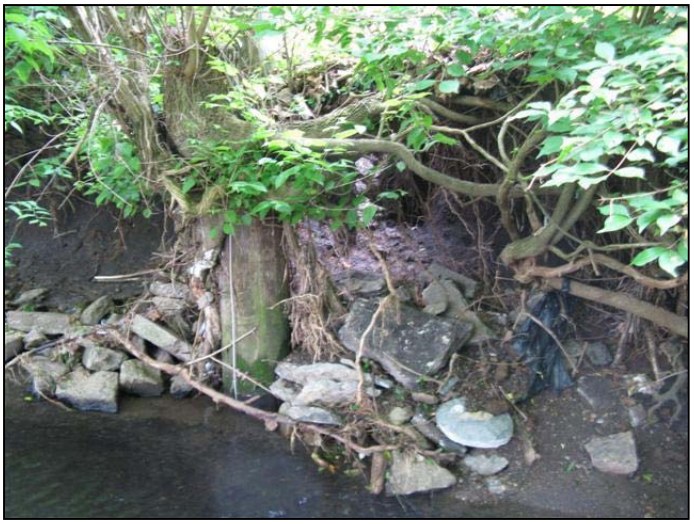
W-2 Upstream

W-4 Bedrock Substrate

W-4 Downstream

W-4 Eroding Left Descending Bank

W-4 Left Descending Bank



W-4 Left Descending Bank Erosion

W-4 Riffle

W-4 Right Descending Bank

W-4 Right Descending Bank

W-4 Sediment Deposition

W-4 Shallow Root wad

W-4 Upstream

W-5A Confluence

W-5A Downstream

W-5A Left Descending Bank

W-5A Left Descending Bank

W-5A Right Descending Bank

W-5A Right Descending Bank

W-5A Upstream

W-6 Downstream

W-6 Left Descending Bank

W-6 Riffle

W-6 Right Descending Bank

W-6 Upstream

W-6 Upstream View from Downstream End

W-11 Downstream

W-11 Downstream from Upper Limit

W-11 Lower Right Descending Bank

W-11 Pool

W-11 Riffle

W-11 Right Descending Bank

W-11 Upper Limit

W-11 Upstream

W-12 Downstream

W-12 Left Descending Bank

W-12 Riffle

W-12 Over-hanging Vegetation

W-12 Right Descending Bank

W-12 Upstream

APPENDIX D – HABITAT RESULTS FROM FRIENDS OF WOLF RUN AND THIRD ROCK CONSULTANTS

Appendix D: Habitat Results from Friends of Wolf Run and Third Rock Consultants

Segment ID	Stream	Location	Date	Time	Sampler	Latitude	Longitude	EpiFauSub	Embeddedness	Vel-DepRegime	SedDep	ChanFlowS	ChanAlter	FreqOfRiffles	BankSta-LB	BankSta-RB	BankVegP-LB	BankVegP-RB	RipVegZW-LB	RipVegZW-RB	Total	Headwater / Wadeable	Rating	Picture File Names
1A1	Wolf Run	Nuti Property upstream of Mouth	7/9/2011	2:00 PM	K Cooke	38.070040	-84.554356	7	7	9	15	17	9	18	9	9	8	8	5	5	126	W	Fair	1A-Downstream-OldFrankfortPike (2).JPG
1A2 - W1	Wolf Run	Wolf Run at Mouth	5/12/11	11:30 AM	E Hartowicz	38.067303	-84.554182	15	10	13	10	17	15	17	5	3	2	2	2	2	113	W	Poor	
1B	Wolf Run	Upstream of Commerce Drive	7/9/2011	1:30 PM	K Cooke	38.061035	-84.549440	7	3	9	7	17	2	12	7	7	7	7	4	5	94	W	Poor	1B-upstream-commercedr.JPG
1C	Wolf Run	Valley Park downstream to Vaughns Bra	7/13/2011	3:00 PM	J Anderson	38.054630	-84.550395	6	12	10	13	18	8	12	5	3	8	8	4	4	111	W	Poor	1C-Wolfs Run @ Valley Park - Copy.jpg
1D	Wolf Run	Cambridge Drive to New Circle Rd.	9/11/2011	6:21 PM	K Cooke	38.050097	-84.551389	6	12	9	12	10	8	12	8	8	6	6	3	3	103	H	Poor	1D-WolfRun-below-CardinalRun.jpg
1E1 - W6	Wolf Run	Downstream of Roanoake	5/17/11	3:00 PM	B Remley / D Miller	38.045274	-84.550661	12	13	12	11	15	15	14	8	7	8	7	1	2	125	H	Poor	
1E2	Wolf Run	Sample site W6 at labyrinth upstream	5/28/2011	11:25 AM	W Havens	38.045370	-84.550740	9	13	10	15	16	13	17	5	6	4	5	2	3	118	H	Poor	DSC1021.jpg
1E2	Wolf Run	Sample site W6 at labyrinth upstream	5/28/2011	11:25 AM	B Bell	38.045370	-84.550740	8	14	10	12	18	11	18	4	5	3	5	2	5	115	H	Poor	DSC1024.jpg,DSC1025.jpg
1E3	Wolf Run	Above swim hole behind Wolf Run Park	5/28/2011	12:20 PM	W Havens	38.043260	-84.549400	8	11	7	15	17	14	2	4	5	5	6	2	2	98	H	Poor	DSC1033.jpg
1E3	Wolf Run	Above swim hole behind Wolf Run Park	5/28/2011	12:20 PM	B Bell	38.043260	-84.549400	9	10	6	12	18	11	1	3	4	5	5	2	2	88	H	Poor	DSC1035.jpg
1F	Wolf Run	Furlong Drive Greenway	10/10/2011	3:26 PM	K Cooke	38.032454	-84.541169	12	15	12	13	14	8	18	7	9	7	7	8	7	137	H	Poor	1F-FurlongDrGreenway.JPG
1G1	Wolf Run	Clays Mill Greenway, Clays Mill Rd	9/13/2011	5:00 PM	B Hutcheson	38.026559	-84.531788	2	9	2	7	2	1	7	4	3	5	3	4	2	51	H	Poor	1G-WolfRun-ClaysMillGreenway.JPG
1G1	Wolf Run	Clays Mill Greenway, Clays Mill Rd	9/13/2011	5:00 PM	K Cooke	38.026559	-84.531788	3	12	2	8	0	2	14	7	4	5	3	4	1	65	H	Poor	1G-WolfRun-ClaysMillGreenway.JPG
1G2 - W12	Wolf Run	Downstream of Rosemont Garden	5/18/11	11:00 AM	B Remley / D Miller	38.022932	-84.528581	11	11	10	16	17	5	6	9	9	1	3	1	1	100	H	Poor	
1H	Wolf Run	Behind Good Food co-op	8/1/2011	5:50 PM	J Anderson	38.020503	-84.527086	2	5	1	20	6	0	0	10	10	0	0	0	0	54	H	Poor	1H behind GFco-op (2).jpg
1J1	Wolf Run	Near Railroad Crossing and tunnel	8/1/2011	4:45 PM	J Anderson	38.015858	-84.522662	3	5	6	4	6	8	3	3	3	7	2	2	1	53	H	Poor	1J North section next to RR (4).jpg
1J2	Wolf Run	Parallel to Southland Dr.	8/1/2011	5:25 PM	J Anderson	38.014803	-84.522330	1	5	1	19	16	0	0	10	10	0	0	0	0	62	H	Poor	1J on Southland.jpg
2A - W2	McConnell Br	Preston Cave	5/17/11	11:30 AM	B Remley / D Miller	38.057333	-84.542169	12	12	13	13	17	18	16	6	8	8	9	8	9	149	H	Fair	
2A	McConnell Br	Prestons Cave Spring Park	5/23/2011	5:41 PM	J Watts	38.057146	-84.542509	10	4	11	5	14	18	19	8	9	8	8	9	9	132	H	Poor	2A-Prestons Cave Spring (2) - Copy.jpg
2B	McConnell Br	McConnell Springs Park	10/6/2011	9:44 AM	K Cooke	38.054348	-84.531181	18	6	15	8	15	18	19	9	9	9	9	9	9	153	H	Fair	2B-McConnellsSp04.JPG
3A 1- W4	Vaughns Br	Conf with Wolf Run	5/17/11	2:00 PM	B Remley / D Miller	38.054904	-84.549624	8	14	10	13	15	15	18	5	7	5	7	2	3	122	H	Poor	
3A2	Vaughn's Br	Sample site W4 and upstream	5/28/2011	3:30 PM	W Havens	38.054990	-84.549880	13	13	11	17	13	17	17	5	7	6	6	4	4	133	H	Poor	DSC1037.jpg,DSC1038.jpg
3A2	Vaughn's Br	Sample site W4 and upstream	5/28/2011	3:30 PM	B Bell	38.054990	-84.549880	15	15	11	17	13	14	18	2	6	6	6	5	4	132	H	Poor	DSC1040.jpg
3C1	Vaughn's Br	Behind Cardinal Hill Hospital	6/5/2011	2:00 PM	j Anderson	38.046660	-84.539850	5	5	2	2	3	2	1	5	4	9	3	8	1	50	H	Poor	3c Versailes rd to Summerville dr (8).JPG
3C2	Vaughn's Br	Pine Meadow Park	7/21/2011	3:35 PM	J Anderson	38.045075	-84.536936	13	11	1	9	3	14	0	2	2	9	9	2	2	77	H	Poor	3C-Pine Meadow Park (11).jpg
3D	Vaughn's Br	Picadome Golf Course	7/21/2011	2:45 PM	J Anderson	38.037597	-84.525697	3	14	8	14	7	15	3	2	2	3	3	0	0	74	H	Poor	3D-PicadomeGolfCourse13.jpg
3E	Vaughn's Br	Next to Ky Clinic from fence to underground	7/21/2011	2:00 PM	J Anderson	38.037372	-84.522060	1	16	1	15	8	2	1	2	5	1	1	0	0	53	H	Poor	3E-Ky Clinic, Harrodsburg Rd (7).JPG
3F	Vaughns Br	Simpson Ave Stormwater Structure	7/9/2011	10:00 AM	K Cooke	38.033692	-84.514507	6	7	4	7	7	1	9	7	7	2	2	1	1	61	H	Poor	3F-Simpson-Ave.JPG
4A	Big Elm Trib	Picadome Golf Course	10/10/2011	11:10 AM	K Cooke	38.035575	-84.526831	5	5	0	8	0	8	8	5	2	5	2	1	1	50	H	Poor	4A-PicadomeSinkHoleTrib3.JPG
4B1 - W11	Big Elm Trib	Upstream of Harrodsburg Rd	5/18/11	9:00 AM	B Remley / D Miller	38.031245	-84.526027	13	14	10	15	13	12	16	7	8	6	7	7	2	130	H	Poor	
4B1	Big Elm Trib	Behind Bob-o-link Dr behind Fire Station	6/16/2011	11:30 AM	B Radcliffe	38.0277	-84.5231	16	9	8	13	9	13	17	5	5	7	7	2	2	113	H	Poor	4B-BigElm-Bob-o-Link2.JPG
4B2	Big Elm Trib	Near LaFayette High School	6/16/2011	12:00 PM	B Radcliffe	38.0291	-84.5242	14	11	10	11	11	10	17	6	6	7	7	2	5	117	H	Poor	4B-BigElm-Bob-o-Link6.JPG
4C	Big Elm Trib	University to Nicholasville Rd	6/16/2011	10:30 AM	B Radcliffe	38.0219	-84.511	7	7	5	12	17	5	7	7	2	3	1	1	0	74	H	Poor	4C-BigElm-1.JPG
5A1	Cardinal Run	Devonport Dr. bridge to behind apts.	7/6/2011	8:00 PM	J Anderson	38.048340	-84.535850	10	8	9	11	13	10	15	2	4	7	5	1	1	96	H	Poor	5A-Devonport Dr (5).jpg
5A2 - W5A	Cardinal Run	Below Parkers Mill Rd	5/17/11	4:30 PM	B Remley / D Miller	38.043212	-84.557131	10	12	10	14	18	16	17	4	5	4	5	1	1	117	H	Poor	
5B1	Gardenside Trib	Cross Keys and Parkers Mill Rd.	9/13/2011	4:31 PM	B Hutcheson	38.042966	-84.557147	9	7	13	14	16	9	16	6	6	7	7	1	1	112	H	Poor	
5B1	Gardenside Trib	Cross Keys and Parkers Mill Rd.	9/13/2011	4:31 PM	K Cooke	38.042966	-84.557147	14	7	14	13	12	8	16	6	4	8	8	1	0	111	H	Poor	
5B2	Cardinal Run	Chinquapin Lane	9/13/2011	4:00 PM	B Hutcheson	38.040002	-84.560043	14	7	10	6	14	15	9	8	5	8	5	8	2	111	H	Poor	5B-WilliamsburgEstates02.JPG
6A1	Gardenside Trib	Cross Keys Park Upstream of Pond	9/13/2011	3:24 PM	B Hutcheson	38.038278	-84.555382	14	9	8	9	14	13	17	4	4	5	5	2	2	106	H	Poor	6-GardensideBr-CrossKeysPark1.JPG
6A2	Gardenside Trib	Darien Drive	9/13/2011	3:11 AM	B Hutcheson	38.037292	-84.555116	7	9	7	6	12	0	4	8	8	1	1	0	0	63	H	Poor	6-DarinDriveUpstream.JPG

APPENDIX E – VOLUNTEER HABITAT PHOTOGRAPHS (CD)