

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
OCTOBER 2015

STAFF REPORT

A BIOLOGICAL SURVEY OF THE FLAT RIVER WATERSHED
MONTCALM, KENT, AND IONIA COUNTIES, MICHIGAN
AUGUST 2013

INTRODUCTION

Objective

Qualitative biological surveys of the Flat River watershed (Hydrologic Unit Code 04050006) were conducted by staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), during August 2013. The surveys were performed according to the SWAS Procedure 51 (MDEQ, 1990; Creal et al., 1996) at 12 stations (Figure 1, Table 1), to evaluate biological communities and physical conditions of selected locations.

Background and Historical Sampling

The Flat River watershed is within the Southern Michigan Northern Indiana Till Plain (SMNITP) ecoregion (Omernik and Gallant, 1988). The SMNITP is characterized by lacustrine clay and silt soils, and historically white oak-white pine forest.

Biological, chemical, and physical habitat conditions of the Rogue River watershed were monitored at 20 sites by the MDEQ, SWAS, in 2003 (Rockafellow, 2004) and at 19 sites in 2008 (Walterhouse, 2009). In 2003, macroinvertebrate ratings were acceptable at 11 locations and excellent at 9 locations. Habitat ratings were good at 11 locations and excellent at 9 locations. In 2008, macroinvertebrate ratings were acceptable at 12 locations and excellent at 7 locations. Habitat ratings were marginal at 3 locations, good at 10 locations, and excellent at 6 locations. The Flat River Natural River Plan encourages preservation of the watershed along with management guidelines that have helped to protect these water bodies.

METHODS

Procedure 51 describes the methodology for macroinvertebrate and habitat surveys of wadeable streams, and was used to evaluate the stations. Procedure 51 rates macroinvertebrate communities as Poor (-9 to -5), Acceptable (-4 to +4), and Excellent (+5 to +9), based on the proportions of each taxa found, and the sensitivity of the community assemblage to water quality. Habitat was rated on a scale of Poor (<56), Marginal (56-104), Good (105-154), or Excellent (>154) based on in-stream and riparian characteristics and impairments.

Two site-selection methods were used to assess the Flat River watershed in 2013: *stratified random* to address statewide, regional, and watershed questions about water quality and *targeted* to address specific areas of interest. There were 10 randomly selected status sites and 2 randomly selected trend sites that are now fixed to be sampled every 5 years (Figure 1, Table 1). There were no targeted monitoring requests received for the Flat River watershed.

Table 1. Status and Trend Locations in the Flat River Watershed.

<u>Site ID</u>	<u>Water Body</u>	<u>Location</u>	<u>AUID</u>	<u>Status (S) or Trend (T)</u>	<u>Habitat Score</u>		<u>Macroinvertebrate Score</u>	
1	Flat River	d/s Greenville WWTP	040500060206-02	S	Good	137	Excellent	7
2	Alder Creek Drain	Tisdal Avenue	040500060106-01	S	Marginal	104	Acceptable	0
3	Alder Creek Drain	Pine Lake Avenue	040500060106-01	S	Good	113	Acceptable	-1
4	Flat River	M46/M66	040500060103-01	S	Good	138	Acceptable	3
5	Flat River	Johnson Road	040500060206-01	S	Good	149	Excellent	7
6	Black Creek	Hatch Avenue	040500060106-01	S	Good	126	Acceptable	2
7	Seely Creek	Lincoln Lake Road	040500060207-04	S	Good	129	Acceptable	4
8	Wabasis Creek	Stakes Road	040500060201-03	S	Excellent	180	Excellent	6
9	West Branch Creek	Stanton Road	040500060105-02	S	Excellent	158	Acceptable	0
10	Unnamed Tributary to Dickerson Creek	County Farm Road	040500060203-02	S	Good	117	Acceptable	3
11	Seely Creek	u/s Gold Lake Road	040500060207-04	T	Excellent	157	Acceptable	1
12	Black Creek	Rooksby Street	040500060108-02	T	Good	131	Acceptable	3

RESULTS

Status and Trend Surveys

Macroinvertebrate communities in wadeable streams were sampled and scored using Procedure 51 (Tables 2-4). Three sites had Excellent macroinvertebrate community ratings, while the other 9 sites were rated Acceptable (Table 1). The habitat was sampled and scored using Procedure 51 (Table 5-7). Three sites had Excellent habitat scores, 8 sites had Good habitat scores, and 1 site had a Marginal habitat score (Table 1).



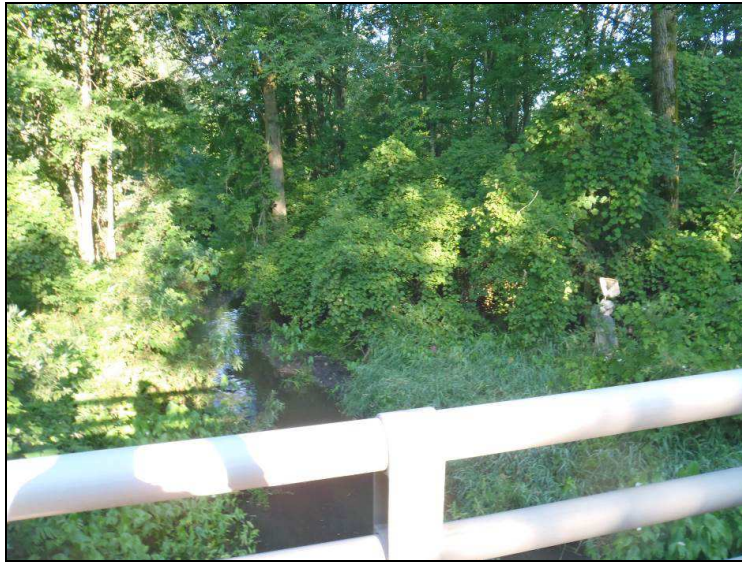
Flat River downstream of the Greenville Wastewater Treatment Plant.

Site 1. This glide/pool station had an Excellent (7) macroinvertebrate score and a Good (137) habitat score. This stretch of river was extensively covered with *Cladophora* downstream of the Wastewater Treatment Plant (WWTP) discharge pipe. While sampling the stretch, fish were jumping and swarming the WWTP discharge tube. A majority of the substrate was gravel with smaller amounts of cobble and sand present. A total of 33 taxa were identified in this stretch with representation from the sensitive taxa of mayflies, stoneflies, and caddisflies.



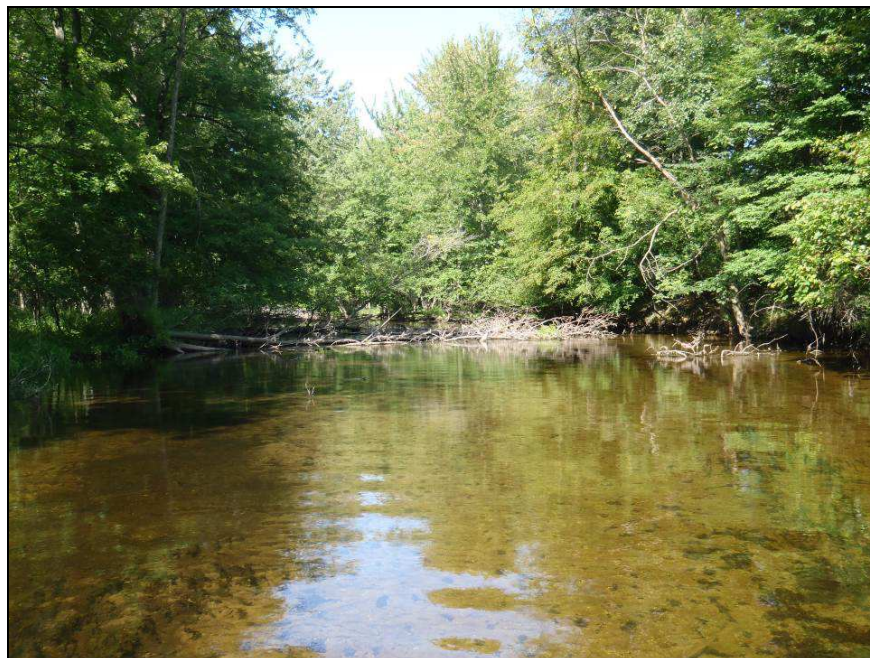
Alder Creek Drain at Tisdell Avenue.

Site 2. This glide/pool site had an Acceptable (0) macroinvertebrate score and a Marginal (104) habitat score. This drain shows a history of dredging, canopy removal, and bank stabilization. A double culvert is located at Tisdal Avenue where sediment off the dirt and gravel road has accumulated on the upstream side of one of the culverts and prevents flow. Silt and sand substrate dominate this stretch of the drain. A total of 30 taxa were identified; however, the majority of macroinvertebrates were amphipods at 57 percent.



Alder Creek Drain at Pine Lake Avenue.

Site 3. This glide/pool site had an Acceptable (-1) macroinvertebrate community and a Good (113) habitat score. The drain consists of fine silt substrate, sparse available bottom habitat, and a moderate level of large woody debris. A total of 26 taxa were identified; however, the majority of macroinvertebrates were amphipods at 78 percent.



Flat River at M-46/M-66.

Site 4. This glide/pool site had an Acceptable (3) macroinvertebrate score and a Good (138) habitat score. The substrate consists mostly of sand with small amounts of gravel and cobble. The stretch is clear and shallow with moderate levels of large woody debris. The stretch is surrounded by agricultural fields and has a 66 percent majority of amphipods in the macroinvertebrate community.



Flat River at Johnson Road.

Site 5. This glide/pool station had an Excellent (7) macroinvertebrate community and a Good (149) habitat score. The stretch consists mostly of sand with some cobble and gravel. Cooper's Creek flows into the Flat River within this stretch. The Flat River has high biodiversity with 37 taxa in this stretch and the 3 most sensitive taxa: mayflies, stoneflies, and caddisflies.



Black Creek at Hatch Avenue.

Site 6. This glide/pool station had an Acceptable (2) macroinvertebrate community and a Good (126) habitat score. The majority of substrate was sand with a high number of live unionids present within the stretch that are not included in the taxa count. The road crossing has a triple culvert and erosion at the road crossing. Amphipods are the dominant taxa.



Seely Creek at Lincoln Lake Road.

Site 7. This riffle/run station had an Acceptable (4) macroinvertebrate community and a Good (129) habitat score. Sand substrate dominates this stretch along with moderate levels of aquatic macrophytes. Severe erosion was noted along the east side of Lincoln Lake Road as a ditch was filled with road gravel and sand. The creek showed signs of flashy conditions with poorly vegetated banks and exposed soil. This stretch had high levels of debris including old tires, bannisters, and food packaging that lead from one residence along the creek down to the water. Amphipods and mayflies were the most prevalent macroinvertebrate taxa.



Wabasis Creek at Stakes Road.

Site 8. This riffle/run station had an Excellent (6) macroinvertebrate community and an Excellent (180) habitat score. The majority of substrate was sand with a mix of cobble and gravel. Two rock riffles and undercut banks were within the stretch providing excellent habitat. The macroinvertebrate community diversity was very high with 39 taxa located in this stretch of the stream and all 3 sensitive taxa present.



West Branch Creek at Stanton Road.

Site 9. This glide/pool station had an Acceptable (0) macroinvertebrate community and an Excellent (158) habitat score. The substrate is 90 percent sand through this stretch. Wetland hydrology and vegetation surround this stretch of creek. Simuliids, amphipods, and baetids were most prevalent in the macroinvertebrate community.



Unnamed Tributary to Dickerson Creek at County Farm Road.

Site 10. This glide/pool station had an Acceptable (3) macroinvertebrate community and a Good (117) habitat score. The substrate was primarily silt with extensive aquatic macrophytes along the edges of the stream. A man-made riffle was located within the stretch and provided some habitat for macroinvertebrates. Baetids composed about 30 percent of the macroinvertebrate community.



Seely Creek upstream of Gold Lake Road.

Site 11. This riffle/run station had an Acceptable (1) macroinvertebrate community and an Excellent (157) habitat score. The west bank of the creek has a mowed lawn with a very thin strip of riparian vegetation along the edge of the water. The east bank is tree-lined with moderate overhanging vegetation. Chironomids composed 56 percent of the macroinvertebrate community through this stretch.



Black Creek upstream of Rooksby Road.

Site 12. This glide/pool station had an Acceptable (3) macroinvertebrate community and a Good (131) habitat score. The substrate was even parts of sand and silt. Sediment deposition was visible in terms of bar formation and silt that lined the edges of the stream. The road crossing has a triple culvert that backs up water in the creek. Root wads and large woody debris are located along the banks. A cow pasture is northeast of this stretch. Amphipods are the dominant taxa.

DISCUSSION

The status and trend sites in the Flat River watershed are in good condition. All sites are meeting the Other Indigenous Aquatic Life and Wildlife designated use. Throughout the past 3 sampling sessions (2003-2013), sites have remained consistent for macroinvertebrate and habitat scoring for all but one location. The Flat River at M-46/M-66 showed a decrease in the macroinvertebrate community from excellent (6) to acceptable (3) between the sampling years of 2008 and 2013. The site showed a large drop in macroinvertebrate taxa from 43 to 26, a decrease in mayfly and caddisfly percent composition, and the elimination of stoneflies. The site is surrounded by agricultural land and has a high level of sand substrate. Even though the habitat score has remained good over the past 5 years, it appears that the presence of available stable habitat has decreased for macroinvertebrates in this stretch and the sensitive taxa have decreased. The Flat River downstream of the Greenville WWTP should be sampled for water nutrients during the next priority year to determine if nutrients are too high due to the visible *Cladophora* in the stream and fish swarming the discharge tube. Nonpoint source improvement suggestions for the watershed are provided below.

Watershed Attainment

In 2013, 14 randomly selected sites within the Rogue River/Flat River watershed group were sampled to support attainment status calculation. Based on the probabilistic monitoring aspect of this watershed group survey, 100 +/- 19.3 percent of the randomly selected sites supported

the Other Indigenous Aquatic Life and Wildlife designated use based on biological monitoring procedures. Percent attainment was calculated by dividing the number of random sites that met Water Quality Standards by the total number of random locations $((14 / 14)100 = 100$ percent). This value is coupled with a 95 percent confidence interval to provide our estimation of certainty, meaning there is 95 percent certainty that the true proportion of attainment in the Rogue River/Flat River watershed group is between 80.7 and 100 percent.

Nonpoint Source Summary

This watershed did not have any specific sampling requests due to nonpoint source concerns; however, while sampling the status and trend locations there are a few sites that would benefit from best management practices. Alder Creek Drain at Tisdell Avenue has a double culvert, Black Creek at Hatch Avenue has a triple culvert, and Black Creek at Rooksby Road has a triple culvert. Each of these multiple culvert road crossings is restricting flow, causing stagnant areas of water, and causing bar formation in the water body to uneven flow through the culverts. Amphipods are the dominant taxa located at each of these sites, which indicates that each of these locations potentially could improve their macroinvertebrate scores through proper road crossings of either a single culvert or a bridge. In addition, Seely Creek at Lincoln Lake Road shows signs of flashy conditions and steep banks along the water body. A residence along the water body has placed large amounts of debris consisting of old tires, bannisters, and food packaging within the stream, which reduce the water quality of this stretch. This creek would benefit from shoreline protection, reduced erosion from stream banks and the gravel/dirt road, and a stream cleanup event.

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Table 2. Qualitative macroinvertebrate sampling results for

TAXA	Flat River d/s Greenville WWTP 8/7/2013 STATION 1	Alder Creek Drain Tisdal Ave 8/8/2013 STATION 2	Alder Creek Drain Pine Lake Ave 8/8/2013 STATION 3	Flat River M-46/M-66 8/8/2013 STATION 4
PLATYHELMINTHES (flatworms)				
Turbellaria	1		12	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	1	1	5
Oligochaeta (worms)	4	1	1	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	54	173	227	207
Decapoda (crayfish)	3	2	1	1
Isopoda (sowbugs)	1	1		
Arachnoidea				
Hydracarina	1			
Insecta				
Ephemeroptera (mayflies)				
Baetidae	42	9	2	2
Caenidae				13
Ephemeridae	7			1
Heptageniidae	28	3	5	18
Leptophlebiidae	5			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	2	
Gomphidae	1			1
Zygoptera (damselflies)				
Calopterygidae	1	1	2	1
Plecoptera (stoneflies)				
Perlidae	2			
Pteronarcyidae	1			
Hemiptera (true bugs)				
Belostomatidae				
Corixidae		35	3	
Gerridae	4	8	4	2
Notonectidae		1		
Megaloptera				
Corydalidae (dobson flies)				
Sialidae (alder flies)		1	1	2
Trichoptera (caddisflies)				
Brachycentridae	4	1		1
Helicopsychidae	1	1		3
Hydropsychidae	36	1	3	7
Leptoceridae		2	1	1
Limnephilidae	1		1	1
Molannidae		1	1	
Philopotamidae	1			
Coleoptera (beetles)				
Dytiscidae (total)	2	5	4	
Gyrinidae (adults)	1	1		
Halplidae (adults)		1		
Dryopidae	2		2	
Elmidae	5		3	7
Psephenidae (larvae)	5			
Scirtidae (larvae)		1		
Diptera (flies)				
Chironomidae	44	32	4	10
Culicidae		4		
Dixidae		2	1	
Simuliidae	5	1		15
Tipulidae		1	1	1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				
Lymnaeidae	1		1	
Physidae	13	8	2	
Planorbidae	2	1		1
Pelecypoda (bivalves)				
Dreissenidae	1			
Sphaeriidae (clams)	3	2	4	8
Unionidae (mussels)				1
TOTAL INDIVIDUALS	283	302	290	312

METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	33	1	30	1	26	1	26	1
NUMBER OF MAYFLY TAXA	4	1	2	0	2	0	4	1
NUMBER OF CADDISFLY TAXA	5	1	5	1	4	0	5	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	28.98	1	3.97	0	2.41	-1	10.90	0
PERCENT CADDISFLY COMP.	15.19	0	1.99	-1	2.07	-1	4.17	0
PERCENT DOMINANT TAXON	19.08	1	57.28	-1	78.28	-1	66.35	-1
PERCENT ISOPOD, SNAIL, LEECH	6.36	0	3.64	1	1.38	1	2.24	1
PERCENT SURF. AIR BREATHER	2.47	1	18.21	0	4.14	1	0.64	1
TOTAL SCORE		7		0		-1		3
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Table 3. Qualitative macroinvertebrate sampling results for

TAXA	Flat River Johnson Rd 8/9/2013 STATION 5	Black Creek Hatch Ave 8/8/2013 STATION 6	Seely Creek Lincoln Lake Rd 8/7/2013 STATION 7	Wabasis Creek Stakes Rd 8/7/2013 STATION 8
PLATYHELMINTHES (flatworms)				
Turbellaria				1
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			
Oligochaeta (worms)			1	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	42	112	50	51
Decapoda (crayfish)	5	13	2	1
Isopoda (sowbugs)	1		2	
Arachnoidea				
Hydracarina	2		3	1
Insecta				
Ephemeroptera (mayflies)				
Baetisidae	3			
Baetidae	34	10		51
Caenidae	1			10
Ephemeridae	9			
Heptageniidae	27	25	36	23
Isonychiidae				1
Leptophlebiidae	1		35	7
Tricorythidae				1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1		2
Gomphidae	7	3	2	
Libellulidae	1			1
Zygoptera (damselflies)				
Catopterygidae	7	10	27	13
Coenagrionidae			1	1
Plecoptera (stoneflies)				
Perlidae	3			2
Pteronarcyidae	4			
Hemiptera (true bugs)				
Belostomatidae	1			1
Corixidae	8	7	1	6
Gerridae	2	7	2	26
Notonectidae		1		
Megaloptera				
Corydalidae (dobson flies)	1	1		2
Trichoptera (caddisflies)				
Brachycentridae	2	2	1	6
Glossosomatidae		1		
Helicopsychidae	8	5	18	5
Hydropsychidae	7	8	8	6
Leptoceridae	1	7		1
Limnephilidae	11	14	15	9
Molannidae			1	
Philopotamidae		1	1	2
Polycentropodidae				1
Coleoptera (beetles)				
Dytiscidae (total)		2	1	
Gyrinidae (adults)				1
Halplidae (adults)				1
Dryopidae	5	1	2	
Elmidae	31	7	10	8
Psephenidae (larvae)	5		6	
Sciitidae (larvae)				1
Diptera (flies)				
Athericidae		1		
Chironomidae	34	19	26	13
Culicidae	3	1		3
Dixidae		5		
Simuliidae	4	1	14	3
Tipulidae	1	2	1	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpels)	3	1	4	1
Hydrobiidae				2
Lymnaeidae	3	1	19	2
Physidae	8	2		7
Planorbidae		2		5
Pelecypoda (bivalves)				
Sphaeriidae (clams)	5	1	18	8
Unionidae (mussels)		1		
TOTAL INDIVIDUALS	292	275	309	285

METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	37	1	33	1	29	1	39	1
NUMBER OF MAYFLY TAXA	6	1	2	0	2	0	6	1
NUMBER OF CADDISFLY TAXA	5	1	7	1	6	1	7	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	0	-1	1	1
PERCENT MAYFLY COMP.	25.68	1	12.73	0	22.98	1	32.63	1
PERCENT CADDISFLY COMP.	9.93	0	13.82	0	14.24	0	10.53	0
PERCENT DOMINANT TAXON	14.38	1	40.73	-1	16.18	1	17.89	1
PERCENT ISOPOD, SNAIL, LEEI	5.48	0	2.18	1	8.74	0	5.26	0
PERCENT SURF. AIR BREA THE	4.79	1	6.55	1	1.29	1	13.33	0
TOTAL SCORE		7		2		4		6
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPTABLE		ACCEPTABLE		EXCELLENT

Table 4. Qualitative macroinvertebrate sampling results for

TAXA	West Branch Creek	Unnamed Trib to Dickerson Creek	Seely Creek	Black Creek
	Stanton Rd 8/9/2013 STATION 9	County Farm Rd 8/7/2013 STATION 10	u/s Gold Lake Rd 8/7/2013 STATION 11	Rooksby St 8/8/2013 STATION 12
PLATYHELMINTHES (flatworms)				
Turbellaria		1		
ANNELIDA (segmented worms)				
Hirudinea (leeches)			3	
Oligochaeta (worms)				6
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	57	23	6	67
Decapoda (crayfish)		4	2	8
Isopoda (sowbugs)		1		
Arachnoidea				
Hydracarina	1	10	2	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	40	66	11	18
Caenidae	1			
Ephemeridae	1			
Heptageniidae		4	10	41
Isonychiidae		1	6	
Leptophlebiidae	10	19	10	1
Tricorythidae	1			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		2	
Gomphidae			1	2
Libellulidae		1		
Zygoptera (damselflies)				
Calopterygidae	1	13	12	5
Coenagrionidae	1	1		
Hemiptera (true bugs)				
Belostomatidae		1		1
Corixidae	19	14	1	1
Gerridae		1	17	5
Pleidae	1	2		
Megaloptera				
Corydalidae (dobson flies)		1		
Trichoptera (caddisflies)				
Brachycentridae		3	1	
Helicopsychidae		1		11
Hydropsychidae	1	23	15	27
Leptoceridae		3	1	3
Limnephiliidae	2	6	1	3
Molannidae	1			
Polycentropodidae				3
Coleoptera (beetles)				
Dytiscidae (total)	2	1	1	2
Gyrinidae (adults)		1		
Halplidae (adults)	1	1		
Hydrophilidae (total)	1			
Dryopidae			2	6
Elmidae	1	6	4	4
Gyrinidae (larvae)			1	
Diptera (flies)				
Athericidae	6			
Ceratopogonidae	4		2	3
Chironomidae	24	41	164	38
Culicidae	4	2	3	
Dixidae	14	1		
Simuliidae	80	14	5	12
Stratiomyidae			1	
Tipulidae	1	5		8
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Hydrobiidae		1		
Lymnaeidae		1	1	
Physidae	18	9	1	10
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3	2	2	
TOTAL INDIVIDUALS	298	284	289	285

Table 2B. Macroinvertebrate metric evaluation of

METRIC	West Branch Creek		named Tributary to Dickerson Cre		Seely Creek		Black Creek	
	Stanton Rd 8/9/2013 STATION 1	Score	County Farm Road 8/7/2013 STATION 2	Score	Upstream Gold Lake Road 8/7/2013 STATION 3	Score	Rooksby Street 8/8/2013 STATION 4	Score
TOTAL NUMBER OF TAXA	29	1	35	1	30	1	24	0
NUMBER OF MAYFLY TAXA	5	1	4	1	4	1	3	0
NUMBER OF CADDISFLY TAXA	3	0	5	1	4	0	5	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	17.79	0	31.69	1	12.80	0	21.05	1
PERCENT CADDISFLY COMP.	1.34	-1	12.68	0	6.23	0	16.49	0
PERCENT DOMINANT TAXON	26.85	0	23.24	0	56.75	-1	23.51	0
PERCENT ISOPOD, SNAIL, LEEI	6.38	0	4.23	0	2.08	1	3.51	1
PERCENT SURF. AIR BREA THE	9.40	0	8.10	0	7.96	0	3.16	1
TOTAL SCORE		0		3		1		3
MACROINV. COMMUNITY RATING		ACCEPTABLE		ACCEPTABLE		ACCEPTABLE		ACCEPTABLE

Table 5. Habitat evaluation for

	Flat River d/s Greenville WWTP GLIDE/POOL	Alder Creek Drain Tisdal Ave GLIDE/POOL	Alder Creek Drain Pine Lake Ave GLIDE/POOL	Flat River M-46/M-66 GLIDE/POOL	Flat River Johnson Rd GLIDE/POOL
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	19	8	9	12	13
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	14	11	10	10	12
Pool Variability (20)**	2	6	5	8	5
Channel Morphology					
Sediment Deposition (20)	19	5	8	16	16
Flow Status - Maint. Flow Volume (10)	10	5	5	10	10
Flow Status - Flashiness (10)	10	8	7	8	9
Channel Alteration (20)	18	9	16	19	20
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	8	6	8	6	11
Riparian and Bank Structure					
Bank Stability (L) (10)	5	7	7	9	9
Bank Stability (R) (10)	8	7	7	8	9
Vegetative Protection (L) (10)	5	6	8	9	9
Vegetative Protection (R) (10)	8	6	6	8	9
Riparian Veg. Zone Width (L) (10)	7	10	7	5	9
Riparian Veg. Zone Width (R) (10)	4	10	10	10	8
TOTAL SCORE (200):	137	104	113	138	149
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Date:	8/7/2013	8/8/2013	8/8/2013	8/8/2013	8/9/2013
Weather:	Partly Cloudy	Sunny	Sunny	Sunny	Sunny
Air Temperature:	81 Deg. F.	66 Deg. F.	58 Deg. F.	75 Deg. F.	74 Deg. F.
Water Temperature:	64 Deg. F.	62 Deg. F.	53 Deg. F.	65 Deg. F.	57 Deg. F.
Ave. Stream Width:	65 Feet	8 Feet	10 Feet	Feet	40 Feet
Ave. Stream Depth:	1.5 Feet	0.5 Feet	1 Feet	1.5 Feet	2 Feet
Surface Velocity:	3 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	292.5 CFS	2 CFS	5 CFS	CFS	80 CFS
Stream Modifications:	None	Dredged	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	590308	410775	410776	590337	590349
Stream Name:	Flat River	Alder Creek Drain	Alder Creek Drain	Flat River	Flat River
Road Crossing/Location:	d/s Greenville WWTP	Tisdal Ave	Pine Lake Ave	M-46/M-66	Johnson Rd
County Code:	59	41	41	59	59
TRS:	09N08W15	10N10W02	10N10W02	12N07W15	10N08W30
Latitude (dd):	43.16656	43.28239	43.28215	43.424	43.22561
Longitude (dd):	-85.25187	-85.45174	-85.4717	-85.144	-85.30221
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Coldwater	Coldwater	Coldwater	Warmwater	Coldwater
USGS Basin Code:	4050006	4050006	4050006	4050006	4050006

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

Table 6. Habitat evaluation for

	Black Creek Hatch Ave GLIDE/POOL	Seely Creek Lincoln Lake Rd RIFFLE/RUN	Wabasis Creek Stakes Rd RIFFLE/RUN	West Branch Creek Stanton Rd GLIDE/POOL	Unnamed Trib to Dickerson Creek County Farm Rd GLIDE/POOL
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	13	19	5	8
Embeddedness (20)*		15	19		
Velocity/Depth Regime (20)*		13	19		
Pool Substrate Characterization (20)**				9	13
Pool Variability (20)**	11			10	7
Channel Morphology					
Sediment Deposition (20)	10	9	19	19	6
Flow Status - Maint. Flow Volume (10)	8	7	10	10	9
Flow Status - Flashiness (10)	8	2	9	10	9
Channel Alteration (20)	14	19	19	20	18
Frequency of Riffles/Bends (20)*		11	15		
Channel Sinuosity (20)**	9			15	6
Riparian and Bank Structure					
Bank Stability (L) (10)	6	7	10	10	9
Bank Stability (R) (10)	7	5	10	10	9
Vegetative Protection (L) (10)	8	7	7	10	9
Vegetative Protection (R) (10)	9	6	9	10	9
Riparian Veg. Zone Width (L) (10)	9	8	6	10	2
Riparian Veg. Zone Width (R) (10)	9	7	9	10	3
TOTAL SCORE (200):	126	129	180	158	117

HABITAT RATING:

GOOD
(SLIGHTLY
IMPAIRED)

GOOD
(SLIGHTLY
IMPAIRED)

EXCELLENT
(NON-
IMPAIRED)

EXCELLENT
(NON-
IMPAIRED)

GOOD
(SLIGHTLY
IMPAIRED)

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Date:	8/8/2013	8/7/2013	8/7/2013	8/9/2013	8/7/2013
Weather:	Sunny	Sunny	Sunny	Sunny	Partly Cloudy
Air Temperature:	75 Deg. F.	79 Deg. F.	82 Deg. F.	67 Deg. F.	81 Deg. F.
Water Temperature:	70 Deg. F.	68 Deg. F.	74 Deg. F.	46 Deg. F.	58 Deg. F.
Ave. Stream Width:	18 Feet	18 Feet	30 Feet	8 Feet	10 Feet
Ave. Stream Depth:	1 Feet	2 Feet	2.2 Feet	1.5 Feet	1 Feet
Surface Velocity:	0.5 Ft./Sec.	1 Ft./Sec.	3 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	9 CFS	36 CFS	198 CFS	6 CFS	5 CFS
Stream Modifications:	Bank Stabilization	None	None	None	Impounded
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	410777	410604	590350	590283	590351
Stream Name:	Black Creek	Seely Creek	Wabasis Creek	West Branch Creek	utary to Dickerson Creek
Road Crossing/Location:	Hatch Ave	Lincoln Lake Rd	Stakes Rd	Stanton Rd	County Farm Rd
County Code:	41	41	59	59	59
TRS:	10N09W17	08N09W14	09N08W29	11N08W28	10N07W34
Latitude (dd):	43.25878	43.08181	43.13858	43.30713	43.21363
Longitude (dd):	-85.40193	-85.35243	-85.27305	-85.26604	-85.11727
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:			Coldwater	Coldwater	Coldwater
USGS Basin Code:	4050006	4050006	4050006	4050006	4050006

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

Table 7. Habitat evaluation for

Seely Creek u/s Gold Lake Rd RIFFLE/RUN	Black Creek Rooksby St GLIDE/POOL
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HABITAT METRIC

Substrate and Instream Cover		
Epifaunal Substrate/ Avail Cover (20)	18	11
Embeddedness (20)*	18	
Velocity/Depth Regime (20)*	13	
Pool Substrate Characterization (20)**		9
Pool Variability (20)**		10
Channel Morphology		
Sediment Deposition (20)	18	10
Flow Status - Maint. Flow Volume (10)	9	5
Flow Status - Flashiness (10)	9	8
Channel Alteration (20)	19	19
Frequency of Riffles/Bends (20)*	10	
Channel Sinuosity (20)**		10
Riparian and Bank Structure		
Bank Stability (L) (10)	7	8
Bank Stability (R) (10)	9	8
Vegetative Protection (L) (10)	8	9
Vegetative Protection (R) (10)	9	9
Riparian Veg. Zone Width (L) (10)	1	9
Riparian Veg. Zone Width (R) (10)	9	6
TOTAL SCORE (200):	157	131

HABITAT RATING:	EXCELLENT (NON- IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
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Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).

Date:	8/7/2013	8/8/2013
Weather:	Partly Cloudy	Sunny
Air Temperature:	70 Deg. F.	71 Deg. F.
Water Temperature:	55 Deg. F.	55 Deg. F.
Ave. Stream Width:	18 Feet	17 Feet
Ave. Stream Depth:	2 Feet	2.5 Feet
Surface Velocity:	2 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	72 CFS	21.25 CFS
Stream Modifications:	None	None
Nuisance Plants (Y/N):	N	N
Report Number:		
STORET No.:	340231	410759
Stream Name:	Seely Creek	Black Creek
Road Crossing/Location:	u/s Gold Lake Rd	Rooksby St
County Code:	34	41
TRS:	08N08W21	10N09W07
Latitude (dd):	43.066	43.237
Longitude (dd):	-85.269	-85.415
Ecoregion:	SMNITP	SMNITP
Stream Type:	Warmwater	Warmwater
USGS Basin Code:	4050006	4050006

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys