RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM

2020-2021
STREAM MONITORING REPORT

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Jennifer Hadley
Laura Mann

Friends of the Mississippi River
101 East Fifth Street, Suite 2000
Saint Paul, Minnesota 55101
www.fmr.org

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Local Government

The Rice Creek Watershed District

Organizations

Fortin Consulting

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The Rice Creek Watershed Stream Health Evaluation Program wishes to thank the following partners, without whom this program would not be possible:

Katie Farber and Connie Fortin – Fortin Consulting
Gary Averbek and Wayne LeBlanc – SHEP Team Co-Leaders
Courtney Jones – SHEP Team Leader
Katherine and Darrell Majkrzak – SHEP Team Co-Leaders

2020 Rice Creek SHEP Volunteers

The 2020 Rice Creek Watershed Stream Health Evaluation Program extends our most sincere appreciation to all of the SHEP volunteers who donated their time in the stream last summer. Each of these volunteers contributed between 15 and 30 hours of volunteer service in monitoring the health of our water resources. Thank you!

Team 1: Gary Averbeck,* Wayne LeBlanc,* Barbara Bor, Dana Raines, Danielle McLaughlin, John Sullivan, Laura Dobbins Lyle, Linda Gruntner, Robin Turner, Tere O'Connell, Jake Thering and Ray Thering

Team 2: Courtney Jones,* Bob Bartlett, Gary Ellis, Jo Ann Morse, Michael Hagedorn, Ralph Butkowski and Jennifer Hadley

Team 3: Katherine Majkrzak,* Darrell Majkrzak,* Brad Sielaff, Rachel Beise, Rich Femling, Susan Young, Vincent Thai and Jennifer Olson

** SHEP Team Leader*

For more information on the Rice Creek Watershed Stream Health Evaluation Program or for a copy of this report, please contact Friends of the Mississippi River or visit www.fmr.org

Rice Creek Watershed Stream Health Evaluation Program
2020 Field Monitoring Report

1.0 BACKGROUND

In an effort to obtain a more comprehensive understanding of the health of our water resources, the Minnesota Pollution Control Agency (MPCA) and other agencies have developed protocols and indices for the biological assessment of streams. Because aquatic organisms express a range of tolerances to environmental conditions, biological assessment can be a powerful quantitative tool in understanding the health of water resource and provides a more complete picture of the ecological health of our waters. The National River Watch Network states that five years of data should be collected in order to perform a biological characterization of a sample site.

In the early 1990's, Riverwatch, a national volunteer river monitoring program, was brought to Minnesota to engage schools in river monitoring. The program was started by the Mississippi Headwaters Board and taken over by Hennepin County and eventually spread across the Twin Cities metropolitan area.

In 1997, a citizen wetland monitoring program was formed by local partners and the MPCA to evaluate wetland health. Sampling methods and evaluation metrics were developed by MPCA scientists to measure the health of the local wetlands. This Wetland Health Evaluation Program (WHEP) is now an award-winning and nationally recognized program that uses citizen volunteers to monitor the biological health of local wetlands. Multiple layers of quality control, volunteer training and the use of rigorous protocols assure scientifically-valid monitoring results. Volunteers enjoy the program and, after participating, often become more engaged in wetland and watershed issues and stewardship within their communities.

The Stream Health Evaluation Program (SHEP) is a model for volunteer stream monitoring modeled after WHEP and Riverwatch. SHEP uses trained adult volunteers to evaluate the biological health of streams using advanced bioassessment protocols and indices specifically developed for this region. The program thoroughly monitors volunteer data collection and lab identification techniques to ensure compatibility with established protocols. Complete data cross-checks and programmatic evaluation ensure accurate and timely data that are quality certified.

SHEP provides local communities and watershed organizations with a premier volunteer benthic macroinvertebrate monitoring program that produces reliable data and actively engages citizens in the work of the watershed.

SHEP

- Monitors the health of valuable water resources,
- Uses research-based multiple index metrics,
- Professionally trains adult volunteers,
- Utilizes multiple levels of quality control to ensure quality results,
- Provides relevant, reliable data to local decision makers,
- Engages citizens in water resource management and assessment,

- Promotes water resource health to community members, and
- Promotes partnership between local governments, state agencies and community residents.

2.0 RICE CREEK WATERSHED SHEP

Watershed districts are special purpose units of local government whose boundaries follow those of a natural watershed. The Rice Creek Watershed District (RCWD) was established in 1972 to conserve and restore the water resources of the district for the beneficial use of current and future generations. It is a governmental organization managed by a Board of Managers appointed by the county commissions of Anoka, Ramsey and Washington Counties. About 10 percent of the watershed's surface area is occupied by lakes, the largest of which are White Bear Lake and Bald Eagle Lake. About 13 percent of the watershed consists of wetland areas.

RCWD provides most of the funds for SHEP, which is coordinated primarily by Friends of the Mississippi River (FMR) in partnership Fortin Consulting and the MPCA. Local program partners included the University of Minnesota Water Resource Center, Anoka County Parks and local landowners. Matching resources for SHEP are provided by FMR.

In 2006, RCWD staff selected SHEP monitoring sites, which were chosen to gauge the effects of recent watershed restoration and stewardship activities by being upstream or downstream of such activities. SHEP was first implemented in a pilot phase in the summer and fall of 2006 with Rice Creek Above and Below and Locke Lake Above and Below (Figure 1).

Rice Creek Above and Below sites (both of which are within the boundaries of the restoration) were selected at the beginning and end of the restoration in part to gauge the long-term stream health changes that result from this restoration activity. A third site, Rice Creek Irondale, was introduced to the program in 2012 further downstream of the restoration area, before the Rice Creek discharges into Long Lake.

Locke Lake Above and Below sites are just upstream of Rice Creek's outflow to the Mississippi River. RCWD restoration activities involved installing shoreland restoration and shoreland stabilization measures on properties adjacent to Locke Lake.

In summer 2006, as part of a grant from the Legislative Commission on Minnesota Resources, restoration was performed at three locations along Hardwood Creek that had been identified as having severe bank erosion. Banks were stabilized and in-stream habitat improvement techniques were implemented.

In 2007, Hardwood Creek Above and Clearwater Creek were added. In 2010, Hardwood Creek Below was added, and Locke Lake Park was added in 2012.

Currently, SHEP sites include

- Northern three sites: Hardwood Creek Above, Hardwood Creek Below and Clearwater Creek
- Middle three sites: Rice Creek Above, Rice Creek Below and Rice Creek Irondale, and
- Southern three sites: Locke Lake Park, Locke Lake Above and Locke Lake Below.

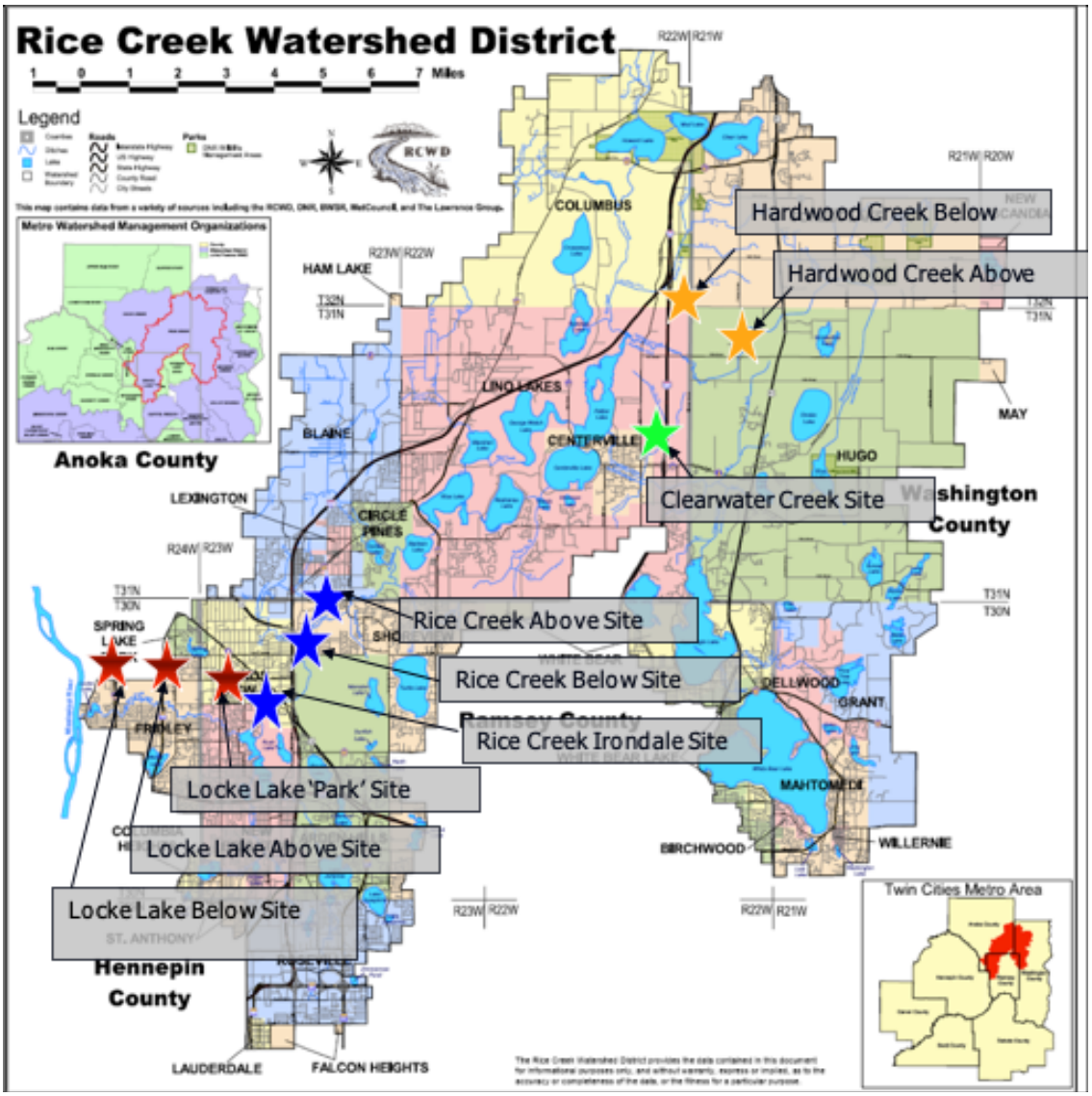

Figure 1: SHEP sampling sites in the Rice Creek Watershed District

The RWCD provides a variety of useful information on their Water Quality Reports and Plans page[1] that provides a picture of stream health and planning in the district. Total

[1] Rice Creek Watershed District Water Quality Reports and Plans, https://www.ricecreek.org/index.asp?SEC=59FA6C4B-0497-43A0-8FD3-B9D2EC83A2E3&Type=B_BASIC. Accessed 7 Mar 2021.

Maximum Daily Load (TMDL) documents are listed and referenced as well as a carp management program, lake management action plan, the 2010 State of the Lakes Report and the 2009 Stream Monitoring Report.

The Stream Monitoring Report[2] documents dissolved oxygen data, transparency, total suspended solids, phosphorus loads and chloride levels for Rice Creek, Hardwood Creek and Clearwater Creek in 2009. Data suggested that, while some impairments existed in the streams, most of the time, water quality standards were not violated, and chloride levels were not problematic.

2.1 Northern Sites: Hardwood Creek and Clearwater Creek

In 2002, Hardwood Creek was included on Minnesota's list of impaired waters because the amount, condition and diversity of aquatic life such as fish were too low. Furthermore, there was not enough oxygen in the water to support fish and aquatic insects. A TMDL collaborative study between the MPCA and RCWD began in 2004 to address the impairments on Hardwood Creek. The TMDL was approved by the MPCA in 2009.[3] In 2014, Hardwood Creek was listed as impaired for aquatic life.[4]

Midpoint sampling locations of Hardwood Creek Above and Below can be seen in Figures 2 and 3, respectively. SHEP sampling began in 2007 for Hardwood Creek Above and in 2010 at Hardwood Creek Below.

[2] 2009 Stream Monitoring Report, https://www.ricecreek.org/vertical/Sites/%7BF68A5205-A996-4208-96B5-2C7263C03AA9%7D/uploads/2009_Stream_Monitoring.pdf Accessed 11 Mar 2021.
[3] Hardwood Creek – Impaired Biota (fish) and Low Dissolved Oxygen: TMDL Project, https://www.pca.state.mn.us/water/tmdl/hardwood-creek-impaired-biota-fish-and-low-dissolved-oxygen-tmdl-project. Accessed 11 Mar 2021.
[4] Rice Creek Watershed District Impaired Waters Inventory Map https://www.ricecreek.org/vertical/Sites/%7BF68A5205-A996-4208-96B5-2C7263C03AA9%7D/uploads/RCWD_Impaired_Waters_Inventory_Map_2014%281%29.pdf. Accessed 7 Mar 2021.

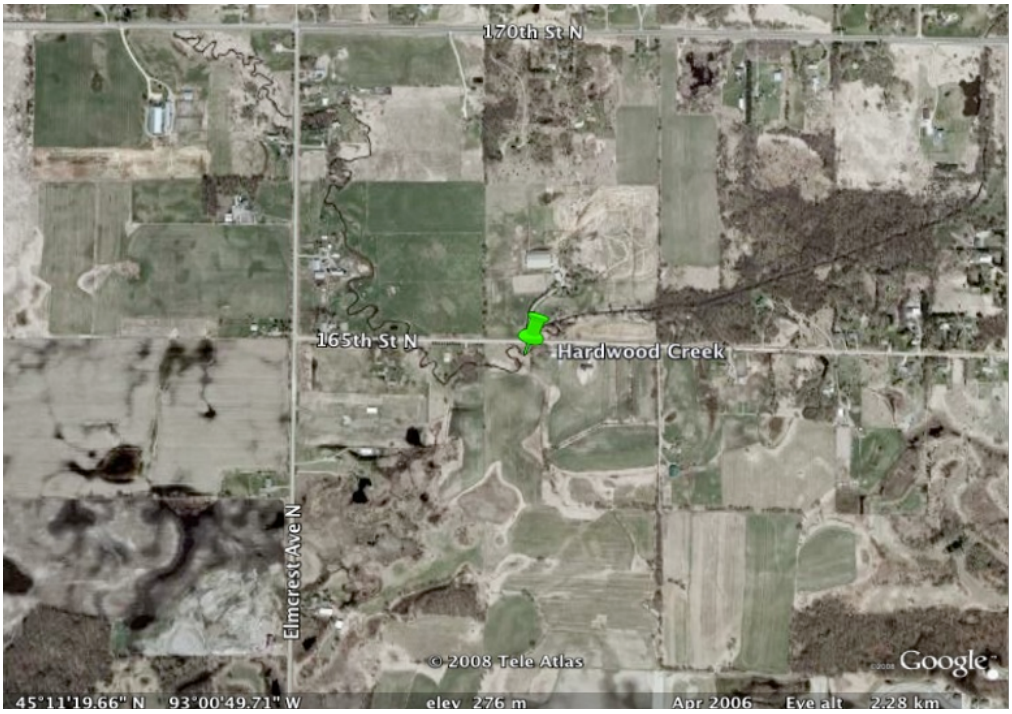

Figure 2: Hardwood Creek Above midpoint sampling location

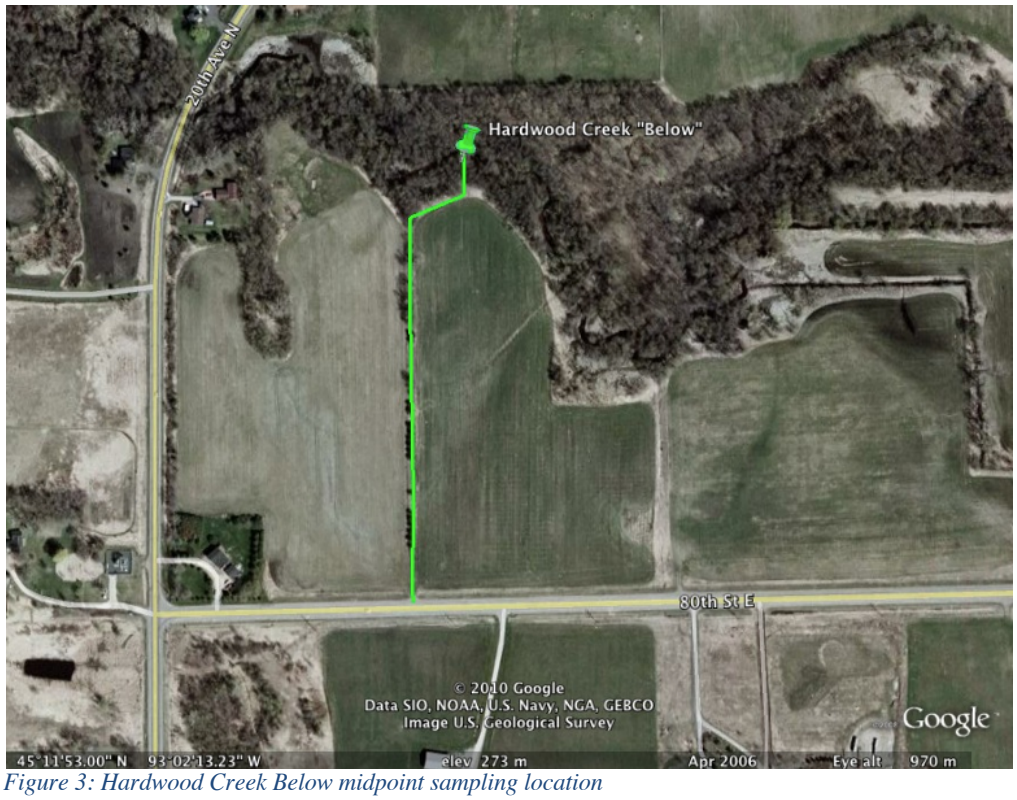

Figure 3: Hardwood Creek Below midpoint sampling location

In 2014, Clearwater Creek was also listed as impaired for aquatic life. SHEP sampling began in 2007. The midpoint sampling location of Clearwater Creek can be seen in Figure 4.

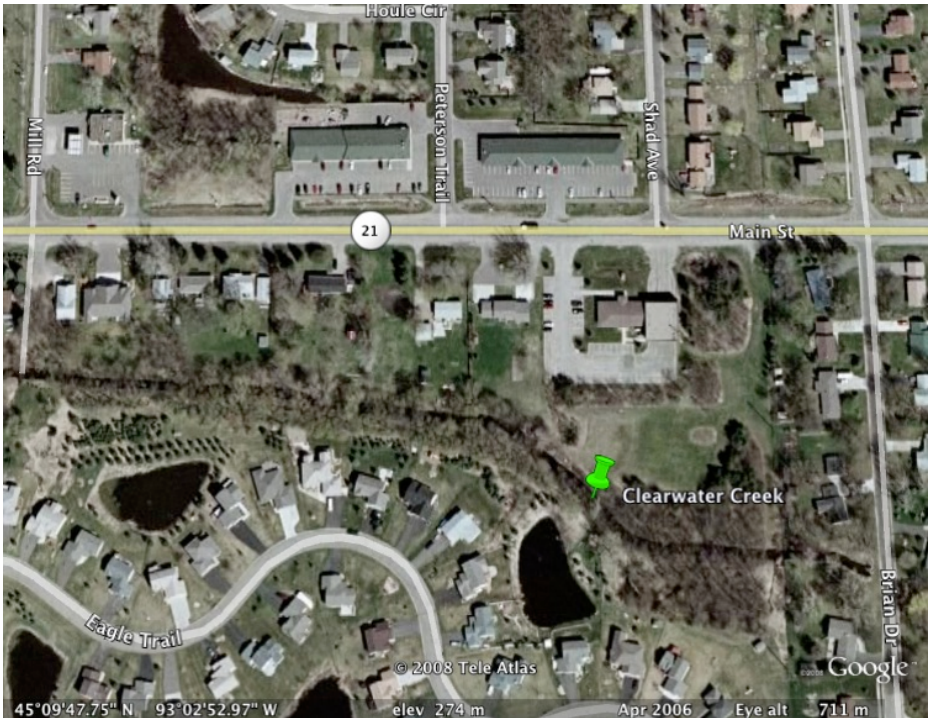

Figure 4: Clearwater Creek midpoint sampling location

2.2 Middle Sites: Rice Creek

In 2014, Rice Creek was listed as impaired for aquatic life. In 2015, RCWD and Emmons and Olivier Resources Inc. completed a re-meander and restoration of a significant reach of Rice Creek.[5] The project was entirely within Rice Creek North Regional Park and includes a stretch of Rice Creek located between County Road J, Lexington Avenue and County Road I. The goal of the project was to restore the historical winding flow path and surrounding wetland hydrology for this reach of stream, which was originally straightened in the early 1900's. Many benefits of this project, such as habitat enhancement, water quality improvement and enriched recreation opportunities, have begun to be realized. While two of the SHEP sampling sites are titled Above and Below for descriptive purposes, both sites are within the boundaries of the restoration.

SHEP sampling began in 2006 for Rice Creek Above and Below and in 2012 for Rice Creek Irondale. Midpoints of the sampling locations for Rice Creek Above and Below can be seen in Figure 5, and the midpoint sampling location for Rice Creek Irondale is shown in Figure 6.

[5] McCormick, Tori J. "Project to restore Rice Creek's meandering path already shows positives for water, wildlife." Special to the Star Tribune, Sept 5, 2019. https://www.startribune.com/project-to-restore-rice-creek-s-meandering-path-already-shows-positives-for-water-wildlife/559485082/ Accessed 7 Mar 2021.

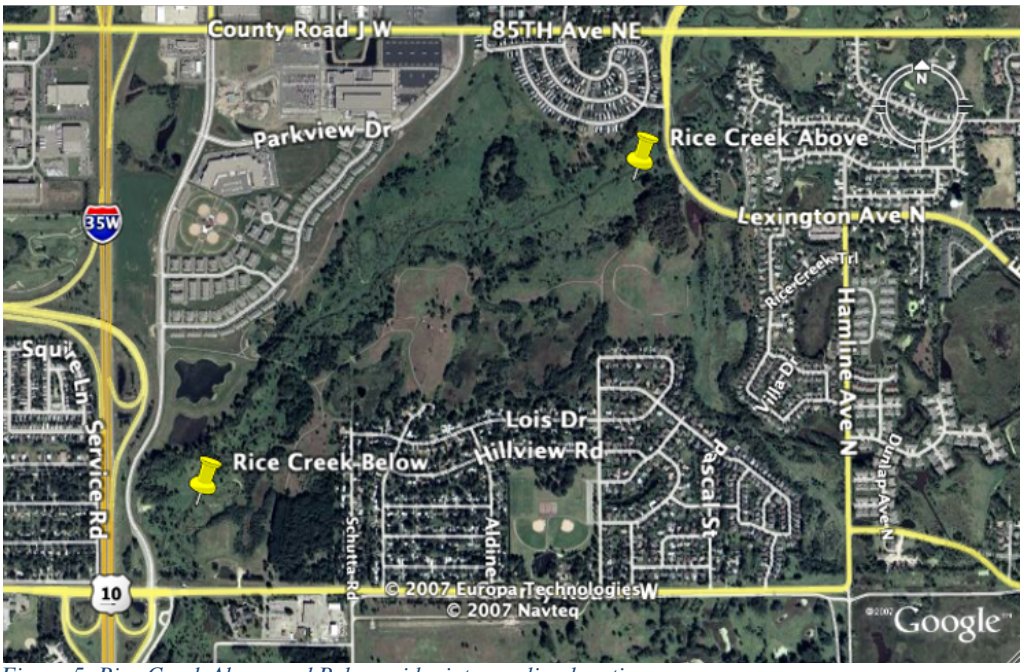

Figure 5: Rice Creek Above and Below midpoint sampling locations

Figure 6: Rice Creek Irondale midpoint sampling location

2.3 Southern Sites: Locke Lake

In 2014, Rice Creek near Locke Lake was listed as impaired for aquatic recreation and aquatic life. Restoration activities by the Rice Creek Watershed District has focused on installing shoreland restoration and shoreland stabilization measures on properties adjacent to Locke Lake.

SHEP sampling began at in 2006 at Locke Lake Above (2006) and Below and in 2012 at Locke Lake Park. Midpoints of the sampling locations for Locke Lake Above and Below can be seen in Figure 7, and the midpoint sampling location for Locke Lake Park is shown in Figure 8.

Figure 7: Locke Lake Above and Below midpoint sampling locations

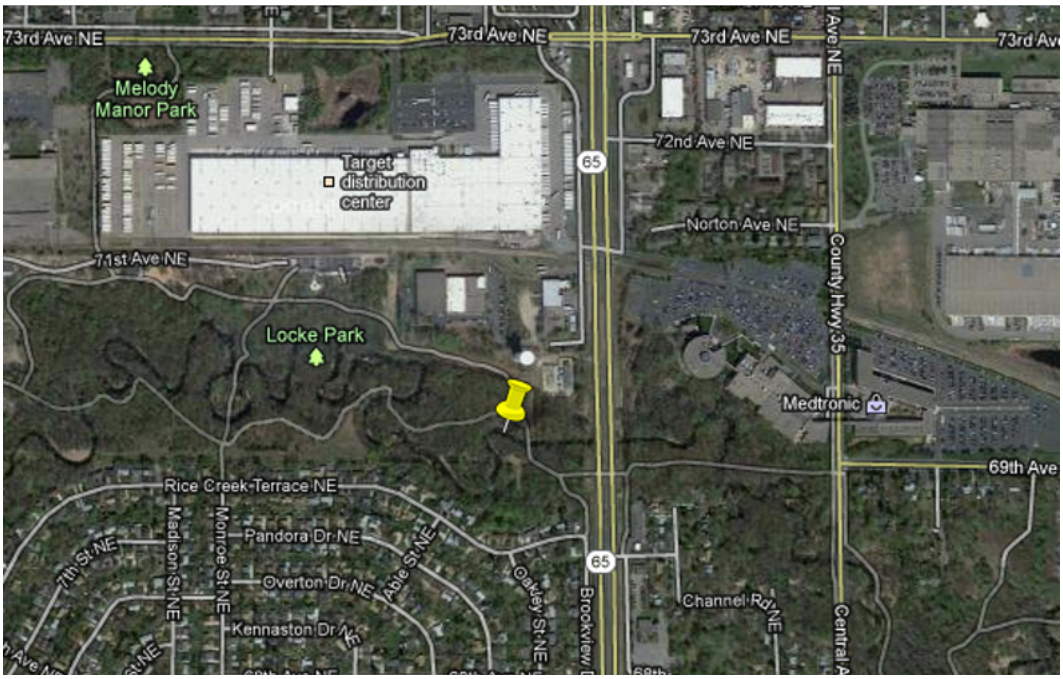

Figure 8: Locke Lake Park midpoint sampling location

3.0 SHEP OPERATIONS

3.1 Volunteer Recruitment

Normally, FMR recruits volunteers who preferably live in the Rice Creek watershed to fill spots as SHEP volunteers when needed. IN 2020, FMR did not recruit any new volunteers because of the risk of spreading COVID-19. Instead, only previous volunteers participated in SHEP, and Jennifer Hadley (FMR SHEP coordinator) joined Team 2, which needed one additional person due to the number of people who did not want to participate in SHEP because of COVID-19.

Twenty-six volunteers, including one teenager, participated in SHEP in 2020. Volunteers were divided into three teams to monitor the nine sites. Each team was led by team leaders, who are an integral part of SHEP and were selected by project staff. Team leaders received a small stipend (unless they had matching funds requirement associated with their volunteer time) and were responsible for managing monitoring activities and communication within their team.

3.2 Team Assignments

Team leaders, team members and monitoring location assignments are listed below.

Team 1
Monitoring Locations: Hardwood Creek and Clearwater Creek
Site Names: Hardwood Creek Above, Hardwook Creek Below, Clearwater Creek
Team Leaders: Gary Averbeck and Wayne LeBlanc
Team Members: Barbara Bor, Dana Raines, Danielle McLaughlin, John Sullivan, Laura Dobbins Lyle, Linda Gruntner, Robin Turner, Tere O'Connell, Jake Thering and Ray Thering

Team 2
Monitoring Location: Rice Creek Area
Site Names: Rice Creek Above, Rice Creek Below, Rice Creek Irondale
Team Leaders: Courtney Jones
Team Members: Bob Bartlett, Gary Ellis, Jo Ann Morse, Michael Hagedorn, Ralph Butkowski and Jennifer Hadley

Team 3
Monitoring Location: Locke Lake Area
Site Names: Locke Lake Above, Locke Lake Below, Rice Creek Park
Team Leaders: Katherine and Darrell Majkrzak
Team Members: Brad Sielaff, Rachel Beise, Rich Femling, Susan Young, Vincent Thai and Jennifer Olson

3.3 Training

Advanced volunteer training is essential to the success of SHEP. Usually, volunteers and FMR and Fortin staff meet in person to review sampling methodology and new volunteers have time in a stream to practice using the equipment. However, in 2020, to reduce the spread of COVID, volunteer training was held virtually.

Volunteers participated in an online training session held on Wednesday, August 12, 2020 via Zoom, which covered COVID safety while sampling in the field and macroinvertebrate sampling protocols set by the MPCA.[6] SHEP coordinator Jennifer Hadley covered FMR's COVID safety measures for field work, which included wearing a mask over mouth and nose, cleaning hands with sanitizer before and after sampling, no sharing of field sampling equipment (one person uses a particular piece of equipment the entire day) and staying six feet apart from one another.

Katie Farber from Fortin Consulting reviewed the SHEP monitoring protocol, which includes a biological assessment (collection of benthic macroinvertebrates) and a physical habitat assessment. Katie noted where to sample for macroinvertebrates, the target number of jabs and the best method of transferring samples to plastic jars. The habitat assessment review included how to measure stream flow, stream depth and stream width as well as noting water odor, temperature and appearance. Also, volunteers were reminded to note general weather information from that day and from the recent past as well as when not to sample (high rainfall previous day).

After the training, FMR staff member Jennifer Hadley distributed sampling equipment to each team leader.

3.4 Field Sampling

SHEP volunteer teams monitored their sites in late August to mid-September 2020 using the MPCA's multi-habitat monitoring protocol. This approach samples major habitats in proportional representation within each sampling reach. Benthic macroinvertebrates were collected systematically from all available in-stream habitats by jabbing with a D-frame dip net. At least 20 samples or jabs were taken from across all major habitat types (snags and woody debris, vegetated banks, cobble, and sand/fine sediment bottom areas) in the reach.

The physical habitat was assessed by measuring stream width, stream depth across three transects, water velocity, water temperature and appearance.

[6] Macroinvertebrate Data Collection Protocols for Lotic Waters in Minnesota, https://www.pca.state.mn.us/sites/default/files/wq-bsm3-12a.pdf. Accessed 11 Mar 2021.

3.5 Lab Identification

In fall 2020, in order to reduce the spread of COVID, Katie Farber from Fortin Consulting (instead of SHEP volunteers who normally do this process) sorted and identified macroinvertebrate samples to minimize touching of sample jars by different people and sharing of microscopes. Katie identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site down to family.

Each macroinvertebrate family is assigned a pollution tolerance number between zero and 10 depending on its sensitivity to pollution. A score of zero indicates very sensitive to organic pollution. A 10 indicates very tolerant of organic pollution.

Once macroinvertebrates were identified, site reaches were scored according to the family level biotic index (FBI). FBI is the weighted average of the biotic indices for all of the invertebrates in the sample. Pollution intolerant families such as stoneflies (FBI of 0 – 2) can only survive in excellent water quality (Table 1). Pollution tolerant organisms such as leeches and aquatic earthworms can live in clean water or poor quality water. They have high FBI values (8 – 10).

FBI	Stream Health	Degree of Organic Pollution
0.00-3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.0	Very poor	Severe organic pollution likely

Table 1: Water quality evaluation using FBI scores[7]

FBI summarizes the various pollution tolerance values of all families in a sample. The score for a particular monitoring site corresponds to a likely degree of organic pollution present at that location (Table 1). As such, the FBI score is a useful tool for evaluating the general status of organic pollution in streams within a watershed.

3.6 Quality Assurance/Quality Control (QA/QC)

When volunteers identify macroinvertebrates, Katie Farber conducts QA/QC on 33% of the identified macroinvertebrates. In recent years, she has reported close to 100% accuracy rates. Because of its history of recruiting and retaining dedicated volunteers, SHEP has become a reliable source of high-quality data.

[7] Hilsenhoff, William L. "Rapid Field Assessment of Organic Pollution with a Family-Level Biotic Index." *Journal of the North American Benthological Society*, vol. 7, no. 1, 1988, pp. 65–68. *JSTOR*, www.jstor.org/stable/1467832. Accessed 7 Mar 2021.

No QA/QC was conducted in 2020 because volunteers did not identify macroinvertebrates.

4.0 MACROINVERTEBRATE RESULTS

First, sample size is looked at because a large sample offers more confidence for a more reliable data set. SHEP protocol requires a minimum of 100 individual invertebrates to be picked and identified per sample.

Second, the number of different macroinvertebrate families found at the site (also known as family richness) is a measure of diversity. In general, more diversity is better. Therefore, a larger number of families may reflect a healthier community than a smaller number.

The dominant family is a record of what macroinvertebrate was most abundant. Its percentage of the total invertebrate sample indicates how dominant a single family is at a site. A high percent dominance is suboptimal; it indicates a less diverse community of macroinvertebrates.

The number of mayfly (Ephemeroptera), stonefly (Plecoptera) and caddisfly (Trichoptera) families in the sample. These families (referred to as EPT families) represent the pollution intolerant insects. A higher EPT score reflects better water quality than a lower one.

As mentioned before, the FBI score is a useful tool for evaluating the general status of organic pollution in streams within a watershed.

4.1 Hardwood Creek Above

A total of 161 invertebrates were identified, which is around average for the years sampled (Table 2), and a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***159***	***15***	***-***	***37***	***4***	***6***
8/29/20	161	8	Gammaridae	29	3	4.3
9/7/19	149	15	Simuliidae	29	4	5.2
9/8/18	192	12	Simuliidae	42	3	5
9/9/17	172	17	Baetidae	33	3	4.9
9/10/16	128	13	Baetidae	56	5	4.8
9/5/15	184	12	Baetidae	40	4	5.2
9/13/14	178	13	Simuliidae	35	4	5.2
8/25/13	157	12	Hyaliellidae	35	0	6.2
10/2/12	177	18	Heptageniidae	40	5	5
8/20/11	115	13	Gammaridae	44	3	5
9/11/10	121	18	Hyalellidae	30	3	6
9/12/09	193	18	Chironomidae	38	4	6.6
9/20/08	143	19	Decapoda	25	5	6.3
9/8/07	162	22	Hyalellidae	40	3	7.3

Table 2: Hardwood Creek Above data

The number of families was eight, which is below average for the years sampled. The dominant family overall was Gammaridae (scud), which are moderately tolerant to pollution. There were three EPT families (mayflies Baetidae and Heptageniidae and caddisfly Hydropsychidae), which made up 50% of the sample.

The FBI score of 4.3 indicates good health. Overall, the FBI trend has improved since initial years of surveys, consistently showing a stream health score of fair to good with exception to 2013 (Figure 9).

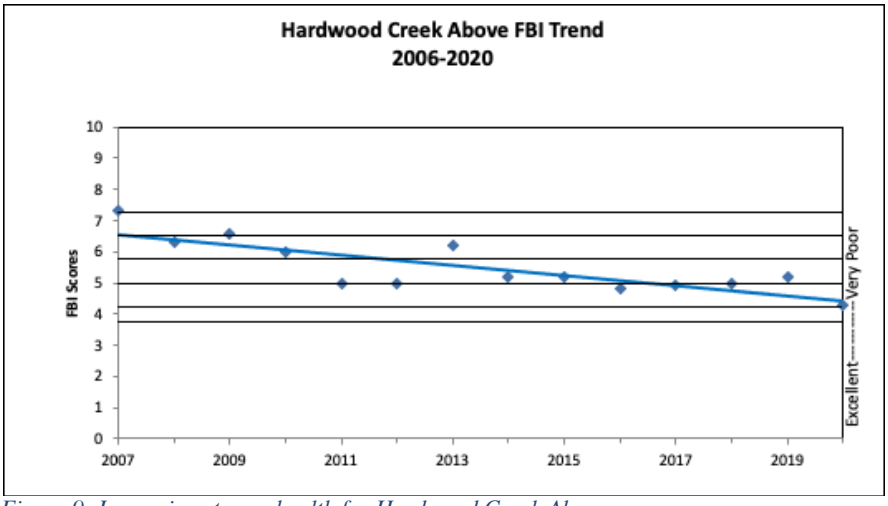

Figure 9: Improving stream health for Hardwood Creek Above

4.2 Hardwood Creek Below

A total of 113 invertebrates were identified, which is lower than average for the years sampled (Table 3), but still a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***147***	***14***	***-***	***51***	***3***	***5***
8/29/20	113	9	Bivalvia	61	4	6.2
9/7/19	118	14	Gammaridae	49	3	4.8
9/8/18	142	17	Baetidae	19	5	5.1
9/9/17	128	17	Gammaridae	49	3	4.5
9/10/16	131	9	Gammaridae	86	2	4.3
9/5/15	159	13	Gammaridae	65	4	4.4
9/13/14	196	10	Gammaridae	63	3	4.2
8/25/13	134	15	Gammaridae	24	4	4.9
10/2/12	210	20	Gammaridae	51	4	4.6
8/20/11	154	11	Gammaridae	60	3	4.4
9/20/10	136	16	Gammaridae	38	3	5.1

Table 3: Hardwood Creek Below data

The number of families was below average for the years sampled. Though several sensitive species were collected, very few individuals of each family were represented. Fingernail clams (Bivalvia) dominated the sample which have a tolerance value of 7 and impacted the FBI score. Four families were EPT families (mayflies Baetidae, Caenidae and Heptageniidae and caddisfly Hydropsychidae), making up 11% of the sample.

The FBI score of 6.2 indicates fairly poor health, which is the poorest score in the history of surveys at this site. Despite the FBI score, the trend has historically been stable wavering between fair and very good over the years (Figure 10).

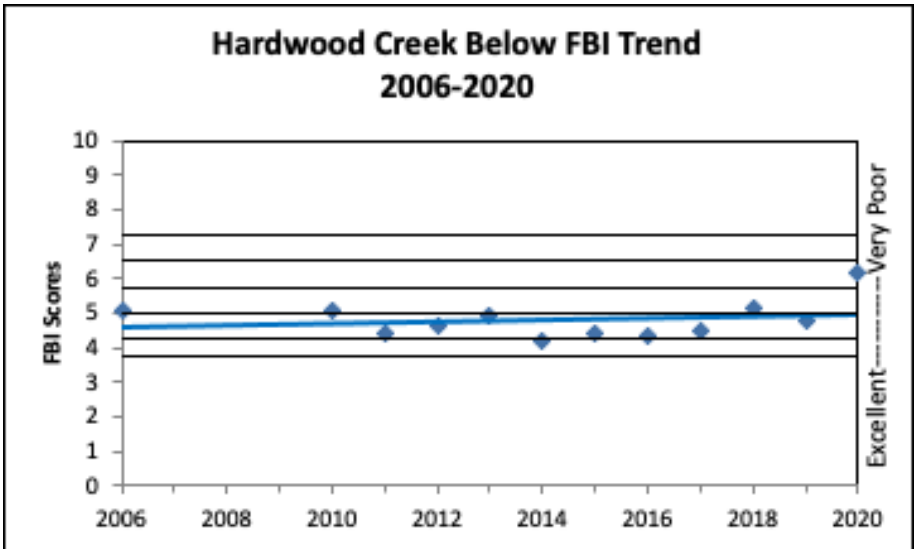

Figure 10: Stable health of Hardwood Creek Below

4.3 Clearwater Creek

A total of 107 invertebrates were identified, which is significantly lower than the average for the years sampled (Table 4) but still above the minimum of 100.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***152***	***13***	***-***	***42***	***2***	***5***
8/29/20	107	8	Chironomidae	29	1	4.8
9/7/19	181	7	Hydropsychidae	45	2	4.8
9/8/18	154	12	Gammaridae	34	1	4.7
9/9/17	115	15	Gammaridae	37	1	4.5
9/10/16	138	5	Gammaridae	51	1	4.6
9/5/15	181	10	Gammaridae	67	3	4.4
9/13/14	140	11	Simuliidae	32	2	5.6
8/25/13	134	12	Gammaridae	58	3	4.9
10/2/12	146	16	Gammaridae	56	2	4.6
9/11/11	363	19	Gammaridae	43	4	4.7
9/11/10	135	10	Gammaridae	76	2	4.5
9/12/09	152	18	Hydropsychidae	17	5	4.7
9/8/08	100	18	Chironomidae	26	3	5.7
9/8/07	84	19	Heptageniidae	19	4	5.9

Table 4: Clearwater Creek data

The number of families was below average for the years sampled. The dominant family overall was Chironomidae (non-biting midges), which have a tolerance value of 6 (moderate). Only one family was from the EPT group (the caddisfly Hydropsychidae), making up 23% of the sample.

The FBI scores are consistent, scoring good most years, and the health trend appears to be steadily improving (Figure 11).

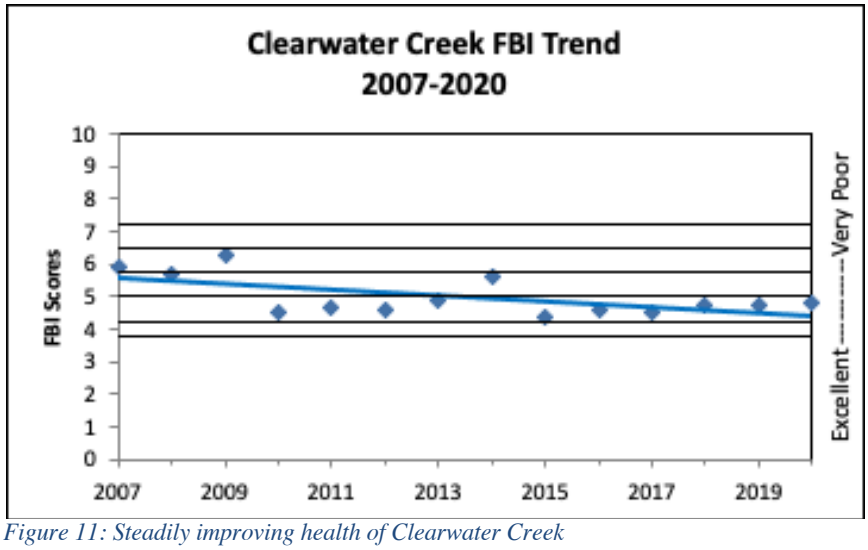

Figure 11: Steadily improving health of Clearwater Creek

4.4 Rice Creek Above

A total of 560 invertebrates were identified, which is over twice the average for the years sampled (Table 5), a very good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***244***	***11***	***-***	***60***	***2***	***7***
9/12/20	560	12	Chironomidae	53	4	5.8
9/21/19	180	7	Corixidae	52	0	7.9
8/26/18	132	11	Chironomidae	59	2	6
9/9/17	130	14	Chironomidae	41	1	7.3
9/17/16	204	6	Chironomidae	65	1	6.7
9/12/15	235	8	Chironomidae	62	2	6.9
9/7/14	139	11	Chironomidae	61	1	5.9
9/21/13	480	13	Chironomidae	82	1	6.1
9/22/12	174	10	Coengrionidae	53	4	8.3
9/18/11	612	15	Hyallelidae	70	3	7.8
9/26/10	227	11	Hyallelidae	66	6	7.3
9/5/09	103	11	Chironomidae	51	3	7
9/6/08	169	14	Hyallelidae	38	2	7
11/13/07	137	5	Coengrionidae	55	0	7.9
9/1/06	180	11	Coengrionidae	87	2	8.8

Table 5: Rice Creek Above data

The total number of families was slightly higher than average. The dominant family overall was Chironomidae (non-biting midges), which have a tolerance value of 6 (moderate). There were four families from the EPT group (mayflies Baetidae and Caenidae and caddisflies Hydropsychidae and Phrygaenidae), making up 14% of the sample.

The FBI score of 5.8 indicates fairly poor health. FBI scores have ranged between fairly poor to very poor since 2006 (Figure 12).

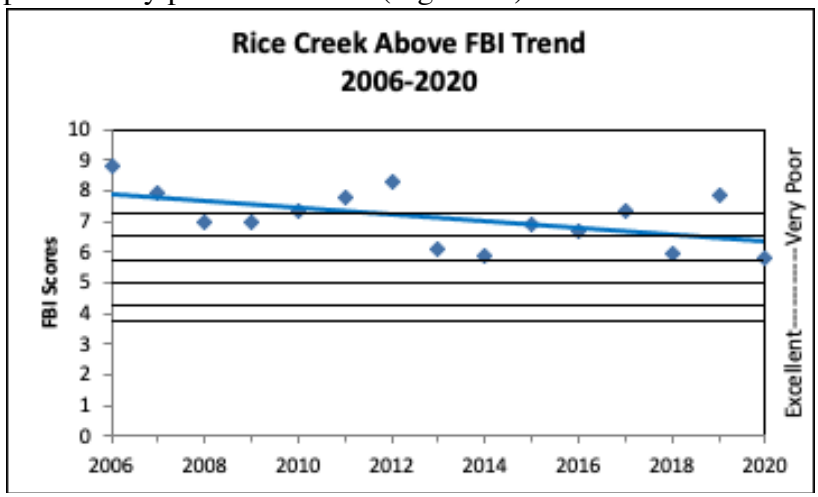

Figure 12: Improving health (though poor) of Rice Creek Above

4.5 Rice Creek Below

A total of 139 invertebrates were identified, which is just above the average for the years sampled (Table 6), and a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***204***	***11***	***-***	***59***	***2***	***7***
9/12/20	139	10	Chironomidae	53	2	5.7
9/21/19	220	11	Chironomidae	34	3	5.9
8/26/18	153	9	Chironomidae	75	2	5.9
9/9/17	147	5	Chironomidae	61	0	6.7
9/10/16	102	7	Chironomidae	53	2	6.7
9/12/15	125	9	Chironomidae	54	3	6.8
8/31/14	170	9	Chironomidae	67	2	6.2
9/14/13	300	16	Chironomidae	72	0	6.4
9/22/12	129	17	Hyallelidae	40	0	7.4
9/18/11	347	15	Hyallelidae	75	3	7.8
9/26/10	680	15	Hyallelidae	80	4	7.8
9/6/09	110	8	Simuliidae	65	2	6.3
9/6/08	178	7	Corixidae	34	2	7.3
11/13/07	137	10	Chironomidae	63	0	6.9
9/1/06	117	12	Coengrionidae	65	2	8.3

Table 6: Rice Creek Below data

The number of families was slightly lower compared to other years sampled. The dominant family overall was Chironomidae (non-biting midges), which have a tolerance value of 6 (moderate). Two families were from the EPT group (caddisflies Hydropsychidae and Phrygaenidae), making up 13% of the sample.

The FBI score of 5.7 indicates fair health, which is the highest health score in the history of surveys at this site. Throughout the years, this stream site has scored between fairly poor and very poor with variable FBI scores but improving through the years (Figure 13).

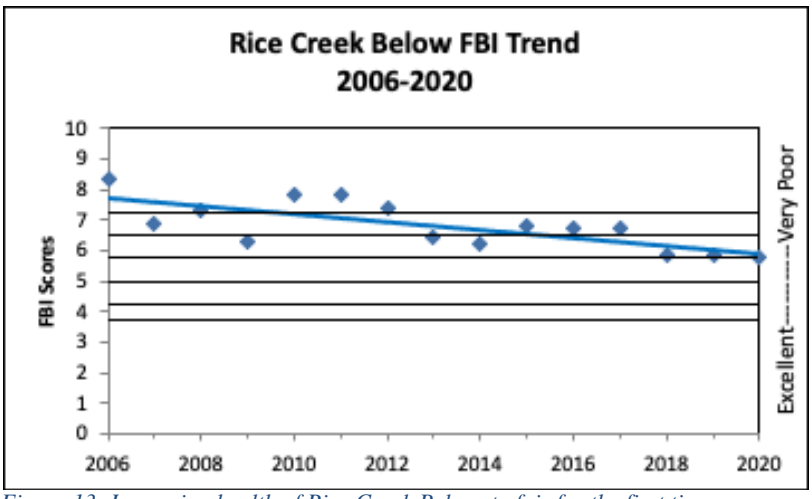

Figure 13: Improving health of Rice Creek Below, to fair for the first time

4.6 Rice Creek Irondale

A total of 220 invertebrates were identified, which is above average for the years sampled (Table 7), and a very good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***165***	***11***	***-***	***55***	***2***	***6***
9/12/20	220	10	Chironomidae	69	3	5.4
9/21/19	146	11	Hyalellidae	51	1	7.2
9/2/18	151	9	Chironomidae	82	3	6.1
9/16/17	128	11	Chironomidae	44	3	6.4
9/10/16	125	7	Chironomidae	47	2	6.7
8/29/15	104	8	Hyalellidae	37	2	6.7
8/31/14	254	13	Chironomidae	60	3	6
9/14/13	195	13	Chironomidae	46	1	6.8
9/2/12	165	13	Chironomidae	61	2	6.8

Table 7: Rice Creek Irondale data

The number of families was slighltly below average for the years sampled. The dominant family overall was Chironomidae (non-biting midges), which have a tolerance value of 6 (moderate). The samples are often low in diversity, the families are unevenly distributed, and heavily dominated by pollution tolerant families. Three families were from the EPT group (mayfly Baetidae and caddisflies Hydropsychidae and Phrygaenidae), making up 23% of the sample.

The FBI score of 5.4 indicates fair health, which is consistent over the years, showing stable health (Figure 14).

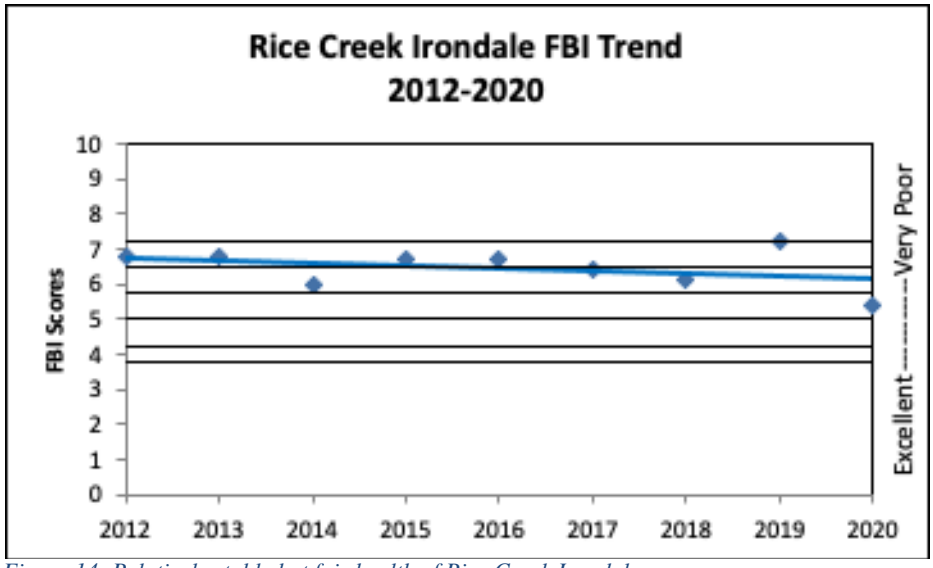

Figure 14: Relatively stable but fair health of Rice Creek Irondale

4.7 Locke Lake Above

A total of 147 invertebrates were identified, which is well below the average for the years sampled (Table 8), a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***259****	***12***	***-***	***51***	***3***	***5***
9/19/20	147	9	Baetidae	76	3	4.1
10/5/19	367	11	Simuliidae	40	2	5.6
8/26/18	184	14	Chironomidae	56	2	5.7
9/9/17	151	9	Simuliidae	79	1	5.8
9/17/16	190	9	Simuliidae	62	3	5.5
9/13/15	152	9	Hydropsychidae	53	2	4.5
9/14/14	198	9	Hydropsychidae	67	2	4.4
9/8/13	225	9	Hydropsychidae	42	2	4.9
9/9/12	629	18	Chironomidae	29	6	5.2
9/11/11	2536	12	Simuliidae	63	3	5.4
9/12/10	197	13	Chironomidae	46	4	5.9
9/13/09	498	18	Chironomidae	37	3	6.1
10/11/08	315	14	Chironomidae	30	4	5.7
9/16/07	257	13	Baetidae	22	3	5.5
9/28/06	111	12	Hydropsychidae	58	2	5.0

*Table 8: Locke Lake Above data, * average calculated after eliminating the outlier of 2536 in 2011 otherwise average is 410*

The number of families was below average for the years sampled. Over the years of monitoring, the distribution of families has been uneven and usually over-dominated by a single family. In 2020, Baetidae heavily dominated the sample, followed by Hydropsychidae. These two species are both sensitive species with low tolerance to pollution which accounts for the improved health score. There were three families from the EPT group (mayfly Baetidae and caddisflies Hydropsychidae and Philopotomidae), making up 89% of the sample.

The FBI score of 4.1 indicates very good health, the highest health score in the history of surveys. The FBI trend is stable but scores fluctuate between fairly poor to very good (Figure 15).

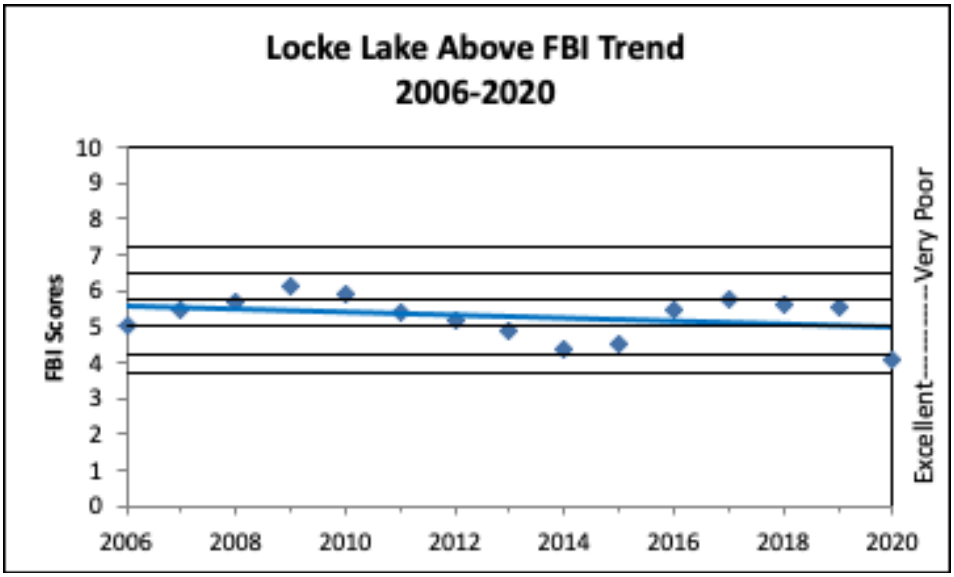

Figure 15: Fluctuating health of Locke Lake Above

4.8 Locke Lake Below

A total of 151 invertebrates were identified, which is slightly below average for the years sampled (Table 9), but still a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***185***	***11***	***-***	***55***	***3***	***5***
9/19/20	151	9	Hydropsychidae	66	3	4.0
10/12/19	178	13	Chironomidae	38	3	5.5
8/26/18	133	15	Chironomidae	64	2	5.5
9/9/17	184	11	Simuliidae	54	2	5.8
9/17/16	212	7	Simuliidae	73	2	5.7
9/13/15	310	10	Chironomidae	72	1	5.7
9/14/14	228	9	Hydropsychidae	49	2	4.8
9/8/13	107	14	Chironomidae	57	2	5.6
9/9/12	314	15	Chironomidae	61	3	5.6
9/11/11	362	13	Simuliidae	80	3	5.7
9/12/10	123	11	Chironomidae	42	5	5
9/13/09	115	12	Hydropsychidae	48	2	5
10/11/08	163	10	Hydropsychidae	42	3	5.1
9/9/07	103	9	Chironomidae	37	2	5.7
9/28/06	95	8	Chironomidae	43	3	5.3

Table 9: Locke Lake Below data

The number of families was below average for the years sampled. The dominant family overall was Hydropsychidae, which have a tolerance value of 4 (moderate). Chironomidae, Simuliidae, and Hydropsychidae have traded in dominance from year to year. Though the FBI scores are healthy, the low diversity and disproportion of families

is not ideal. Three families were from the EPT group (mayfly Baetidae and caddisflies Hydropsychidae and Philopotomidae), making up 81% of the sample.

The FBI score indicates very good health, which is the highest score in the history of surveys at this site. The FBI scores have remained consistent throughout most years of sampling (Figure 16).

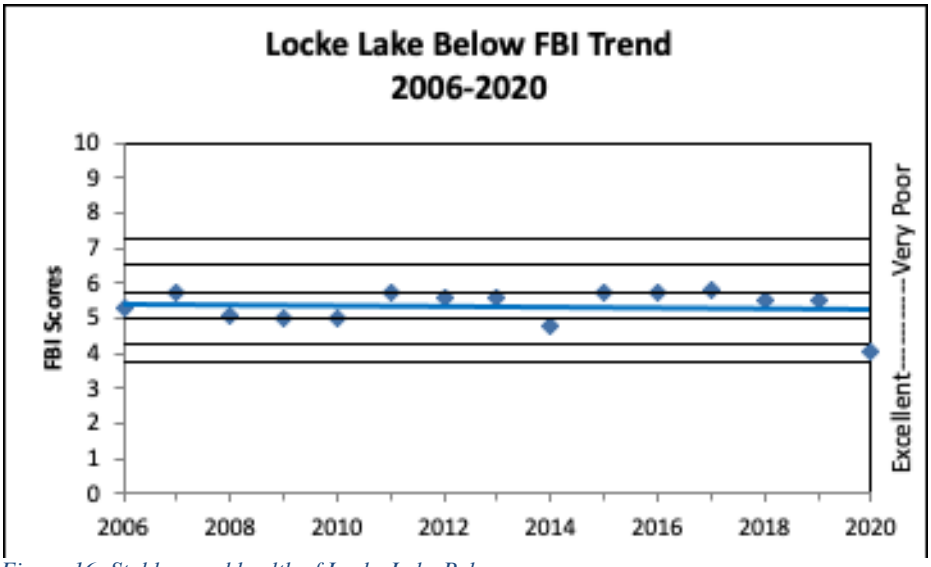

Figure 16: Stable, good health of Locke Lake Below

4.9 Locke Lake Park

A total of 185 invertebrates were identified, which is below average for the years sampled (Table 10), but still a good sample size.

Date	# Identified	# Families	Dominant Family	% Dominance	# EPT Families	FBI
average	***306***	***10***	***-***	***54***	***2***	***5***
9/19/20	185	8	Baetidae	47	2	4.2
9/21/19	217	11	Simuliidae	57	3	5.9
8/26/18	663	15	Chironomidae	45	2	5.7
9/9/17	275	7	Simuliidae	66	1	5.7
9/17/16	219	6	Simuliidae	71	2	5.5
9/13/15	194	11	Hydropsychidae	63	2	4.6
9/14/14	406	11	Hydropsychidae	48	2	4.9
9/8/13	132	11	Nematoda	56	1	6.4
9/9/12	463	14	Chironomidae	32	3	4.7

Table 10: Locke Lake Park data

The number of families was slightly under the average for the years sampled. Baetidae heavily dominated the sample, followed by Hydropsychidae. These two species are both sensitive species with low tolerance to pollution which accounts for the improved health

score. Two families were from the EPT group (mayfly Baetidae and caddisfly Hydropsychidae), making up 87% of the sample.

The FBI score of 4.2 indicates very good health, which is the highest health score in the history of surveys at this site. FBI scores over the years are variable, though the health trend is stable (Figure 17).

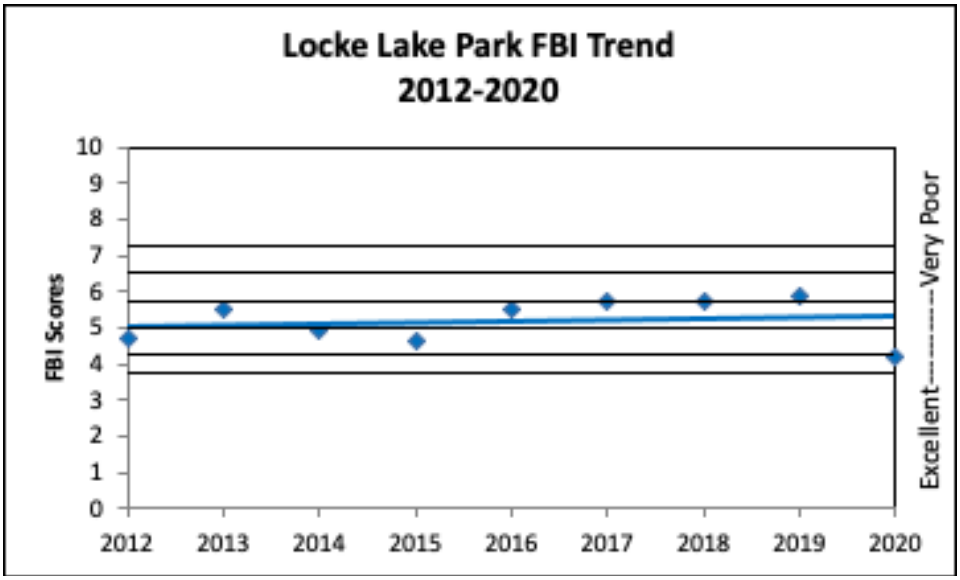

Figure 17: Stable and fairly good health of Locke Lake Park

5.0 SUMMARY OF RESULTS

5.1 Improving

Hardwood Creek Above, Clearwater Creek, Rice Creek Above and Rice Creek Below all seem to be improving through the years that SHEP has sampled at those sites (Figure 18).

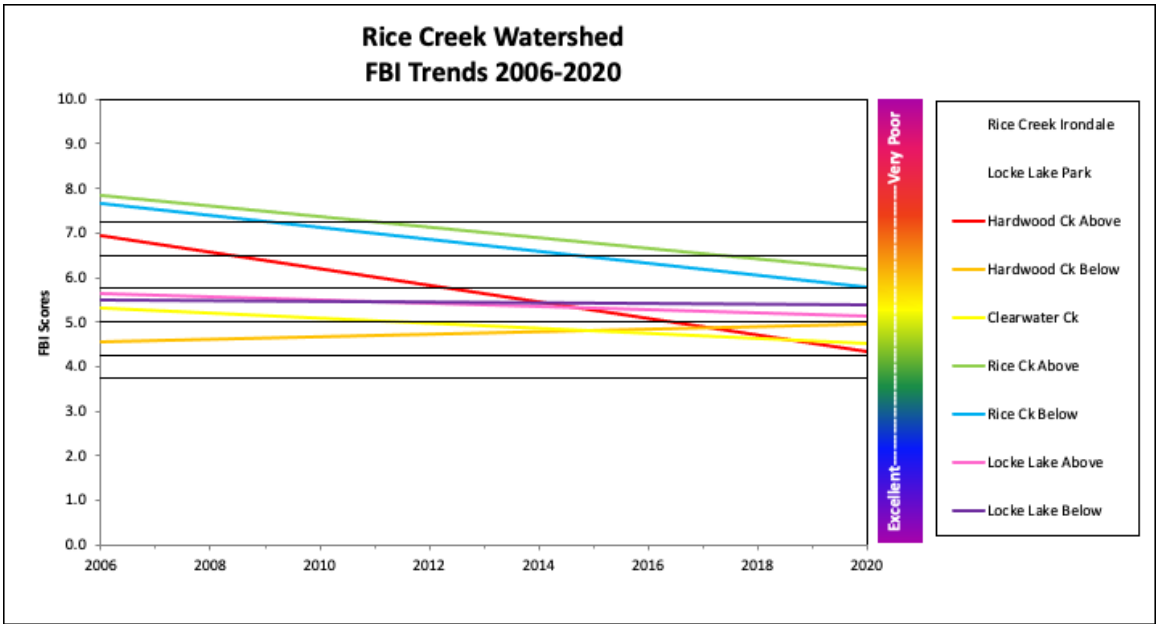

Figure 18: FBI scores for all SHEP sites through the years sampled

5.2 Stable

Rice Creek Irondale, Locke Lake Above, Locke Lake Below and Locke Lake Park all appear stable (Figure 18).

In 2020 we hit a new records for the best FBI values, a 4.0 at Locke Lake Below, followed by 4.1 at Locke Lake Above and 4.2 at Locke Lake Park. Previously, the record was 4.2 in 2014 at Hardwood Creek Below.

5.3 Worsening

While Hardwood Creek Below has had some very healthy scores, in 2020, the site obtained its worst FBI score ever – a 6.2. Luckily, though, the poorest historical FBI value remained 8.8 at the Rice Creek Above site in 2006. Thus, its health appears to be worsening (Figure 18).

5.4 Status in 2020

Figure 19 shows each sampling location's FBI score and stream health rating for 2020. Variability may be caused by environmental factors including water levels, habitat

availability or other sources of disturbance in the area. Team 2 noted that water levels were lower this year than others (pers. comm. Jennifer Haldey), which could cause pollutants and small particles in the water (total suspended solids) to be concentrated and pose challenges to filter feeding organisms such as these macroinvertebrates.

While SHEP volunteers collect data on the physical habitat, SHEP limits their analysis of physical stream data, as it is can be subjective in description and placement of data collection – not only from team to team but from year to year depending on who is collecting the data. Thus, SHEP only provides macroinvertebrate data to provide a picture of stream health and changes throughout time.

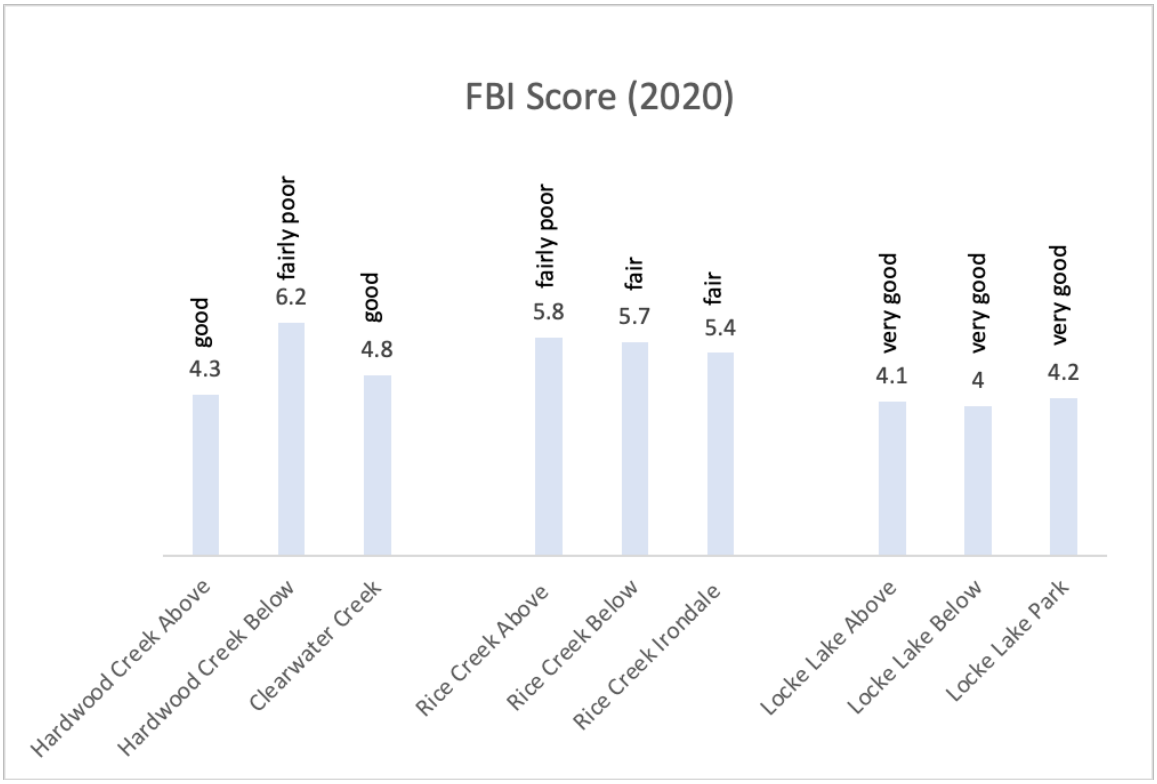

Figure 19: Stream health rating for SHEP sampling sites in 2020