RICE CREEK WATERSHED STREAM HEALTH EVALUATION PROGRAM (SHEP)

2013 BENTHIC MACROINVERTEBRATE STREAM MONITORING REPORT

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Acknowledgements

The 2013 Rice Creek Watershed Stream Health Evaluation Program wishes to recognize the following individuals and organizations for their dedication to the success of this program.

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
2013 Field Monitoring Report

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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, over the last 15 years, developed new 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 resources. Biological monitoring provides a more complete picture of the ecological health of our waters.

By surveying aquatic organisms that grow, develop and reproduce, we can observe any changes occurring to our waters over time. 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 Minnesota Pollution Control Agency (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 often become more engaged in wetland and watershed issues and stewardship within their communities.

1.1   A New Model

The Stream Health Evaluation Program is a new model for volunteer stream monitoring modeled after WHEP and Riverwatch. The Stream Health Evaluation Program (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 is 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, a new model for water quality assessment:
- 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
- Promotes partnership between local governments, state agencies and community residents.

1.2 Rice Creek SHEP

SHEP was first implemented in a pilot phase into the Rice Creek Watershed District in the summer and fall of 2006. In 2013 SHEP was led by Friends of the Mississippi River (FMR) in partnership with the Rice Creek Watershed District (RCWD), Minnesota Pollution Control Agency (MPCA), and Fortin Consulting. Local program partners included the Anoka Conservation District, University of Minnesota Water Resource Center, City of Lino Lakes, City of Centerville, Anoka County Parks, The Wargo Nature Center, and local landowners.

Primary funding for this program was made possible by the Rice Creek Watershed District. Matching resources for the 2013 SHEP season were provided by Friends of the Mississippi River.

The program recruited 30 adult volunteers and one teen volunteer organized in three teams to monitor a total of nine sites in the fall of 2013. These sites were located in Hardwood Creek, Clearwater Creek, Rice Creek, and the inlet/outlet of Locke Lake. Some sites were chosen in part to gauge the effects of recent restoration and stewardship activity. For more information on site selection, see section 4.0.

The SHEP monitoring protocol was divided into two sections: a physical habitat assessment and a biological assessment of benthic macroinvertebrates. Volunteers participated in 1.5 days of training, covering the in-stream physical assessment and macroinvertebrate collection methods, and laboratory macroinvertebrate identification procedures. For more information on methods and training, see section 2.0.

Each volunteer team collected physical assessment data and benthic macroinvertebrate samples at three sites. After macroinvertebrate collection was completed, volunteers participated in laboratory analysis sessions to identify samples. The samples were later cross-checked by macroinvertebrate identification professionals at Fortin Consulting, and results were reported to program partners, local governments and made available to the general public.

1.3   The Rice Creek Watershed

Watershed Districts are special purpose units of local government whose boundaries follow those of a natural watershed. The Rice Creek Watershed District 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.

The Rice Creek watershed drains portions of Anoka, Hennepin, Ramsey, and Washington Counties. The watershed occupies portions of Arden Hills, Birchwood, Blaine, Centerville, Circle Pines, Columbia Heights, Columbus, Dellwood, Falcon Heights, Forest Lake, Fridley, Grant, Hugo, Lauderdale, Lexington, Lino Lakes, Mahtomedi, May Township, Mounds View, New Brighton, New Scandia Township, Roseville, St. Anthony, Shoreview, Spring Lake Park, White Bear Lake, White Bear Township and Willernie.

Rice Creek's principal tributaries are Hardwood Creek, which drains an area of 44 square miles in the cities of Hugo, Forest Lake, and Lino Lakes; and Clearwater Creek, which drains a 62 square mile area of White Bear Lake, White Bear Township, Hugo, Lino Lakes, and Centerville. Both tributaries join Rice Creek in Anoka County as part of the Rice Creek Chain of Lakes.

The Rice Creek has its source at Clear Lake in the City of Forest Lake and flows generally southwestwardly through Anoka and Ramsey Counties, through the cities of Columbus, Lino Lakes, Circle Pines, Shoreview, Arden Hills, Mounds View, New Brighton and Fridley. It joins the Mississippi River at Manomin County Park in Fridley. The creek drops about 84 feet along its course, with most of the drop occurring in the 8 miles upstream of its mouth.

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.

2.0   METHODS

2.1   Volunteer Recruitment

Volunteer recruitment efforts were led by staff from Friends of the Mississippi River in partnership with Rice Creek Watershed District Staff. Recruitment of volunteers was conducted through news releases, list-serves, flyers, city and county publications, presentations, tabling at events and through communication with interested volunteers in existing local programs.

A total of 31 SHEP volunteers were recruited for this program. Volunteers were divided into three teams. Each team was lead by a Team Leader. Team Leaders are an integral part of SHEP and were selected by project staff. Team Leaders received a small stipend and were responsible for managing monitoring activities and communication within their team.

2.2   Team Assignments

SHEP volunteers were assigned to one of three teams. Team leaders, team members and monitoring location assignments are listed below.

Team One:
Monitoring Locations: Hardwood Creek & Clearwater Creek
Site Names: Hardwood Creek Above, Hardwook Creek Below, Clearwater Creek
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Barbara Bor, Jeff Disch, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner.

Team Two:
Monitoring Location: Rice Creek Area
Site Names: Rice Creek Above, Rice Creek Below, Rice Creek Irondale.
Team Leader: Ralph Butkowski
Team Members: Bob Bartlett, James Brozowski, Gary Ellis, Julie Glanton, Courtney Jones, Jo Ann Morse, Fuzu Moy, Rod Venterea.

Team Three:
Monitoring Location: Locke Lake Area
Site Names: Locke Lake Above, Locke Lake Below, Rice Creek Park
Team Leaders: Katherine & Darrell Majkrzak
Team Members: Trisha Flaherty, Jaime Haueter, Alex Haueter, Cathi Lyman-Onkka, Marilyn Radmer, Juliette Schroeder, Rob Schroeder, Jill Schroeder, John Steinworth, Susan Young.

2.3   Training

Advanced volunteer training is essential to the success of SHEP. Volunteers participated in 1.5 days of training in the MPCA's macroinvertebrate sampling protocols. This

training covered in-stream habitat assessment and macroinvertebrate collection methods, along with laboratory procedures for identification of macro-invertebrates.

The first training session, held on Saturday, August 24th 2013 at the Wargo Nature Center in Lino Lakes, included an introduction to macroinvertebrate monitoring, habitat assessment protocols, stream flow measurement protocols and featured macroinvertebrate collection methods under the guidance of Friends of the Mississippi River (FMR) and Fortin Consulting staff. FMR staff also introduced the Rice Creek watershed sampling sites, reviewed each SHEP team's sampling logistics, and distributed necessary sampling equipment. This training was mandatory for all volunteers in their first three years in SHEP, and optional for volunteers who had participated four or more years.

To allow for maximum volunteer participation, program staff organized the two laboratory training sessions on Wednesday, September 25th and Saturday, September 28th 2013 at the Wargo Nature Center. These sessions were led by FMR and Fortin Consulting staff and were designed to focus on laboratory analysis portions of the Stream Health Evaluation Program. These training sessions included benthic macroinvertebrate stream sampling history, sample sorting and sample processing, as well as general lab skills and 'family level' macroinvertebrate identification techniques. SHEP volunteers in their first three years were asked to participate in at least one of these two sessions, though volunteers were permitted to attend both if desired. This training was optional for volunteers who had participated four or more years in SHEP.

2.4   Site Selection

Stream monitoring sites were selected by RCWD staff. Several sites included in the 2013 SHEP season were upstream or downstream of recent watershed restoration activity. A detailed description of monitoring sites is included in section 4.0 of this report. 2013 SHEP sites included:
- Hardwood Creek 'Above'
- Hardwood Creek 'Below'
- Clearwater Creek
- Rice Creek 'Above'
- Rice Creek 'Below'
- Rice Creek 'Irondale'
- Locke Lake 'Park'
- Locke Lake 'Above'
- Locke Lake 'Below'

2.5   Field Sampling

SHEP volunteer teams monitored nine stream sites across the Rice Creek Watershed during the fall of 2013. This represents an increase in three sites since the program began in 2006. FMR and Fortin Consulting staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location throughout the watershed. The multi-habitat approach samples major habitats in

proportional representation within each sampling reach. Benthic macroinvertebrates are 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 in the reach. Habitat types included snags and woody debris, vegetated banks, cobble, and sand/fine sediment bottom areas.

Project staff from the FMR or Fortin Consulting made in-field team visits whenever possible. These visits are conducted to ensure the teams were following the correct protocols in collecting and preserving macroinvertebrates and conducting habitat assessments.

2.6   Lab Identification

SHEP teams sorted and identified macroinvertebrate samples during multiple lab sessions throughout September, October and November 2013. Lab identification sessions were held in partnership with Anoka County Parks at the Wargo Nature Center in Lino Lakes, Minnesota.

Lab sessions identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted and labeled prior to being submitted to project staff for quality assurance / quality control.

2.7   Quality Assurance/Quality Control (QA/QC)

A Quality Assurance/Quality Control (QA/QC) check was performed on macroinvertebrate samples identified by SHEP volunteers. Fortin Consulting staff performed a QA/QC check on 33% of the macroinvertebrates identified by all three teams.

The samples selected for QA/QC were as follows:

> **Team One:**
> Sample: Hardwood Creek 'Below' sample
> Accuracy Score: **98.5%**
>
> **Team Two:**
> Sample: Rice Creek 'Irondale' sample
> Accuracy Score: **96.4%**
>
> **Team Three:**
> Sample: Locke Lake 'Below' sample
> Accuracy Score: **99.1%**

The overall combined QA/QC accuracy score for the 2013 Rice Creek Watershed Stream Health Evaluation Program was: 97.98%.

3.0   MONITORING TERMS

3.1   Monitoring Terms

The descriptions below will help readers understand the results presented on the following pages.

Benthic – Of, relating to, or happening on stream, lake or ocean bottoms.

Complete Metamorphosis – Occurs in the Diptera, Megaloptera, Coleoptera, Trichoptera and Lepidoptera. The life cycle includes the following stages: egg, larva, pupa and adult.

Trichoptera (caddisfly) Larva

Trichoptera (caddisfly) Adult
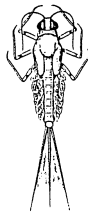
Ephemeroptera (mayfly) Larva

Ephemeroptera (mayfly) Adult

Dominant Family – The family that comprises the largest single portion of the invertebrate sample.

Dominant Family % Overall – The dominant family's percentage of the total invertebrate sample. This metric indicates how dominant a single family is at a site. A high percent dominance is suboptimal. It indicates a less diverse community of macroinvertebrates.

EPT – The number of mayfly (**E**phemeroptera), stonefly (**P**lecoptera), and caddisfly (**T**richoptera) families in the sample. These families represent the pollution intolerant insects. A higher EPT score reflects better water quality than a lower one.

Family – Family is the level of identification used in this protocol. In the taxonomic rank, family appears as follows: Phylum, Class, Order, Suborder, Family, Subfamily, Genus, and Species. An example of an order is Ephemeroptera or Mayflies. An example of a family is Heptageniidae or Flat Head Mayfly.

Family Biotic Index (FBI) – Each macroinvertebrate family is assigned a pollution tolerance number between '0' 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. The FBI for a site is the weighted average of the biotic indices for all of the invertebrates in the sample. The FBI summarizes the various pollution tolerance values of all families in a sample. Pollution <u>intolerant</u> families such as stoneflies (FBI of 0 – 2) can only survive in excellent water quality. Pollution <u>tolerant</u> organisms such as leeches and aquatic earthworms can live in clean water or poor quality water. They have high FBI values (8 – 10). According to Hilsenhoff, who developed this metric, "Use of the FBI is advantageous for evaluating the general status of organic pollution in streams within a watershed for the purpose of deciding which streams or watersheds should be studied further."

Historically, the lowest (best) FBI value reported by our monitoring was a 4.4 score at Hardwood Creek 'Below' in 2011. The highest (poorest) historical FBI value reported was an 8.8 score at the Rice Creek 'Above' site in 2006.

Index of Biotic Integrity (IBI) – "A synthesis of diverse biological information that numerically depicts associations between human influence and biological attributes. It is composed of several biological attributes or 'metrics' that are sensitive to changes in biological integrity caused by human activities."
*Source: Volunteer Surface Water Monitoring Guide, MPCA, 2003*

Incomplete Metamorphosis – Occurs in the Ephemeroptera, Plecoptera, Odonata and Hemiptera. The life cycle includes the following stages: egg, early instar larva, late instar larva and adult. This program monitors the larval stages of development.

Macroinvertebrate – An invertebrate that can be seen with the naked eye.

Metric – A measure of stream health calculated using data from macroinvertebrate monitoring. The family biotic index (FBI), EPT and number of families (family richness) are examples of metrics. Metrics are used to help analyze and interpret biological data. Metrics are often compared to charts that place the values into stream health categories.

Number of Families – The number of different benthic macroinvertebrate families found at the site, also known as family richness. In general, more diversity is better. Therefore a larger number of families may reflect a healthier community than a smaller number. The largest number of families (24) was discovered at the Hardwood Creek 'Above' site in 2007, while the fewest number of families (5) were found at both the Rice Creek 'Above' and Rice Creek 'Below' sampling locations in 2007.

Number of Organisms Identified – The protocol used requires identification of a minimum of 100 organisms to confidently assess a site. When fewer than 100 organisms are identified in a sub-sample, the information is still useful, but we cannot be as confident about characterizing the site's health. Teams in this circumstance will select another sub-sample of a site sample and identify all organisms in the second sub-sample in addition to the original sub sample. Scores are tallied based on the combination of both

sub-sample results, often resulting in larger numbers of individual macroinvertebrates identified.

Water Quality – Refers to anything that might affect the invertebrates living in the river for part of their life cycle (such as nutrients, oxygen, sediment, organic pollution, toxins, stream flow, and quality of habitat).

Source: Fortin Consulting, 215 Hamel Road, Hamel, MN 55340

3.2   Hilsenhoff Family Level Biotic Index

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

Evaluation of water quality using Hilsenhoff's Family Level Biotic Index

Family Biotic Index	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

Source: Hilsenhoff, 1988

4.0   2013 FIELD SAMPLING RESULTS

4.1   Hardwood Creek Sites

4.1.1   Existing Conditions

Hardwood Creek drains an area of 24 square miles in the cities of Hugo, Forest Lake, and Lino Lakes. Its headwaters drain from Rice Lake through Hardwood Creek before emptying into Lake Peltier at the head of the Chain of Lakes, which is located in the cities of Lino Lakes and Centerville.

In the summer of 2006, as part of a grant from the Legislative Commission on Minnesota Resources (LCMR), three locations along Hardwood Creek that were identified as having severe bank erosion were stabilized and in-stream habitat improvement techniques were utilized.

Hardwood Creek is listed as impaired for biota (fish) on the lower portion of the creek (downstream of Highway 61), and low dissolved oxygen (DO) for the full length of the creek. The natural background level of DO is used as the water quality endpoint above Highway 61 due to naturally low oxygen levels occurring in that wetland-dominated part of the watershed.

A Total Maximum Daily Load (TMDL) study began in 2004 and addresses the impairments on Hardwood Creek. The TMDL is a collaborative effort between the MPCA and Rice Creek Watershed District. The TMDL was approved by the Minnesota Pollution Control Agency (MPCA) in 2009.

4.1.2   Site Maps

Below are maps of each of the 2013 Hardwood sampling locations. The pins on each site map correspond to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

The Hardwood Creek 'Above' site was first included in the SHEP sampling protocol in 2007. The 'Below' site was added to the SHEP monitoring protocol for the 2010 season.

2013 Hardwood Creek 'Above' sampling location.

2013 Hardwood Creek 'Below' sampling location.
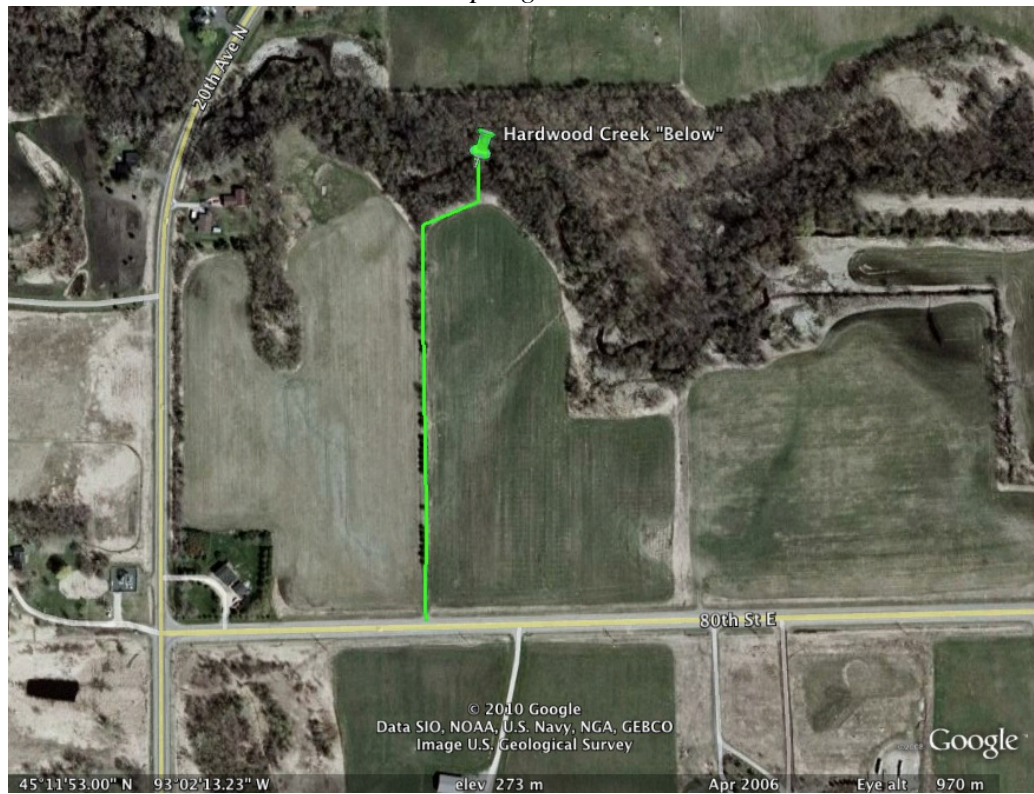
4.1.3   Sampling Methodology
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Barbara Bor, Jeff Disch, Linda Gruntner, Barb Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at this monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols. In the lab, analysis was done to identify macroinvertebrates from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted, labeled and scored.

4.1.4a   Field Sampling Results for Hardwood Creek "Above" Site

Historical Field Results for Hardwood Creek 'Above' Site					
Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
09/08/07	162	**7.2**	4	24	Hyalellidae	41%
09/20/08	143	**6.3**	5	19	Decapoda	24%
9/12/09	193	**6.6**	4	18	Chironomidae	38%
9/11/10	121	**6.0**	3	18	Hyalellidae	30%
8/20/11	115	**5.0**	3	13	Gammaridae	43%
10/2/12	177	**5.0**	5	18	Heptageniidae	39.5%
8/25/13	157	**6.2**	3	12	Hyaliellidae	35%
Cross-Check Results: N/A						

Primary Sampling Data for Hardwood Creek 'Above' - 2013

- Hyalellidae (Scuds & Side-Swimmers) — 35%
- Heptageniidae (Mayflies) — 27%
- Chironomidae (True Flies) — 25%
- Baetidae (Mayflies) — 3%
- Decapoda (Shrimps and Crayfishes) — 2%
- Asellidae (Aquatic Sow Bugs) — 2%
- Other — 6%
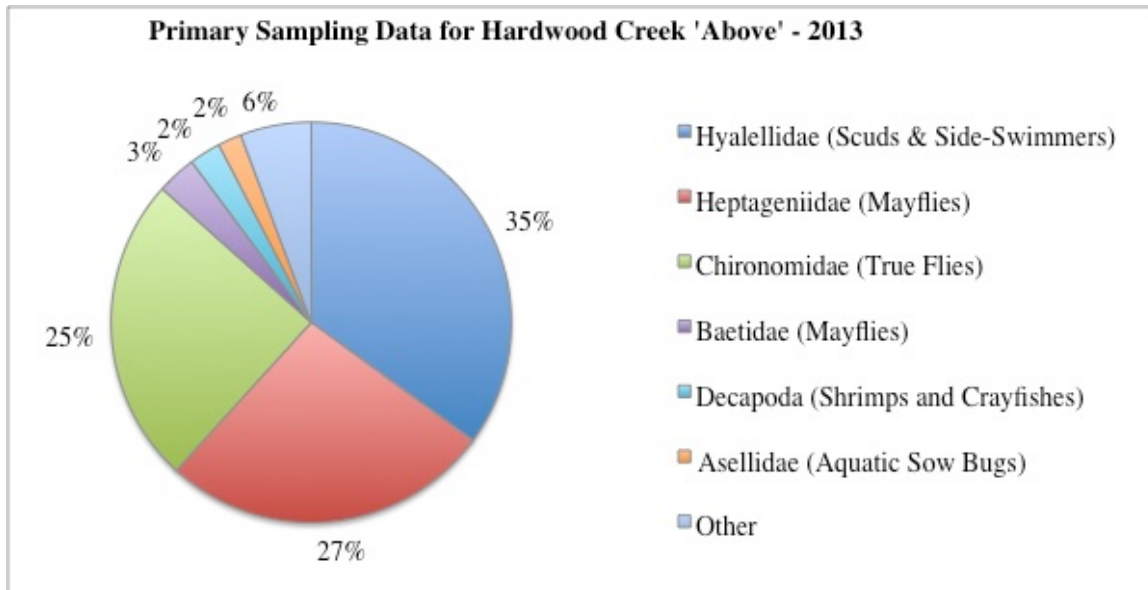
Hardwood Creek 'Above' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 6.2 for the Hardwood Creek 'Above' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. This represents a decline in stream health from 2011 and 2012 (5.0). The diversity and number of EPT species decreased in 2013. Four of the 12 families have tolerance values of 8 or greater (including the Hyaliellidae which dominated the sample). In 2012, Heptageniidae dominated (tolerance value 4) – this helped keep the 2012 FBI score healthier.

Number of individuals: 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. 157 invertebrates were identified in this sample. This is a good sized sample.

Dominant Family: The dominant family was Hyalellidae (scuds). Hyalellidae has a tolerance value of 8 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Gammaridae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 18 families were identified in the sample. This compares to 13 families in 2011 and 18 families in 2010. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 5 EPT families were identified in the sample and made up 55% of the sample.

4.1.4b Field Sampling Results for Hardwood Creek "Below" Site

Historical Field Results for Hardwood Creek 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	Number of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/20/10	136	**5.1**	3	16	Gammaridae	38%
8/20/11	154	**4.4**	3	11	Gammaridae	60.4%
10/2/12	210	**4.6**	4	20	Gammaridae	51.4%
8/25/13	134	**4.9**	4	15	Gammaridae	24%

Primary Sampling Data for Hardwood Creek 'Below' - 2013

- Gammaridae (Scuds and Side-Swimmers) — 24%
- Heptageniidae (Mayflies) — 22%
- Chironomidae (True Flies) — 19%
- Baetidae (Mayflies) — 6%
- Decapoda (Shrimps and Crayfishes) — 6%
- Sialidae (Alderflies) — 5%
- Elmidae (Beetles) — 5%
- Caenidae (Mayflies) — 3%
- Hydropsychidae (Caddisflies) — 3%
- Other — 7%

Hardwood Creek 'Below' Data Summary

<u>Family Biotic Index (FBI)</u>: Our 2013 SHEP field sampling results produced a score of 4.9 for the Hardwood Creek 'Below' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart and is consistent with stream health scores from 2011 (4.4) and 2012 (4.6). In 2013, a slightly smaller and less diverse sample was identified. However, the number of individuals per family were more evenly distributed in 2013 than in 2012, and this helped maintain a healthy overall tolerance value for the sample.

<u>Number of individuals</u>: 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. 134 invertebrates were identified in this sample. This sample size is good.

<u>Dominant Family</u>: The dominant family was Gammaridae (scuds). Gammaridae dominated 24% of the sample, and has a tolerance value of 4 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Hyalellidae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).
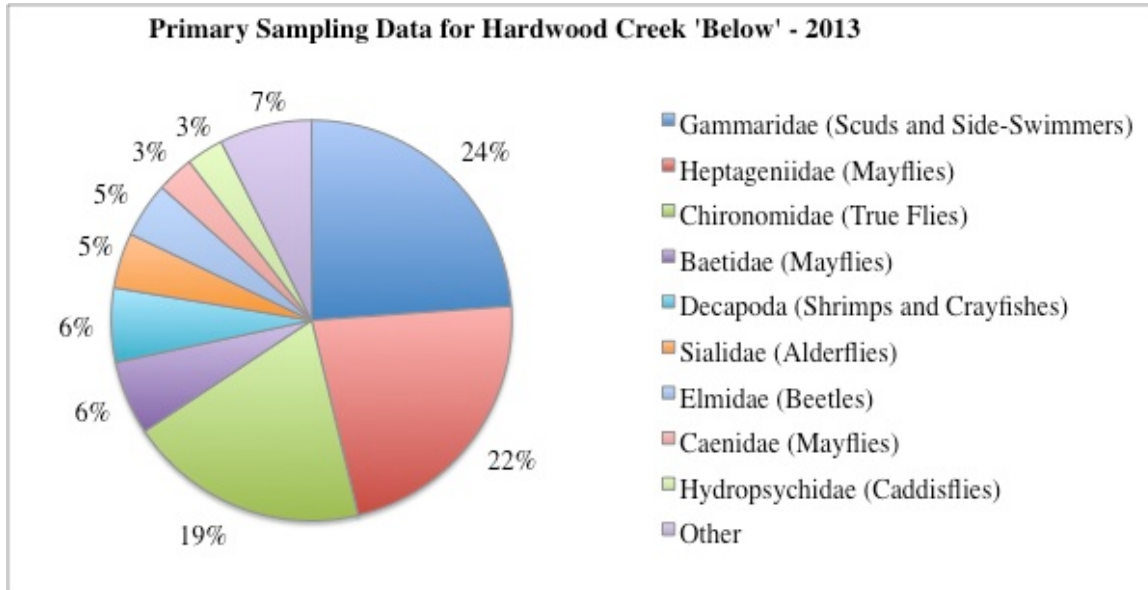
<u>Number of Families</u>: In 2013, 15 families were identified in the sample. This compares to 20 families in 2012 and 11 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 4 EPT families were identified in the sample and made up 34% of the sample.

4.1.5   Hardwood Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index							
Sampling Sites	2007	2008	2009	2010	2011	2012	2013
Hardwood Creek 'Above'	7.2	6.3	6.6	6.0	5.0	5.0	6.2
Hardwood Creek 'Below'	NA	NA	NA	5.1	4.4	4.6	4.9

Hardwood Creek continues to remain stable, perhaps even improving overall, and initial findings indicate that an abundance of habitat and modest organic pollution levels contribute to good overall stream health in this portion of the watershed. Annual variations in local conditions (e.g. water levels, vegetative cover) are affecting the stream health scores.

The Family Biotic Index score of 6.2 at the Hardwood Creek 'Above' site, and the Family Biotic Index score of 4.9 at the Hardwood Creek 'Below' site, indicate an overall stream health score of "Fair".

4.2   Clearwater Creek

4.2.1   Existing Conditions

Clearwater Creek is 8.33 miles long and drains an area of 62 square miles of White Bear Lake, White Bear Township, Hugo, Lino Lakes, and Centerville. Both tributaries join Rice Creek in Anoka County as part of the Chain of Lakes.

Clearwater Creek is listed as impaired for aquatic life, due to fecal coliform, low dissolved oxygen, and negatively impacted aquatic insect communities.

4.2.2   Site Maps

Below is a map of the Clearwater Creek sampling location. The Clearwater Creek site was sampled for the first time in 2007, and sampling was repeated again at the same location in 2008 - 2013. This site also served as our 2013 volunteer field-training site.

The pin on the site map corresponds to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.

2013 Clearwater Creek sampling location.

4.2.3   Sampling Methodology
Team Leader: Gary Averbeck
Team Members: Amy Anderson, Barbara Bor, Jeff Disch, Linda Gruntner, Barb
Hoernemann, Wayne LeBlanc, Tere O'Connell, Dana Raines, Robin Turner.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each
monitoring location. At least 20 dip-net samples (or 'jabs') were taken from across
all major habitat types in the reach. Program staff members performed site visits to
assure monitoring was performed according to MPCA guidelines and protocols.

Lab analysis identified the taxonomic classification of benthic macroinvertebrate
samples from each sampling site. Using taxonomic keys, SHEP volunteers
identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate
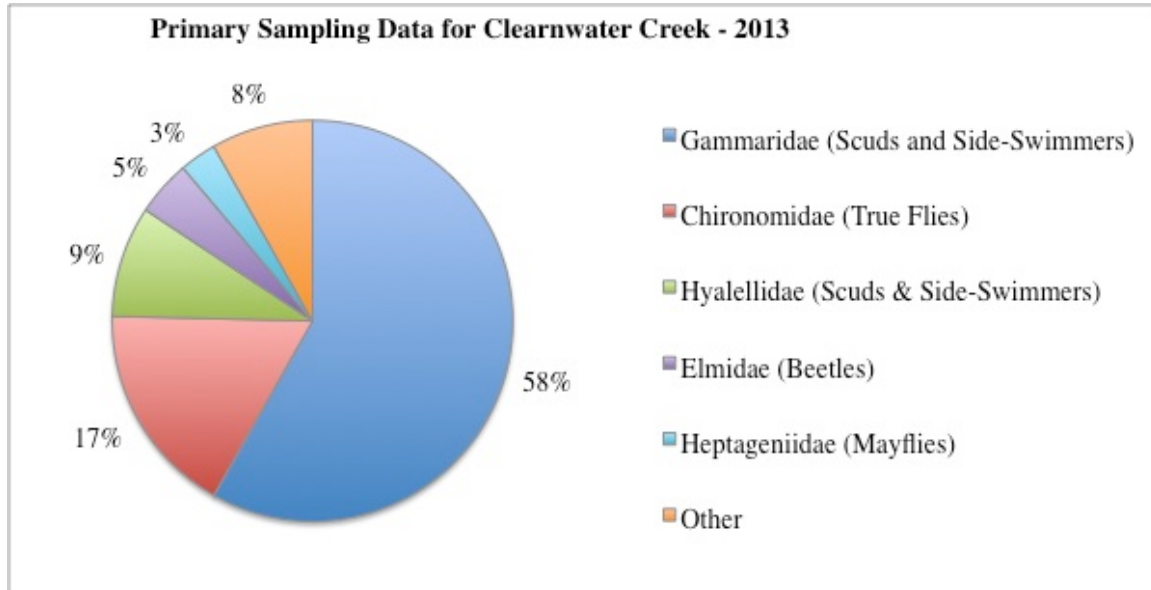organisms. Once identified, samples were sorted, labeled and scored.

4.2.4   Field Sampling Results for Clearwater Creek Site

Historical Field Results for Clearwater Creek Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/8/07	84	**5.9**	4	19	Heptageniidae	19%
9/8/08	100	**5.5**	3	17	Chironomidae	41%
9/12/09	152	**6.3**	5	18	Hydropsychidae	17%
9/11/10	135	**4.5**	2	10	Gammaridae	76%
9/11/11	363	**4.7**	4	19	Gammaridae	43%
10/2/12	146	**4.6**	2	16	Gammaridae	55.5%
8/25/13	134	**4.9**	3	12	Gammaridae	58%
Cross Check Results:						
10/17/07	155	**5.9**	4	20	Hyalellidae	19.4%
9/7/08	109	**6.8**	5	15	Corixidae	22%
9/26/09	113	**4.7**	3	14	Hydropsychidae	43%

Primary Sampling Data for Clearnwater Creek - 2013

Legend:
- Gammaridae (Scuds and Side-Swimmers)
- Chironomidae (True Flies)
- Hyalellidae (Scuds & Side-Swimmers)
- Elmidae (Beetles)
- Heptageniidae (Mayflies)
- Other

Pie chart values: 58%, 17%, 9%, 5%, 3%, 8%

Clearwater Creek Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 4.9 for the Clearwater Creek site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This is consistent with stream health scores from 2011 (4.7) and 2012 (4.6).

Number of individuals: 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. 134 invertebrates were identified in this sample. This is a good-sized sample.

Dominant Family: The dominant family was Gammaridae (scuds). Gammaridae dominated 55.5% of the sample, and has a tolerance value of 4 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are closely related to Hyalellidae (note the pollution tolerance difference). The distinction between the two families is the flagellum found on the antennae of Gammaridae. They are important food sources for fish and invertebrate predators. They can be extremely abundant in water bodies without fish and are important in the breakdown of organic matter (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 12 families were identified in the sample. This compares to 16 families in 2012 and 19 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT

families found around the Twin Cities metro area. In 2013, 3 EPT families were identified in the sample and made up 4.5% of the sample.

4.2.5   Clearwater Creek Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index							
Sampling Sites	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Clearwater Creek	5.9	5.5	6.3	4.5	4.7	4.6	4.9
Cross Check	5.9	6.8	4.7	Na	Na	Na	Na

Overall, Clearwater Creek site results indicate stable stream conditions between 2010 and 2013. Changes in diversity caused the FBI score to increase in 2013, but it remains within the range of a "Good" rating and all other data is quite similar across years. Clearwater Creek continues to post some of the strongest stream health scores in the Rice Creek Watershed.

4.3   Rice Creek Sites

4.3.1 Existing Conditions

The Rice Creek Watershed District and Emmons & Olivier Resources Inc. completed a re-meander and restoration of a significant reach of Rice Creek. 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 already 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. The monitoring sites 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 in 2012 further downstream of the restoration area.

4.3.2 Site Map

Below are maps of the three 2013 Rice Creek sampling locations. The pins correspond to the midpoint of the sampled stream reach. Each stream reach sampled is referred to as the 'sampling site' for the purposes of this report.*2013*

Rice Creek 'Above' and 'Below' Sampling Locations
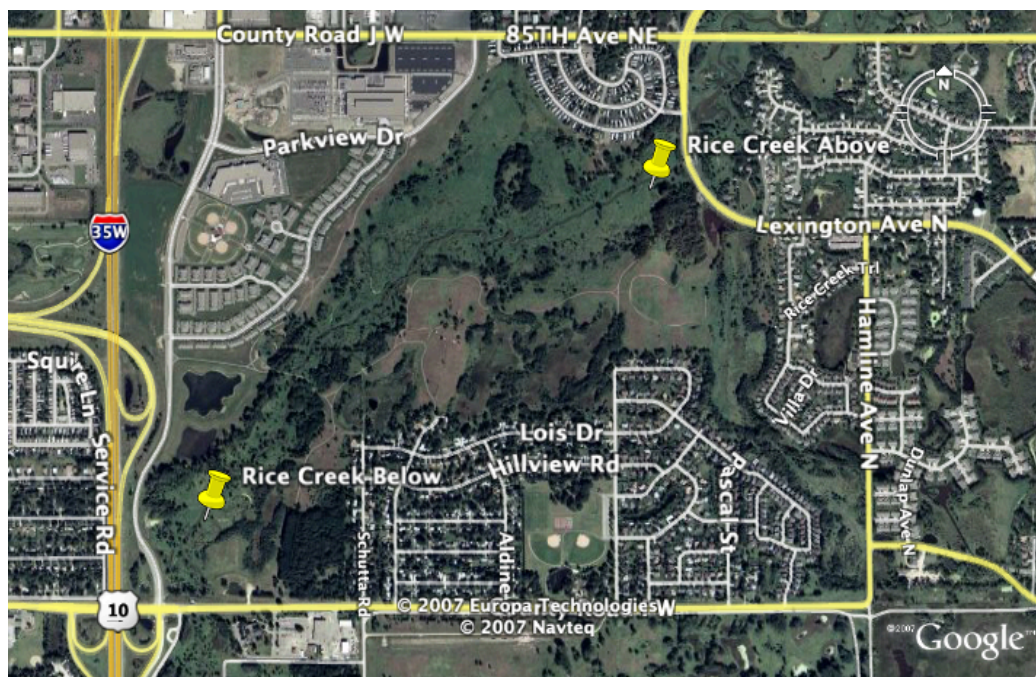
4.3.3   Sampling Methodology

Team Leader: Ralph Butkowski

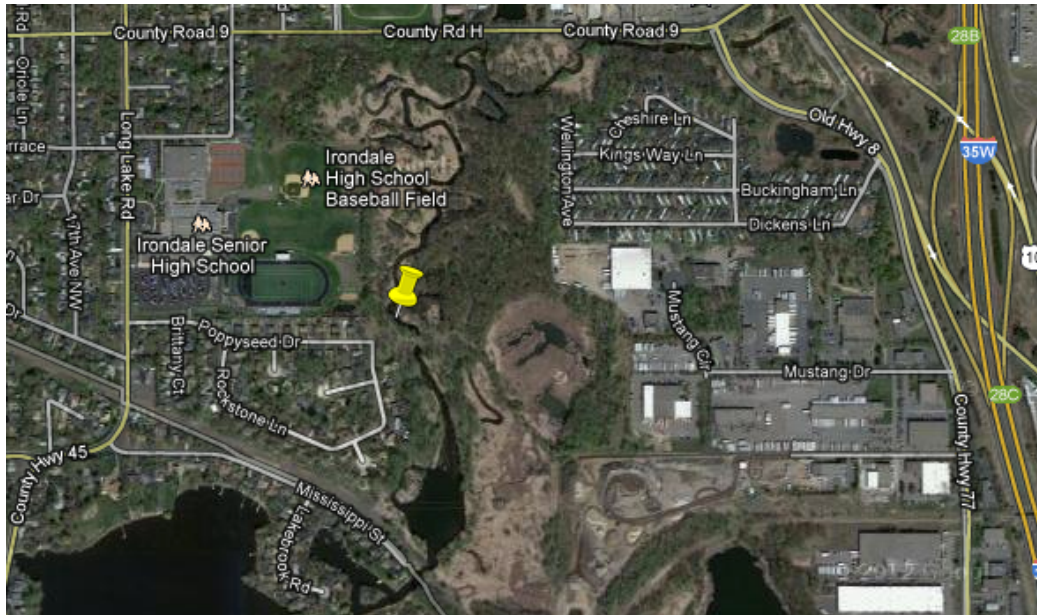Team Members: Bob Bartlett, James Brozowski, Gary Ellis, Julie Glanton, Courtney Jones, Jo Ann Morse, Fuzu Moy, Rod Venterea.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols. Lab analysis identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Once identified, samples were sorted, labeled and scored.

4.3.4a   Field Sampling Results for Rice Creek 'Above' Site

Historical Field Results for Rice Creek 'Above' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/1/06	180	**8.8**	2	11	Coenagrionidae	87%
11/13/07	137	**7.9**	0	5	Coenagrionidae	54.5%
9/6/2008	169	**7.3**	2	14	Hyalellidae	38%
9/5/2009	103	**7.0**	3	11	Chironomidae	51%
9/26/10	227	**7.3**	6	11	Hyalellidae	66%
9/18/11	612	**7.8**	3	15	Hyalellidae	70%
9/22/12	174	**8.3**	4	10	Coengrionidae	52.9%
9/21/13	480	**6.1**	1	13	Chironomidae	81.5%
Cross Check Results:						

| 9/20/09 | 421 | **6.8** | 4 | 14 | Chironomidae | 40% |
| 9/18/10 | 510 | **7.8** | 3 | 11 | Hyalellidae | 75% |

Primary Sampling Data for Rice Creek 'Above' - 2013

- Chironomidae (True Flies)
- Pleidae (True Bugs)
- Gastropoda (Snails & Limpets)
- Hyalellidae (Scuds & Side-Swimmers)
- Other
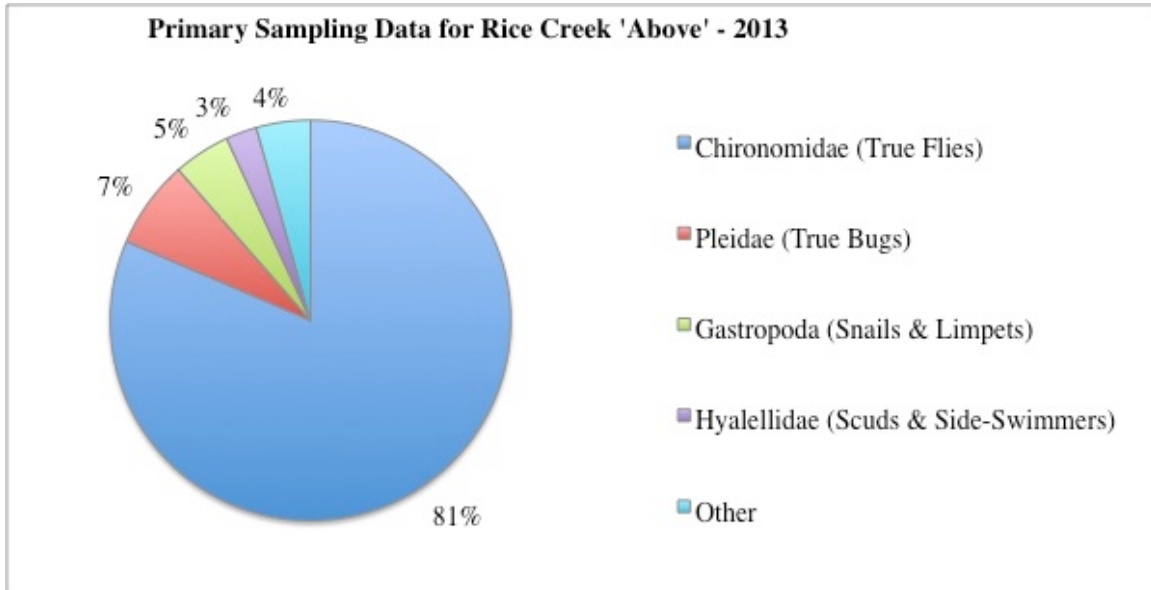
Rice Creek 'Above' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 6.1 for the Rice Creek 'Above' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart and is an improvement over all previous years. Because Chironomidae over-dominated the sample (81.5%), the FBI score naturally averaged closer to the Chironomidae tolverance value of 6. In 2012, Coengrionidae and Hyalellidae quite heavily dominated the sample; they have higher tolerance values that made for a higher FBI score in 2012.

Number of individuals: 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. 480 invertebrates were identified in this sample. This sample size is excellent.

Dominant Family: The dominant family was Chironomidae (midges). Chironomidae dominated 81.5% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr). They are predators and prey on mosquito larva. They use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

Number of Families: In 2013, 13 families were identified in the sample. This compares to 10 families in 2012 and 15 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 1 EPT family was identified in the sample (Leptoceridae) and made up 0.2% of the sample. This compares to 4 EPT families in 2012 and 3 in 2011.

4.3.4b Field Sampling Results for Rice Creek 'Below' Site

Historical Field Results for Rice Creek 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/1/06	117	**8.3**	2	12	Coenagrionidae	65%
11/13/07	137	**6.7**	0	5	Coenagrionidae	54.5%
9/6/08	178	**5.2**	2	7	Corixidae	34%
9/6/09	110	**6.3**	2	8	Simuliidae	65%
9/26/10	680	**7.8**	4	15	Hyalellidae	80%
9/18/11	347	**7.8**	3	15	Hyalellidae	75%
9/22/12	129	**7.4**	0	17	Hyalellidae	39.5%
9/14/13	300	**6.4**	0	16	Chironomidae	72%
Cross Check Results:						
10/1/06	142	**6.1**	4	14	Simuliidae	48%
10/6/07	86	**6.8**	2	14	Chironomidae	62.7%
10/12/08	248	**5.8**	4	13	Chironomidae	29%
9/18/11	1409	**7.4**	3	17	Hyalellidae	58%

Primary Sampling Data for Rice Creek 'Below' - 2013

- Chironomidae (True Flies) — 72%
- Gastropoda (Snails & Limpets) — 8%
- Asellidae (Aquatic Sow Bugs) — 5%
- Pleidae (True Bugs) — 4%
- Oligochaeta (Aquatic Earthworms) — 2%
- Nematoda (Roundworms) — 2%
- Other — 7%
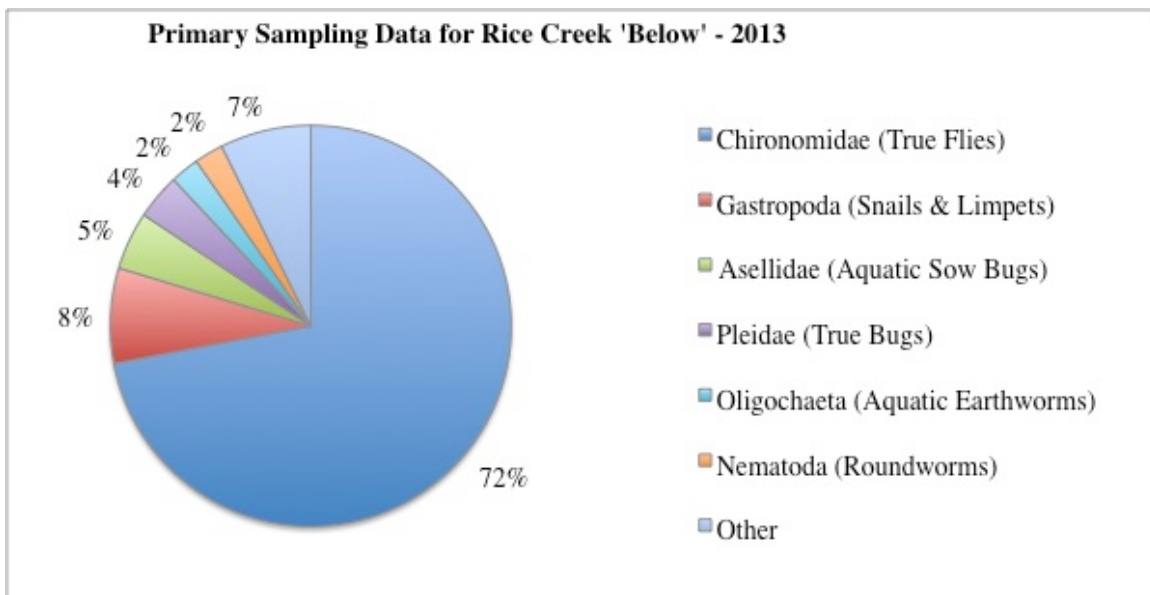
Rice Creek 'Below' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 6.4 for the Rice Creek 'Below' site. This score corresponds to a "Fairly Poor" rating on the Family Biotic Index stream health chart. The FBI score continues to improve from previous years. The diversity of the sample decreased slightly, but the dominating family in 2013 (Chironomidae) has a lower pollution tolerance value than Hyaliellidae, which dominated in past years. This improved the FBI average this year.

Number of individuals: 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. 300 invertebrates were identified in this sample. This sample size is excellent.
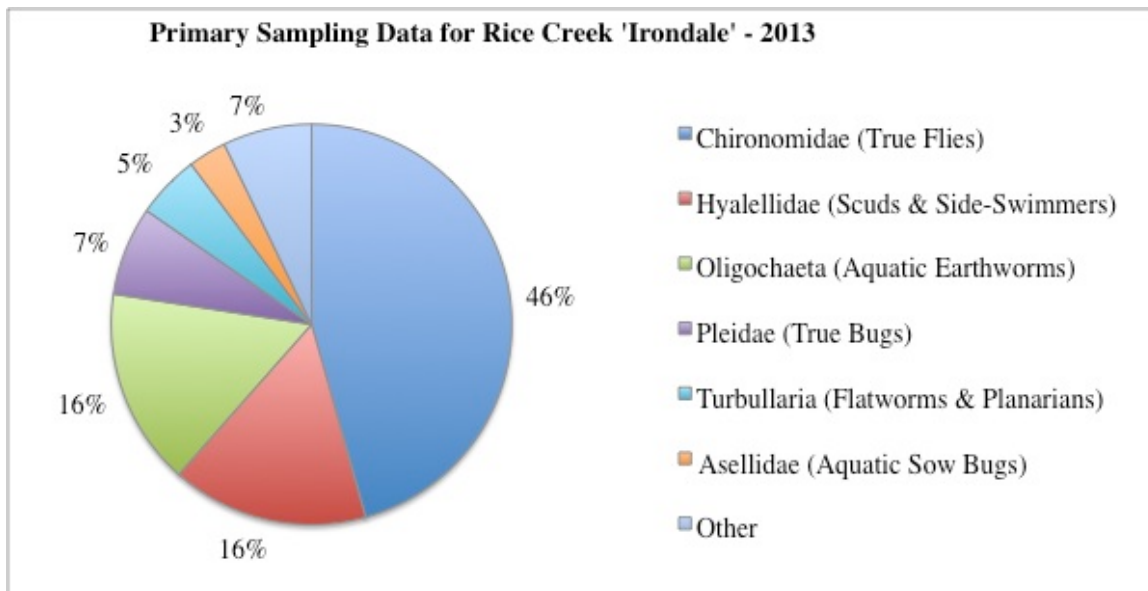
Dominant Family: The dominant family was Chironomidae (midges). Chironomidae dominated 72% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr). They are predators and prey on mosquito larva. They use their tails for breathing. (Aquatic Entomology, McCafferty, W.P).

Number of Families: In 2013, 16 families were identified in the sample. This compares to 17 families in 2012 and 15 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, no EPT families were identified in the sample. This is consistent with 2012.

4.3.4c Field Sampling Results for Rice Creek 'Irondale' Site

Historical Field Results for Rice Creek 'Irondale' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/2/12	165	**6.8**	2	13	Chironomidae	60.6%
9/14/13	195	**6.8**	1	13	Chironomidae	46%

Primary Sampling Data for Rice Creek 'Irondale' - 2013

- Chironomidae (True Flies)
- Hyalellidae (Scuds & Side-Swimmers)
- Oligochaeta (Aquatic Earthworms)
- Pleidae (True Bugs)
- Turbullaria (Flatworms & Planarians)
- Asellidae (Aquatic Sow Bugs)
- Other

Rice Creek 'Irondale' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 6.8 for the Rice Creek 'Irondale' site. This score corresponds to a "Poor" rating on the Family Biotic Index stream health chart. This is consistent with the 6.8 FBI score in 2012; however, 2013 is only the second year data has been collected at this site, and as a result no trend analysis information is available.

Number of individuals: 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. 195 invertebrates were identified in this sample. This sample size is good.

Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 46% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 13 families were identified in the sample. The same number of families was identified in 2012. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 1 EPT family was identified in the sample and made up 1% of the sample.

4.1.5   Rice Creek Overall Data Summary

Stream health scores indicate "Fairly Poor" stream health conditions overall, although FBI scores at these sites have improved since 2012. However, the individual families present in the sample, and their percentage make-up, have varied widely in each year. Further long-term sampling data is required in order to more accurately determine what are normal conditions at these sites, especially 'Irondale'.

| *Interpretation of the Hilsenhoff Biotic Index*								
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Rice Creek 'Above'	8.8	7.9	7.3	7	7.3	7.8	8.3	6.1
Rice Creek 'Below'	8.3	6.7	5.2	6.3	7.8	7.8	7.4	6.4
Rice Creek 'Irondale'	Na	Na	Na	Na	Na	Na	6.8	6.8
Cross Check 'Above'	-	-	-	6.8	7.8	-	Na	Na
Cross Check 'Below'	6.1	6.8	5.8	-	-	7.4	Na	Na

4.4   **Locke Lake Area Sites**

4.4.1 Existing Conditions
Locke Lake is located just upstream of the Rice Creek Watershed's outlet to the
Mississippi River. All outflows from the Rice Creek Watershed pass through
Locke Lake and flows directly into the Mississippi River. Recent activity by the
Rice Creek Watershed District has focused on installing shoreland restoration and
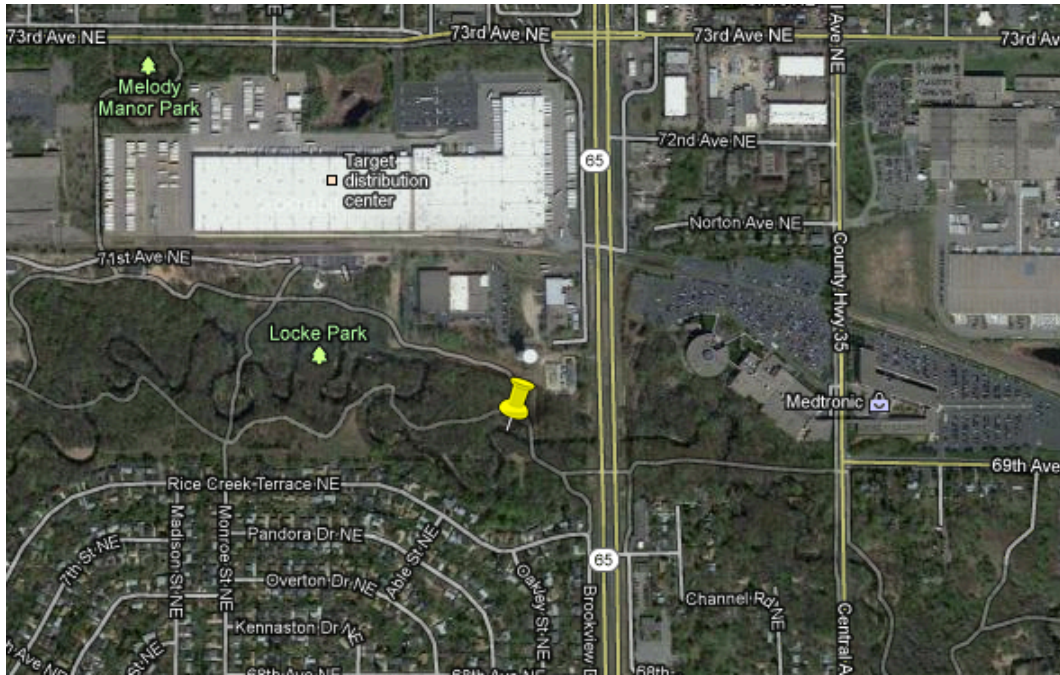shoreland stabilization measures on properties adjacent to Locke Lake.

4.4.2 Site Map
Below are maps of the 2013 Locke Lake sampling locations. The pins correspond
to the midpoint of the sampled stream reach. Each stream reach sampled is referred
to as the 'sampling site' for the purposes of this report.

2013 Locke Lake 'Above' and 'Below' Sampling Locations
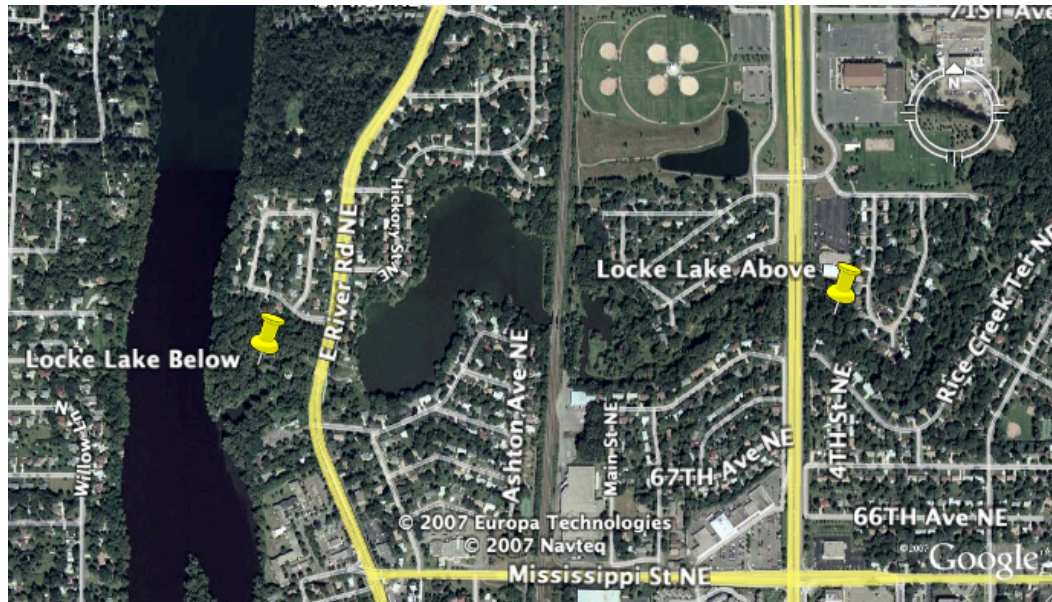
4.4.3   Sampling Methodology

Team Leaders: Katherine & Darrell Majkrzak

Team Members: Trisha Flaherty, Jaime Haueter, Alex Haueter, Cathi Lyman-Onkka, Marilyn Radmer, Juliette Schroeder, Rob Schroeder, Jill Schroeder, John Steinworth, Susan Young.

SHEP volunteers used the MPCA's multi-habitat monitoring protocol at each monitoring location. At least 20 jabs were taken from across all major habitat types in the reach. Habitat types include snags and Program staff members performed site visits to assure monitoring was performed according to MPCA guidelines and protocols.

Lab analysis identified the taxonomic classification of benthic macroinvertebrate samples from each sampling site. Using taxonomic keys, SHEP volunteers identified the Kingdom, Phylum, Class, Order and Family of macroinvertebrate organisms. Once identified, samples were sorted, labeled and scored.

4.4.4a Field Sampling Results for Locke Lake 'Above' Site

Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Historical Field Results for Locke Lake Creek 'Above' Site						
Field Sampling Results:						
9/28/06	95	**5.0**	2	12	Hydropsychidae	58%
9/9/07	103	**5.1**	3	13	Baetidae	26.2%
10/11//08	163	**5.7**	4	14	Chironomidae	30%
9/13/09	115	**6.1**	3	18	Chironomidae	37%
9/12/10	123	**5.9**	4	13	Chironomidae	43%
9/11/11	362	**5.4**	3	12	Simuliidae	62%
9/9/12	314	**5.2**	6	18	Chironomidae	29.3%
9/08/13	107	**4.9**	2	9	Hydropsychidae	42%
Cross Check Results:						
9/20/08	115	**4.9**	4	17	Hydropsychidae	33%
9/19/09	107	**6.7**	4	14	Corixidae	36%

Primary Sampling Data for Locke Lake 'Above' - 2013

- Hydropsychidae (Caddisflies) — 42%
- Nematoda (Roundworms) — 25%
- Chironomidae (True Flies) — 9%
- Elmidae (Beetles) — 8%
- Oligochaeta (Aquatic Earthworms) — 8%
- Other — 8%
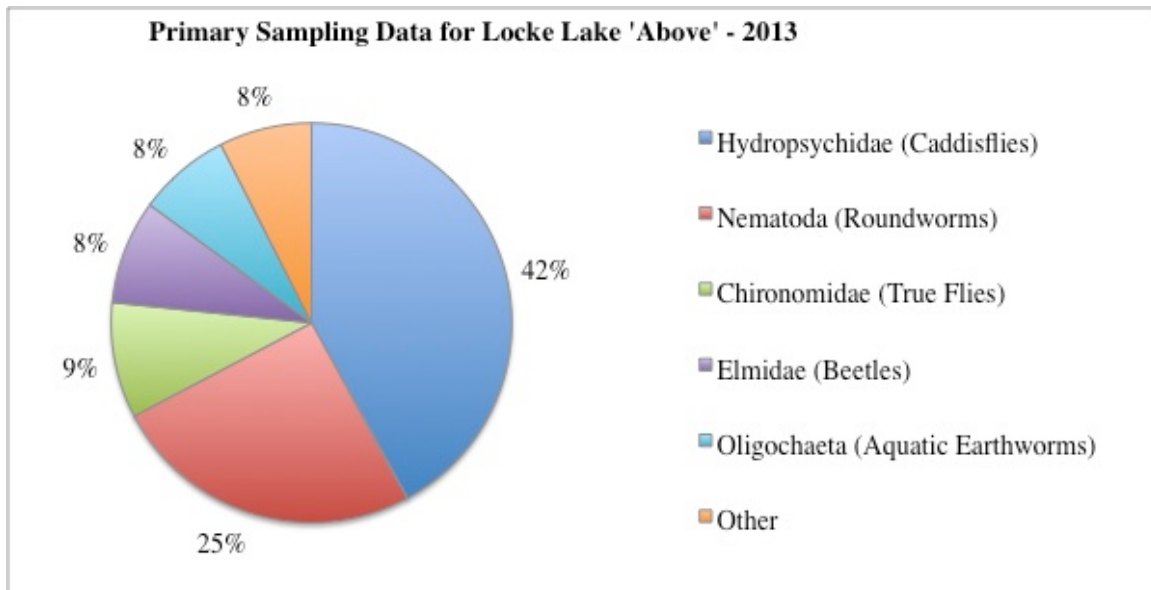
Locke Lake 'Above' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 4.9 for the Locke Lake 'Above' site. This score corresponds to a "Good" rating on the Family Biotic Index stream health chart. This shows continued improvement in stream health scores from 2012 (5.2) and 2011 (5.4); in fact, scores have steadily declined since 2009 (6.1). In 2013, the diversity decreased but the dominating family was Hydropsychidae, which has a lower tolerance value than Chironomidae, the dominating family in 2012. Despite the low total number of families (9) and the lower number of

EPT families in the sample (2), more families with lower tolerance to pollution were present in the sample.

Number of individuals: 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. 107 invertebrates were identified in this sample. This sample size is adequate.
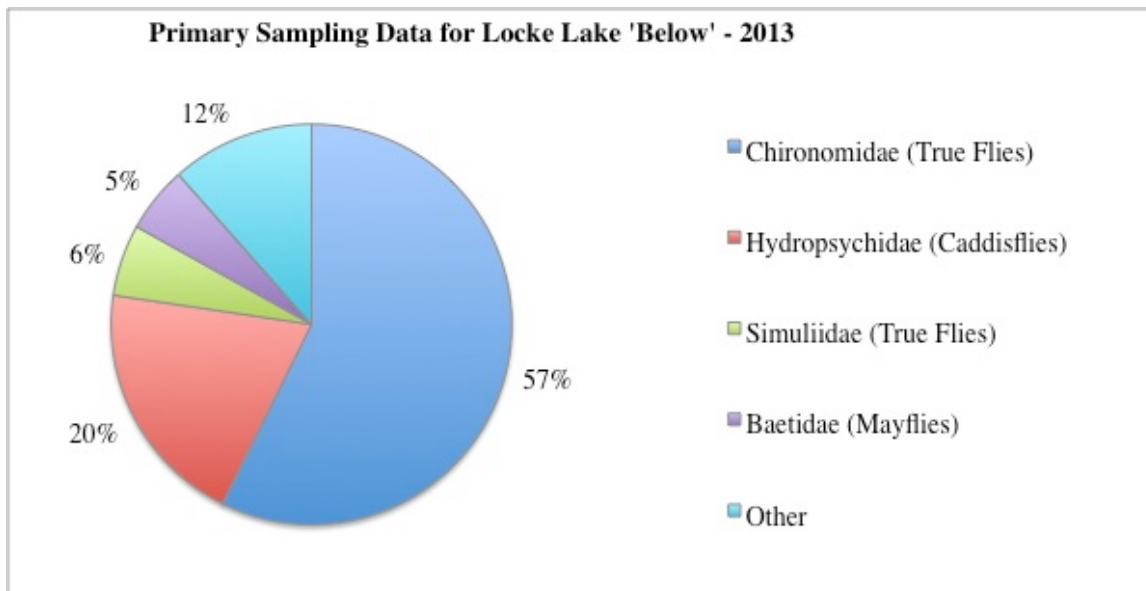
Dominant Family: The dominant family was Hydropsychidae. Hydropsychidae (Common net-spinner caddisfly) has a tolerance value of 4 (moderate) and dominated 42% of the sample. Hydropsychidaes are collectors/filterers. They are restricted to flowing waters, and are most commonly collected from areas with cobble or bedrock substrate where solid structures are available on which to attach their nets. They glean material that is collected in their nets. In some situations, such as below pond outflows and downstream of sewage treatment plants, they can reach large densities (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 9 families were identified in the sample. This compares to 18 families in 2012 and 12 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 2 EPT families were identified and made up 44% of the sample.

4.4.4b Field Sampling Results for Locke Lake 'Below' Site

Historical Field Results for Locke Lake 'Below' Site						
Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Field Sampling Results:						
9/28/06	111	**5.3**	3	8	Chironomidae	43%
9/16/07	257	**5.7**	2	9	Chironomidae	36.6%
10/11/08	315	**5.1**	5	13	Hydropsychidae	41%
9/13/09	498	**5.0**	2	12	Hydropsychidae	48%
9/12/10	197	**5.0**	5	11	Chironomidae	42%
9/11/11	2536	**5.7**	3	13	Simuliidae	80%
9/9/12	629	**5.6**	3	15	Chironomidae	61.4%
9/8/13	225	**5.6**	2	14	Chironomidae	57%
Cross Check Results:						
10/8/06	137	**4.3**	3	10	Hydropsychidae	85%
9/22/07	87	**5.4**	2	9	Gammaridae	23%
10/2/10	100	**5.6**	3	12	Simuliidae	33%
9/3/11	205	**5.1**	4	12	Chironomidae	35%

Primary Sampling Data for Locke Lake 'Below' - 2013

Legend:
- Chironomidae (True Flies)
- Hydropsychidae (Caddisflies)
- Simuliidae (True Flies)
- Baetidae (Mayflies)
- Other

Pie chart values: 57%, 20%, 6%, 5%, 12%

2013 Locke Lake 'Below' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 5.6 for the Locke Lake 'Below' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. This compares to stream health scores from 2012 (5.6) and 2011 (5.7). This stream is remaining stable.

Number of individuals: 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. 225 invertebrates were identified in this sample. This sample size is good.
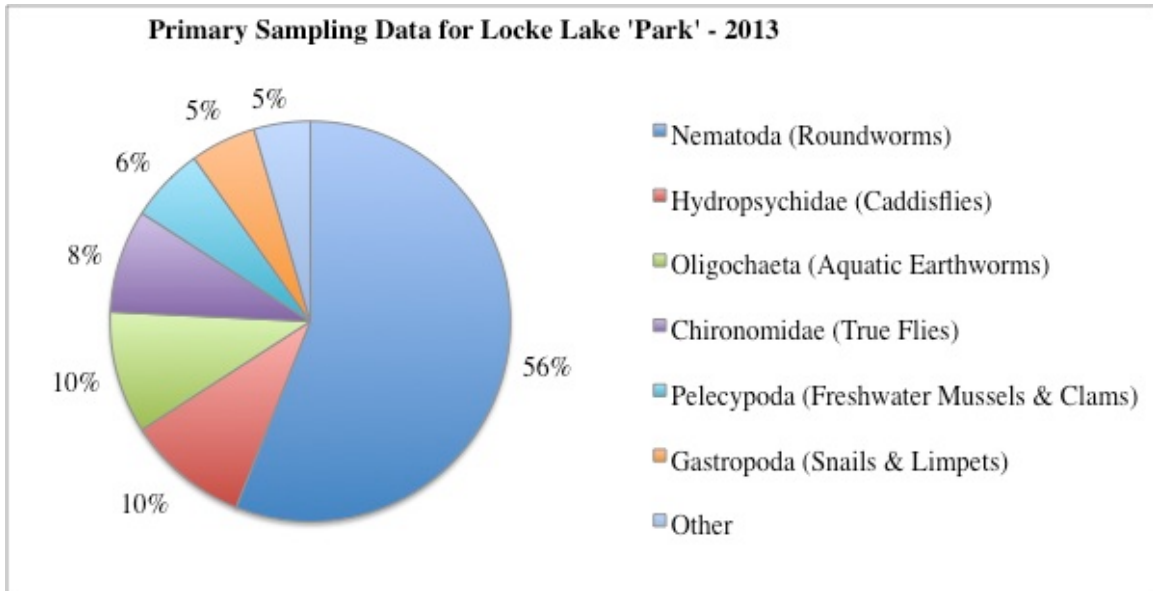
Dominant Family: The dominant family was Chironomidae. Chironomidae dominated 57% of the sample, and has a tolerance value of 6 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are a very abundant and diverse group of aquatic insects, and it is common for them to dominate samples (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 14 families were identified in the sample. This compares to 15 families in 2012 and 13 families in 2011. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 2 EPT families were identified and made up 25% of the sample.

4.4.4c   Field Sampling Results for Locke Lake 'Park' Site

Date	# Identified	Family Biotic Index	EPT	# of Families	Dominant Family	Dominant Family % Overall
Historical Field Results for Locke Lake 'Park' Site						
Field Sampling Results:						
9/9/12	463	**4.7**	3	14	Chironomidae	31.7%
9/8/13	132	**5.5**	1	11	Nematoda	56%

Primary Sampling Data for Locke Lake 'Park' - 2013

- Nematoda (Roundworms) — 56%
- Hydropsychidae (Caddisflies) — 10%
- Oligochaeta (Aquatic Earthworms) — 10%
- Chironomidae (True Flies) — 8%
- Pelecypoda (Freshwater Mussels & Clams) — 6%
- Gastropoda (Snails & Limpets) — 5%
- Other — 5%

2013 Locke Lake 'Park' Data Summary

Family Biotic Index (FBI): Our 2013 SHEP field sampling results produced a score of 5.5 for the Rice Creek 'Park' site. This score corresponds to a "Fair" rating on the Family Biotic Index stream health chart. This compares to a stream health score of 4.7 ("Good") in 2012, the first year this site was sampled. In 2013, the sample was smaller and less diverse, and contained more families with higher tolerance values; this caused the FBI score to be higher (poorer).

Number of individuals: 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. 132 invertebrates were identified in this sample. This sample size is adequate.

Dominant Family: The dominant family in 2013 was Nematoda, which dominated 56% of the sample. Nematoda (roundworms) has a tolerance value of 5 on a scale of 0-10 (the lower the tolerance value, the lower their tolerance to pollution). They are parasites and are found in and on the substrate in most aquatic habitats. Nematoda are very common, but rarely collected because they are so small (Guide to Aquatic Invertebrates of the Upper Midwest, R.W. Bouchard, Jr).

Number of Families: In 2013, 11 families were identified in the sample. This compares with 14 families identified in 2012. In general, a more diverse sample suggests a healthier stream environment.

EPT: Ephemeroptera-Plecoptera-Tricoptera (Mayfly-Stonefly-Caddisfly) are three Orders of invertebrates with low tolerance to pollution. The more of these families in a sample, the better. In healthy streams, more than 10-12 EPT families is considered good; in an urban area like the Rice Creek Watershed, 3-5 EPT families is considered good. Baetidae (mayfly), Caenidae (mayfly), and Hydropsychidae (caddisfly) are the most common EPT families found around the Twin Cities metro area. In 2013, 1 EPT family was identified and made up 10% of the sample.

This site was first sampled in 2012. The 2012 and 2013 samples showed quite different composition. Among other differences, the 2013 sample was smaller and contained fewer EPT families and more families with higher tolerance values. More years of sampling are needed to determine a health trend.

4.1.5   Locke Lake Area Overall Data Summary

Interpretation of the Hilsenhoff Biotic Index								
Sampling Sites	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Locke Lake 'Above'	5	5.1	5.7	6.1	5.9	5.4	5.2	4.9
Locke Lake 'Below'	5.3	5.7	5.1	5	5	5.7	5.6	5.6
Locke Lake 'Park'	Na	Na	Na	Na	Na	Na	4.7	6.4
Cross Check 'Above'	-	-	4.9	6.7	-	-	Na	Na
Cross Check 'Below'	4.3	5.4	-	-	5.6	5.1	Na	Na

The Locke Lake sites continue to post some of the most consistently stable and encouraging stream health scores in the Rice Creek Watershed.

The Locke Lake 'Park' site, which was a new monitoring location in 2012, showed a stream health score of 6.4, indicating a stream health designation of "Fairly poor". This is a decline in stream health score from the 2012 FBI score of 4.7 ("Good").

However, the 2013 Family Biotic Index score of 4.9 at the Lock Lake 'Above' site, 5.6 at the Locke Lake 'Below' site and 6.4 at the Locke Lake 'Park' site indicates an overall average stream health score of "Fair". This is a reasonably strong stream health score.

Further long-term sampling data is required in order to more accurately gauge the overall rate of stream health change at these sites.

APPENDIX A: 2014 Rice Creek Watershed District
Stream Health Evaluation Program (SHEP) Sampling Sites