Technical Memorandum

3159 Voyager Drive ● Green Bay, WI 54311 ● 920.205.4519

Via Email: glea.office1@gmail.com, admin@gleawi.org pkenny@vi.fontana.wi.gov, rumans@vi.williamsbay.wi.gov, mfesenmaier@cityoflakegeneva.gov

To: Geneva Lake Environmental Agency
Aimee Townsend, Patrick Kenny, Rob Umans, and Mary Jo Fesenmaier

From: Korin Doering, Project Manager

Date: February 14, 2025

Re: Geneva Lake Macroinvertebrate Survey Report
Geneva Lake Macroinvertebrate Survey
Geneva Lake, Wisconsin

Project No.: 2405325

1. Overview

To help inform a study of wake enhancement impacts, the Geneva Lake Environmental Agency (GLEA) requested a macroinvertebrate survey be conducted in 2024 using a standard Wisconsin Department of Natural Resources (WDNR) methodology adapted for Geneva Lake. This is intended to complement Aquatic Plant- Lake Wide and Sub Point Intercept Surveys being conducted by Wisconsin Lake and Pond during the same field season.

The need to assess the lake was identified by GLEA after a Nearshore Fisheries Survey, completed in 2023, highlighted disruptions to nearshore fish spawning habitats due to increased wake activity and pier density. Geneva Lake also has starry stonewort which was initially verified in 2018. Despite existing challenges like zebra mussels and starry stonewort, recent surveys reveal a diverse aquatic ecosystem, emphasizing the need for conservation.

GEI was retained by GLEA to conduct the 2024 macroinvertebrate study. GEI's expertise in freshwater ecology, aquatic macrophyte surveys, invasive species management, and citizen science initiatives uniquely positions the team to handle the complexities of Geneva Lake's littoral zone. The macroinvertebrate study consisted of two components: public education and outreach and macroinvertebrate sampling and analysis. The educational and outreach component focused on engaging students and GLEA volunteers in the macroinvertebrate sample collecting and sorting process. The survey participants are further described in Section 2. The sample analysis component was conducted at a GEI environmental lab for species level identification. The use of the laboratory provided efficient and high-quality data processing for the macroinvertebrate survey results.

Results from this survey will be used by GLEA, in combination with data from surveys completed by other firms, to assess the impact of wake enhancement on Geneva Lake's littoral zone. This is crucial to the ongoing update of the lake's management plan. Data collected from previous surveys are

summarized in Section 1.1 below. Results and future management recommendations are discussed in Section 5 and Section 6.

2. Previous Studies

Geneva Lake is a 5,262-acre lake located in south-central Walworth County. It has a maximum depth of 42 meters and a mean depth of 18.3 meters. Approximately 11% of the lake is less than 3 meters deep. Geneva Lake's littoral zone generally runs between eight and nine meters. The 25-year mean July Secchi disk reading for Geneva Lake is 5.1 meters.

Benthic macroinvertebrate studies have been conducted throughout Geneva Lake historically. The most recent benthic macroinvertebrate study was conducted within the littoral zone of Geneva Lake in 2016 (Taplin, 2016). Two rounds of surveys were completed (July and August 2016). Benthic macroinvertebrate samples were collected at seven sampling locations. Each sample consisted of three grabs obtained by an Ekman dredge. Samples were preserved and transported to the University of Wisconsin – Superior taxonomy lab. Organisms were identified to the family level (when feasible) and volumetric abundance of samples was used to calculate macroinvertebrate densities. The results indicated that a total of 25 taxa of benthic macroinvertebrates were identified. This included 23 benthic macroinvertebrate taxa were identified to the family level, and an additional 2 macroinvertebrates taxa were identified to the class level. These results were compared to previous studies conducted in 2004, 2008, and 2012 to evaluate changes in benthic macroinvertebrate taxa and densities over time. In general, 2016 results indicated an increase in the density and presence of multiple macroinvertebrate families (Taplin, 2016). However, prior to 2016, a hand lens was used to identify samples, whereas a dissecting microscope was utilized in 2016. This change in sampling identification methodology likely attributed to the increase in taxa.

Additionally, zebra mussel populations were surveyed in 2016 (Taplin, 2016). Three artificial substrates (squares of stacked plexiglass) were deployed to document zebra mussel attachment and densities. The three substrates were deployed from June to October. The substrates were checked, cleaned, and redeployed once in July and once in August. During each substrate check, the number of zebra mussels were counted, and densities were calculated. Results indicated that, in additional to identifiable organisms, thousands of veligers were attached to the substrates that were too small to positively identify as zebra mussel. Therefore, the actual density of zebra mussels on the substrates were likely higher than could be determined. These results were compared to a previous study conducted in 2009. However, substrate checks and counts were conducted later in the summer during the 2009 survey, and issues with veliger abundance and identification were not experienced.

In August 2018, the aquatic invasive, starry stonewort was discovered in a lagoon attached to Geneva Lake. An aquatic plant point-intersect (PI) survey conducted in selected areas near the launch sites on Geneva Lake in October of 2018 found no starry stonewort in any areas other than the lagoon. Aquatic plant sub-PI surveys were completed in 2020, 2021, 2022, and 2023 to monitor starry stonewort and eradication efforts. The 2023 results indicate that starry stonewort was observed within the Tinke Lagoon and Trinke Lagoon Bay (SEWRPC, 2023).

In June 2023, a comprehensive Nearshore Fisheries Survey of Geneva Lake was conducted (Marshall, 2023). This marks the fourth iteration of the survey, with previous assessments conducted in 1978, 2004,

and 2018. A total of 18 sites were surveyed to gain insights into the nearshore fish population conducted. The findings revealed the presence of various species, including gar, darter species, bass, panfish (bluegill, sunfish, perch, rock bass), bullheads, and killifish, a total of 20 different species, surpassing the counts from the 2018 and 2004 surveys but falling short of the 1978 survey conducted (Marshall, 2023). Fewer fish were observed in areas with wave-impacted shorelines and dense growth of filamentous algae. The nearshore fish survey provides evidence of severe disruptions to the spawning habitats of nearshore fish species due to increased wake activity and pier density on the lake. These findings raise concerns that these impacts could have far-reaching consequences, affecting the entire health of the littoral zone.

3. Participants

The GLEA invited local science teachers, students, and GLEA volunteers to participate in the 2024 macroinvertebrate survey. Prior to taking part in macroinvertebrate survey activities, all students turned in signed liability waivers to their associated school groups. An Aquatic Zoologist from the Wisconsin Department of Natural Resources (WDNR) was present to assist with volunteer training and education prior to initiating the surveys. Students and volunteers participated in helping GEI staff collect and sort samples. Samples were sent for analysis at the GEI environmental laboratory. GEI staff also provided students with additional grab samples to practice sorting and identifying macroinvertebrates. This effort allowed students to gain practical, hands-on learning experience that may help develop a sense of environmental stewardship and connection to their lake.

A special thank you is extended to the following students, teachers, GLEA volunteers, GEI staff, and WDNR staff who participated in the 2024 macroinvertebrate surveys. This was a productive and valuable experience made possible through the collaboration amongst multiple school groups, environmental organizations, and a government agency.

- Badger High School Participants:
  - Moira Gerard
  - Johanna Hefner
  - Kason Klabunde
  - Hollie White
  - Emelyn Basurto
  - Daniela Sandoval
  - Ada Benavidez Rivera
  - Teacher: Candice Franks
- Fontana Ecology Club Participants:
  - Avery Bullard
  - Leonard Thourot
  - Samuel Cubert

- Harrison Latek
- Millie Ferretti
- Olive Miller
- Kinley Robbins
- Jaxn Booth
- Mallory Booth
- Kristin Rabe

- GLEA Participants:
  - Executive Director: Jake Schmidt
  - Moira Gerard
  - Henry Huss
- GEI Staff:
  - Project Manager: Korin Doering
  - Invertebrate Lab Manager: Michelle Chadwick
  - Jennifer Lynch
- WDNR Staff:
  - Aquatic Zoologist: Jesse Weinzinger

4. Methods

Public engagement and macroinvertebrate surveys were conducted on October 1, 2024, at pre-determined survey locations throughout Geneva Lake. Methods for conducting the macroinvertebrate study were adapted from WDNR methodology (WDNR, 2017). Survey locations, field methods, aquatic invasive species prevention, and laboratory analysis methods are described below.

4.1. Sample Locations

Benthic macroinvertebrates samples were collected at five sampling locations within the littoral zone of Geneva Lake (Table 1). These sites, selected by GLEA, are associated with five of the locations surveyed during the 2023 comprehensive Nearshore Fisheries Survey of Geneva Lake (Table 1). The locations of each survey area are displayed on the Survey Location Map included as Appendix A.

Table 1. Macroinvertebrate Survey Sample Locations.

2024 Macroinvertebrate Survey Site ID	Approximate GPS Coordinates	Associated 2023 Nearshore Fisheries Survey Site ID
GL-01	42.5667, -88.5546	10a
GL-02	42.5782, -88.5375	13
GL-03	42.5741, -88.4683	15
GL-04	42.5628, - 88.4735	05
GL-05	42.5604, -88.4672	03

4.2. Equipment

Equipment utilized during the macroinvertebrate sample collection process included the following:

- D-frame kick nets
- Handheld GPS unit
- Printed Macroinvertebrate Field Data Report forms
- Wide mouth sample jars (8 total)
- Labels on waterproof paper
- Ethanol (95%)
- White sorting basins and ice cube trays
- Magnifying glass and tweezers
- Cooler
- AIS decontamination kit (bleach, vinegar, hand sprayer with water, scrub brush, bucket)
- Life jackets and waders
- Pontoon boat (2)
- Duct tape
- Laboratory chain of custody form

4.3. Field Methods

On October 1, 2024, the survey group (students, teachers, GLEA volunteers, WDNR staff, and GEI staff) met at the Riviera in Downtown Lake Geneva. The group met at approximately 8:30 am and started field surveys at approximately 9:00 am.

Macroinvertebrate survey utilized methods adapted from the WDNR *Guidelines for the Standard Collection of Macroinvertebrates Samples from Wadeable Streams – Version 2.0* (WDNR, 2017). This methodology is the best available guidance from the WDNR and was adapted to the near-shore lake area for this project per the request of GLEA. Methods followed WDNR field data sheets, weather conditions, sample site information, and macroinvertebrate species identification.

The WDNR Macroinvertebrate Field Data Report (3200-081) was adapted for this project and selected portions were completed at each survey location. A blank Macroinvertebrate Field Data Report is included as Appendix B. Data collected on the data report form included waterbody name, waterbody ID code, sample ID, date, GPS coordinates, county, collector name, sampling device, habitat sampled, total sampling time, area sampled, number of samples in composite, reason for sampling, transparency, water color, average water depth, composition of substrate sampled, and additional site notes. Scanned copies of completed Macroinvertebrate Field Data Reports are included as Appendix C.

At each survey area, sample collection and processing methods included:

1. Navigate to the survey area on GLEA pontoon
2. Brief observation of the survey area to look for variations in vegetation, coarse habitat, etc.
3. Identify different habitats at each location to create composite samples to send to the lab. Different habitat types may include:
    a. Vegetation
    b. Soft sediment
    c. Around woody structures and rocks
    d. Sandy areas

1. Approach the selected sample locations carefully to prevent disturbing the sediment at the site.
2. Sample the targeted location with D-frame kick nets (500- or 600-micron mesh) using standard kick net methodology
    a. Note the survey start time
    b. Hold the net frame firmly against the substrate
    c. Disturb the substrate on the upstream side so that when you disturb the sediment, the sediment will flow into the kick net
    d. Dig deeply into the substrate with a heel or toe to dislodge macroinvertebrates from the streambed
    e. Avoid kicking coarse debris into the kick net such as rocks or wood
    f. Make sure the silt plume flows into the net
    g. Collect substrate debris for about 1 minute per net
    h. Note the end time
    i. Note approximate size of the total area sampled
3. Take photographs of notable findings and/ or field work being conducted
4. After the samples are collected, rinse fine sediment from the net by forcefully swinging each net through the water a few times, being careful to not dislodge macroinvertebrates from the net
    a. Removing find sediment makes laboratory analysis of the sample easier and helps with preservation
    b. Discard large sticks, rocks, and leaves
5. Transfer the debris and macroinvertebrates from each net into a wide-mouth jar to create a composite sample
    a. Inspect the nets and transfer any clinging macroinvertebrates into the jar
    b. The sample debris should occupy less than ½ the sample jar's volume
    c. A second jar may be used if necessary
6. Preserve the sample(s) with the denatured alcohol (ethanol [95%])

7. Properly label the jar(s)
8. Seal the jar(s) with duct tape
9. Fill out the WDNR Macroinvertebrate Field Data Report forms

It should be noted that methodology was adapted in the field, and varied slightly across survey locations, upon request of the GLEA Executive Director. The sampling effort at the first survey location (GL-01) consisted of utilizing 20 kick nets for approximately 1 minute each (20 minutes total). The sampling effort at the remaining sampling locations consisted of utilizing 8 kick nets used simultaneously for approximately 1 minute each (8 minutes total). The volume of collected samples varied by location depending on the substrate resulting in sampling locations GL-01, GL-02, and GL-04 having two sample bottles each and sampling locations GL-03 and GL-05 having one sample bottle each.

Following completion of field surveys, data from the WDNR Macroinvertebrate Field Data Report forms were transcribed into an excel spreadsheet for comparison. General survey location information, sampling collection efforts, and environmental conditions described in Table 2. Substrate information for each survey location is included as Table 3. Photographs taken during the surveys are included as Appendix D.

4.4. Aquatic Invasive Species Prevention

Due to the presence of aquatic invasive species (AIS), Starry stonewort and zebra mussels, within Geneva Lake, survey efforts took necessary precautions to prevent the spread of these species within the lake and to other waterbodies. Caution was utilized when conducting survey work in areas of known high-density patches of starry stonewort, which included survey location GL-04 and GL-05. This was completed to help minimize the spread of AIS to other parts of Geneva Lake.

To prevent the spread of AIS, GEI staff completed the following:

- Sample survey locations GL-04 and GL-05 last to avoid spreading AIS between survey locations.
- Inspect and clean all watercraft and equipment, according to WDNR guidance, before leaving the lake each day to prevent the spread of AIS.

4.5. Laboratory Analysis Methods

Following sample collection and preservation, sample bottles were packed and shipped to the GEI Ecological Laboratory for species level identification. Laboratory and shipping information is included below.

Shipping Information:

- Containers: Provided by the lab in advance of field surveys
- Preservative: De-natured alcohol (ethanol 95%)
- Packaging:
    - Duct tape the lids of the containers to create a good seal to prevent leaking during shipment
    - Samples did not need to be shipped on ice (once preserved, samples do not need to be kept cold)

- Shipping Address: 4601 DTC Boulevard, Suite 325, Denver, CO 80237

A laboratory report was completed and included analysis results and a quality assurance/ quality control (QA/QC) summary (Appendix E). The lab also provided a summary data tables for each survey location which included a list of taxa, macroinvertebrates counts, and metrics on density/abundance, number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), also known as EPT taxa, and mayfly abundance. For each survey location, the Shannon diversity index was calculated, which is a measure of species diversity that considers species richness (the number of species in a given sample) and the proportional abundance of those species. These data tables are included as Appendix F.

5. Results

A total of five survey locations were sampled on October 1, 2024. GEI staff, WDNR staff, students, teachers, and GLEA volunteers took part in the sample collection process. Photographs taken during the surveys are included as Appendix D. General survey location information, sampling collection efforts, and environmental conditions described in Table 2. The sampling device, reason to sample, habitat surveyed, water color, and transparency were consistent across survey locations. Water depths were similar across most survey locations, with survey location GL-01 being significantly shallower than the remainder of survey locations (Table 2). The time and number of nets per survey effort was also consistent across most survey locations, aside from survey location GL-01. The approximate area sampled varied significantly across survey locations, with survey locations GL-02 and GL-04 being much smaller areas than the remainder of survey locations (Table 2).

Substrate information observed at each survey location is included in Table 3. In general, most survey locations (GL-01, GL-03, GL-04, and GL-05) had substrate that was largely comprised of gravel and sand; however, survey location GL-02 was comprised of sand and silt/ muck (Table 3). Survey location GL-04 had a slightly higher percentage of aquatic macrophytes (aquatic plants) growing within the survey area compared to the remainder of survey locations (Table 3). Survey location GL-01 was the only location to have canopy cover within the survey area (Table 3).

GEI staff packaged and sent the macroinvertebrate sample to the GEI Environmental Laboratory for species level identification and density calculations. The laboratory report memo is included as Appendix E. Summary data tables of all taxa identified, macroinvertebrates counts, and diversity/ abundance metrics for each survey location are included as Appendix F. Results indicate that survey location GL-04 (898) and survey location GL-05 (601) had the highest total numbers of macroinvertebrates in the samples (Table 4). Survey location GL-01 (40) and survey location GL-04 (34) had the highest total numbers of taxa in the samples (Table 4). Based on having one of the highest total number of macroinvertebrates and taxa in the sample, survey location GL-04 had the highest Shannon diversity index of 3.90 (Table 4).

Aquatic invasive species findings included quagga mussel (*Dreissena bugensis*) and zebra mussel (*Dreissena polymorpha*) which were found at all sites. Rusty crayfish (*Faxionus rusticus*) were also present at all sites, excluding GL-02. These three invasive species had been previously confirmed in Geneva Lake.

Table 2. Survey Location Summary

Site	Sampling Device	Habitat Sampled	Sampling Time per effort (minutes)	Number of nets per effort	Reason to sample	Water color	Transparency (cm)
GL-01	Kick net	Littoral zone	1	20	Baseline	Clear	> 120
GL-02	Kick net	Littoral zone	1	8	Baseline	Clear	> 120
GL-03	Kick net	Littoral zone	1	8	Baseline	Clear	> 120
GL-04	Kick net	Littoral zone	1	8	Baseline	Clear	> 120
GL-05	Kick net	Littoral zone	1	8	Baseline	Clear	> 120

Site	Avg. Site Depth (ft)	Approx. Area Sampled (ft^2)	Dimensions (ft)
GL-01	0.9	4,500	150 x 30
GL-02	2.0	1,800	200 x 30
GL-03	2.0	6,000	200 x 30
GL-04	2.3	1,500	50 x 30
GL-05	2.5	7,500	100 x 75

Table 3. Substrate Composition Summary

Site	Rubble	Gravel	Sand	Silt/muck	Aquatic macrophytes	Canopy cover
GL-01	5%	40%	55%	0%	0%	30%
GL-02	0%	0%	50%	40%	10%	0%
GL-03	20%	30%	40%	0%	10%	0%
GL-04	0%	70%	10%	0%	20%	0%
GL-05	0%	80%	10%	0%	10%	0%

Table 4. Macroinvertebrate and Taxa Results Summary

Survey Location	Total Number of Macroinvertebrates in Sample	Total Number of Taxa in Sample	Shannon Diversity Index
GL-01	408	40	3.47
GL-02	202	25	3.22
GL-03	445	24	2.95
GL-04	898	34	3.90
GL-05	601	26	3.32

6. Discussion & Management Recommendations

Wake boats are motorized vessels designed to generate substantial wakes for activities such as wake surfing. These boats emerged in the 1980s, gained popularity during the 1990s, and continue to experience increased usage today. When operated under the proper conditions, wake boats can be a fun recreational activity with minimal ecological impact. However, many Wisconsin lakes are too small or too shallow to appropriately accommodate this type of power boat activity. In larger, deeper lakes, wake boats should only use enhanced wake features at appropriate depths and distances from the shoreline and structures.

Enhanced wakes, with much greater energy than typical power boat wakes, can contribute to shoreline erosion, sediment resuspension, and habitat degradation. A wake boat engine's powerful thrust is

directed toward the lake bottom, affecting depths of up to 20 feet and causing significant disruption below the water's surface. These enhanced wakes can reach heights of 3 to 4.5 feet. The exact depth of impact and wake height varies by boat manufacturer and installed equipment. These powerful wakes can contribute to shoreline erosion even when the boat is operated from a significant distance. For example, a study by the University of Minnesota indicates that wake boats require operational distances greater than 500 ft to attenuate wake wave characteristics to levels equivalent to non-wake surf boats operating under typical planning conditions (University of Minnesota, 2022).

At this time, there has not been enough comparable data collected for Geneva Lake to make definitive connections between macroinvertebrate communities and near-shore disturbances from enhanced wake. Data from previous surveys may be used as a reference but cannot be directly compared to 2024 results. Additional surveys, as described below, are recommended to be conducted in future years to be able to more accurately assess enhanced wake impacts on near-shore areas.

The sampling effort for survey location GL-01 was greater than the remainder of the survey locations. This is because the approach to sampling was modified in the field to accommodate the number of students participating. This should be taken into consideration when comparing the number of macroinvertebrates and taxa observed within the samples collected from GL-01 to the remainder of the survey locations. Lab results indicated that survey location GL-01 had the highest number of taxa observed within its sample (40). The additional survey effort (number of nets) may have led to additional organisms or taxa being collected. However, survey location GL-01 was also the only survey location with canopy cover. Larger amounts of canopy cover over an aquatic environment will create areas with cooler water temperatures. This sunlight variability and temperature fluctuation within the survey area may have an influence on the total number of macroinvertebrates observed. This also could have contributed to survey location GL-01 having the highest number of taxa observed within its sample. Additional data collection, with consistent methodology, should be completed to accurately compare results across survey locations.

The approximate area sampled varied across survey locations. Survey locations GL-02 and GL-04 had much smaller survey areas than the remainder of survey locations. This should be taken into consideration when comparing the number of macroinvertebrates and taxa observed within the samples collected from GL-02 and GL-04 to the remainder of the survey locations. Lab results indicated that survey location GL-02 had the lowest number of macroinvertebrates and taxa observed within its sample (24). The smaller survey area may have contributed to survey location GL-02 having lower numbers of macroinvertebrates or taxa observed. However, survey location GL-02 also had a different substrate composition than the remainder of survey locations. In general, most survey locations (GL-01, GL-03, GL-04, and GL-05) had substrate that was largely comprised of gravel and sand, and survey location GL-02 had substrate that was comprised of sand and silt/ muck. This also could have contributed to survey location GL-02 having lower numbers of macroinvertebrates or taxa observed. Additional data collection, with consistent methodology should be completed to accurately compare results across survey locations.

Despite survey location GL-04 having a smaller survey area, it still had the highest number of macroinvertebrates observed in its sample and Shannon biodiversity index across survey locations. Survey location GL-04 had the highest percentage of aquatic macrophytes (aquatic plants) growing within the survey area compared to the remainder of survey locations. Aquatic plants provide protection

and foraging habitat to aquatic macroinvertebrates. This also could have contributed to survey location GL-01 having the highest number of taxa observed within its sample.

In addition to the variability in the sample collection effort and survey area size across 2024 survey locations, there is also variability in the survey methods between the 2024 macroinvertebrate surveys and the 2016 macroinvertebrate surveys. Prior to 2024, macroinvertebrates surveys conducted in Geneva Lake utilized an Ekman dredge to collect sediment samples. This method varies significantly from the standard d-net kick net methodology that GLEA requested be used in 2024. Therefore, survey results are not comparable across survey years, as methods for sample collection were different. Therefore, it is recommended that the standard d-net kick net methodology is used for future macroinvertebrate surveys to provide consistent, comparable data.

Currently, there are no macroinvertebrate standard for lakes in Wisconsin. Therefore, the macroinvertebrate survey data collected in 2024 may be used as a baseline for future survey efforts. Conducting surveys with consistent, repeatable methods will allow survey data to be comparable across survey years. Repeatable methods include conducting surveys at the same survey locations and during the same time of year. This will allow GLEA to evaluate trends in the macroinvertebrate communities over time and compare these trends to any water use/ activity changes that have occurred. WDNR Guidelines for the Standard Collection of Macroinvertebrates Samples from Wadeable Streams – Version 2.0 states that data may be used to inventory current species presence/absence, track changes in species composition or metrics over time, detect changes before-after stream restorations, and evaluate the recovery from a spill or other disturbance (WDNR, 2017).

WDNR guidance states that macroinvertebrate data may be applicable for these purposes if:

- Appropriate metrics are selected to describe the assemblage based on the project objective
- Consistent sampling techniques applied over the timespan of the project when analyzing trends
- All sampling methods and project objectives are recorded in a SWIMS project and associated with each sample event

In addition to setting a baseline for future macroinvertebrate surveys, data collected on the environmental conditions observed at each survey location may be used to inform habitat restoration or lake management activities. Environmental conditions, such as substrate, aquatic vegetation, canopy cover, water levels, and transparency, should be referenced when identifying locations for improving near-shore habitat.

7. References

Marshall, David W. 2023. *2023 Shoreline Fish Survey Results and Implications for Geneva Lake Management.* Underwater Habitat Investigations LLC. Accessed from: https://www.gleawi.org/_files/ugd/456c61_751db43fe1bd4d528bfe4159b69b4612.pdf

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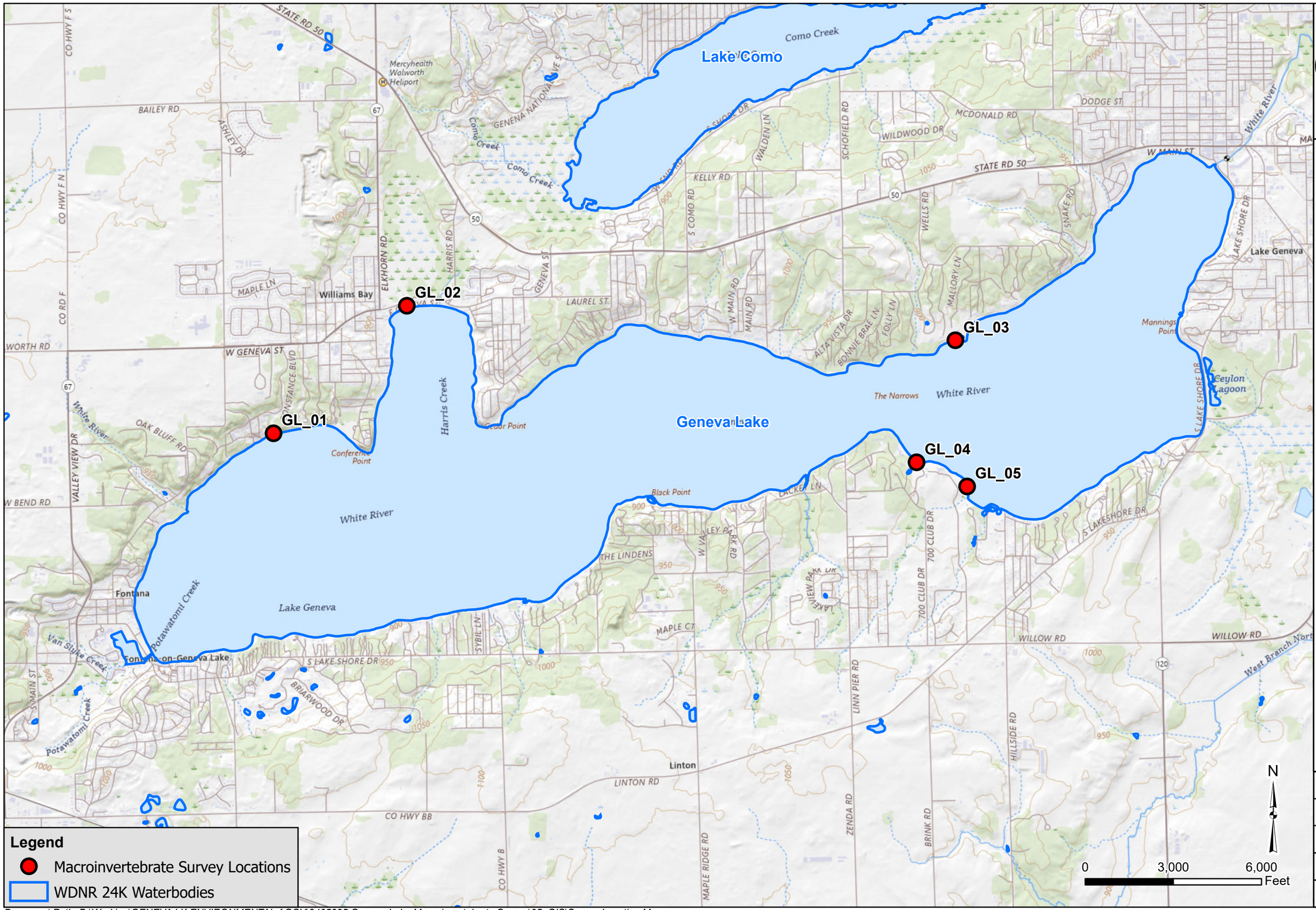
Appendices

Appendix A	Survey Location Map
Appendix B	Blank Macroinvertebrate Field Data Report
Appendix C	Scanned Macroinvertebrate Field Data Reports
Appendix D	Photographic Log
Appendix E	Laboratory Report Memo
Appendix F	Laboratory Results Data Tables

Appendix A Survey Location Map



Legend

- Macroinvertebrate Survey Locations
- WDNR 24K Waterbodies

GEI Consultants

3159 Voyager Drive
Green Bay, WI 54311
www.geiconsultants.com

FIGURE 1
2024 MACROINVERTEBRATE SURVEY LOCATION MAP

GENEVA LAKE ENVIRONMENTAL AGENCY
GENEVA LAKE MACROINVERTEBRATE SURVEY
WALWORTH COUNTY, WISCONSIN

Drawn: SLC2/7/2025	
Approved: KD2/7/2025	
Scale: As Shown	
Project Number: 2405325	
Figure Number: 1	

Document Path: B:\Working\GENEVA LK ENVIRONMENTAL AGCY\2405325 Geneva Lake Macroinvertebrate Survey\05_GIS\Survey Location Map.aprx

Source Credits: USGS Topo: USGS The National Map, WDNR 24K Hydrography Dataset

Appendix B Blank Macroinvertebrate Field Data Report

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Wadeable Macroinvertebrate Field Data Report

Form 3200-081 (R 08/14)

Instructions: **Bold** fields must be completed.

Station Summary

Waterbody Name	**Waterbody ID Code**	**Sample ID (YYYYMMDD-CY-FD)**

Sampling Location

SWIMS Station ID	**SWIMS Station Name**	**Database Key**

Latitude	**Longitude**	**Lat/Long Determination method (circle)**	**Datum Used if using GPS**
		SWIMS SWDV GPS	**NAD 27** or **NAD83**

Basin (WMU)	**Watershed Name**	**County**

Sample and Site Descriptors

Sample Collector (Last Name, First)	**Project Name**

Sampling Device

☐ Kick Net ☐ Surber Sampler ☐ Eckman
☐ Ponar ☐ Artificial Substrate ☐ Hess Sampler ☐ Other: _____

Habitat Sampled

☐ Riffle ☐ Run ☐ Pool
☐ Other ☐ Shoreline Composite ☐ Proportionally-Sampled Habitat
☐ Littoral Zone ☐ Profundal Zone ☐ Wetland

Total Sampling Time (min)	**Estimated Area Sampled (m^2)**	**Number of Samples in Composite**	**Replicate No._____of _____**

Reason for Sampling

☐ Least Impacted Reference ☐ Baseline ☐ Impact / Treatment Site
☐ Control Site ☐ Trend ☐ Other: _____

Water Temp. (C)	**D.O. (mg/l)**	**D.O. (% sat.)**	**pH (su)**	**Conductivity (umhos/cm)**	**Transparency (cm)**

Water Color

☐ Clear ☐ Turbid ☐ Stained

Estimated Stream Velocity (m/s)

☐ Slow (< 0.15 m/s) ☐ Moderate (0.15 m/s - 0.5 m/s) ☐ Fast (>0.5 m/s)

Measured Velocity circle units mps **or** cfs	**Average Stream Depth of reach (m)**	**Average Stream Width of reach (m)**

Composition of Substrate Sampled (Percent):

Bedrock:_____ Boulders (basketball or larger):_____ Rubble (tennisball or basketball):_____ Gravel (ladybug to tennisball.):_____

Sand: _____ Clay:_____ Silt/Muck:_____ Overhanging Vegetation:_____

Aquatic Macrophytes:_____ Leaf Snags:_____ Course Woody Debris:_____ Other (_____):_____

Embeddedness of Substrate at Sample Site (%)_____ **Canopy Cover at Sample Site (%)** _____

Stream and Watershed Descriptors

N = Not a problem
U = Uncertain
PL= Present, Low Impact
PH= Present, High Impact

Factors that may be Influencing Water Resource Integrity	Local	Water-shed	Factors that may be Influencing Water Resource Integrity	Local	Water-shed
Biological			**Chemical**		
Algae: - Diatoms / Periphyton			Chlorine		
- Filamentous Algae			Dissolved Oxygen		
- Planktonic Algae			Nutrients (P, N....)		
Other -Specify:			Toxics: - Inorganic (Metals)		
Iron Bacteria			- Organic (PCBs, pesticides ...)		
Macrophytes			Other - Specify:		
Slimes			**Sources of Stream Impacts**		
Other - Specify:			Bank Erosion		
Physical			Point Source - Specify:		
Bank Erosion			Pasturing of Livestock		
Channelization - Upstream			Runoff: - Barnyard		
- Downstream			- Construction		
Hydraulic Scour / Channel Incision			- Cropland		
Impoundment: - Upstream			- Urban		
- Downstream			Septic Systems		
Low Flow			Tile Drainage - Organic Soils		
Sedimentation			- Minerals soils		
Sludge			Springs		
Thermal			Tributary(s)		
Turbidity			Wetland		
Other - Specify:			Other - Specify:		

Comments

Special Instructions for Laboratory

For Lab Use Only		
Sample Sorter	Taxonomist	Estimated Percent of Sample Sorted
Date Processed	Specimens Saved	

Appendix C Scanned Macroinvertebrate Field Data Reports

150 ft x 30 ft

20 nets ~ 1 min each

State of Wisconsin
Department of Natural Resources
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Wadeable Macroinvertebrate Field Data Report

Form 3200-081 (R 08/14) Page 1 of 2

Instructions: **Bold** fields must be completed.

Station Summary

Waterbody Name	**Waterbody ID Code**	**Sample ID (YYYYMMDD-CY-FD)**
Geneva Lake	758300	GL-01 10/01/2024

Sampling Location 10:00 am

[redacted] Station ID	[redacted] Station Name	[redacted]

Latitude	**Longitude**	**Lat/Long Determination method (circle)**	**Datum Used if using GPS**
42.566561	88.554599	SWIMS SWDV (GPS)	NAD 27 or (NAD83)

[redacted] (WMU)	[redacted] Watershed Name	**County**
		Walworth

Sample and Site Descriptors

Sample Collector (Last Name, First) Doering, Karin; Klabunde, Kason

[redacted] Project Name

Sampling Device

- [x] Kick Net
- [ ] Surber Sampler
- [ ] Eckman
- [ ] Ponar
- [ ] Artificial Substrate
- [ ] Hess Sampler
- [ ] Other: _____

Habitat Sampled

- [ ] Riffle
- [ ] Run
- [ ] Pool
- [ ] Other
- [ ] Shoreline Composite
- [ ] Proportionally-Sampled Habitat
- [x] Littoral Zone
- [ ] Profundal Zone
- [ ] Wetland

Total Sampling Time (min)	**Estimated Area Sampled (m²)**	**Number of Samples in Composite**	**Replicate No.** ~~2~~ A & B **of** _____
3 min	150 x 30	2 A & B	

Reason for Sampling

- [ ] Least Impacted Reference
- [x] Baseline
- [ ] Impact / Treatment Site
- [ ] Control Site
- [ ] Trend
- [ ] Other:

[redacted]	**Conductivity (umhos/cm)**	**Transparency (cm)**
		≥120cm

Water Color

- [x] Clear
- [ ] Turbid
- [ ] Stained

[redacted] Estimated Stream Velocity (m/s)

- [ ] [redacted]
- [ ] Moderate (0.15 m/s - 0.5 m/s)
- [ ]

[redacted] Velocity	**Average Stream Depth of reach (ft)**	[redacted] Average Stream Width of reach (m)
	0.9 ft	

Composition of Substrate Sampled (Percent):

Bedrock: 0	Boulders (basketball or larger): 0	Rubble (tennisball or basketball): 5	Gravel (ladybug to tennisball.): 40
Sand: 55	Clay: 0	Silt/Muck: 0	Overhanging Vegetation: 20
Aquatic Macrophytes: 0	Leaf Snags: 0	Course Woody Debris: 0	Other (_____): _____

Embeddedness of Substrate at Sample Site (%) _____ **Canopy Cover at Sample Site (%)** 20

Also plant substrate w/detritis

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Wadeable Macroinvertebrate Field Data Report

Form 3200-081 (R 08/14)

Instructions: **Bold** fields must be completed.

Station Summary

Waterbody Name	**Waterbody ID Code**	**Sample ID (YYYYMMDD-CY-FD)**
Geneva Lake	758300	GL-02 10/01/24

Sampling Location: #13 11:00am

[redacted] Station ID	SWIMS Station Name	[redacted] Database Key

Latitude	**Longitude**	**Lat/Long Determination method (circle)**	**Datum Used if using GPS**
42.578232	-88.537488	SWIMS SWDV (GPS)	NAD 27 or (NAD83)

[redacted] WMU	Watershed Name	**County**
		Walworth

Sample and Site Descriptors

Sample Collector (Last Name, First): Doering Korin

[redacted] Project Name

Sampling Device

- [x] Kick Net
- [ ] Surber Sampler
- [ ] Eckman
- [ ] Ponar
- [ ] Artificial Substrate
- [ ] Hess Sampler
- [ ] Other: _____

Habitat Sampled

- [ ] Riffle
- [ ] Run
- [ ] Pool
- [ ] Other
- [ ] Shoreline Composite
- [ ] Proportionally-Sampled Habitat
- [x] Littoral Zone
- [ ] Profundal Zone
- [ ] Wetland

Total Sampling Time (min)	**Estimated Area Sampled (m²)**	**Number of Samples in Composite**	**Replicate No.** of
1 min 8 nets	200 x 30 ft	2 A & B	A & B 1 of

Reason for Sampling

- [ ] Least Impacted Reference
- [x] Baseline
- [ ] Impact / Treatment Site
- [ ] Control Site
- [ ] Trend
- [ ] Other:

[redacted] Temp (C)	[redacted] DO (mg/l)	[redacted] DO (%sat)	[redacted] pH (su)	[redacted] Conductivity (umhos/cm)	**Transparency (cm)**
					>120

Water Color

- [x] Clear
- [ ] Turbid
- [x] Stained

[redacted] Estimated Stream Velocity (m/s)

- [ ] Slow (<0.15 m/s)
- [ ] Moderate (0.15 - 0.5 m/s)
- [ ] Fast (>0.5 m/s)

[redacted] Measured Flow Velocity cfs or cms	**Average Stream Depth of reach (m)**	[redacted] Average Stream Width of reach (m)
	~2.0 ft	

Composition of Substrate Sampled (Percent):

Bedrock: 0	Boulders (basketball or larger): 0	Rubble (tennisball or basketball): 0	Gravel (ladybug to tennisball.): 0
Sand: 50%	Clay: 0	Silt/Muck: 40%	Overhanging Vegetation: 0
Aquatic Macrophytes: 10%	Leaf Snags: 0	Course Woody Debris: 0	Other (_____): _____

Embeddedness of Substrate at Sample Site (%) _____ **Canopy Cover at Sample Site (%)** 0

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Wadeable Macroinvertebrate Field Data Report
Form 3200-081 (R 08/14) Page 1 of 2

Instructions: Bold fields must be completed.

Station Summary

Waterbody Name	Waterbody ID Code	Sample ID (YYYYMMDD-CY-FD)
Geneva Lake	758300	GL-03 10/01/2024

Sampling Location 12:00pm

SWIMS Station ID	SWIMS Station Name	Database Key
15		

Latitude	Longitude	Lat/Long Determination method (circle)	Datum Used if using GPS (circle)
42.574093	-88.468327	SWIMS SWDV (GPS)	NAD 27 or (NAD83)

WMU	Waterbody Type	County
		Walworth

Sample and Site Descriptors

Sample Collector (Last Name, First): Doering, Korin

Project Name:

Sampling Device
- [x] Kick Net
- [ ] Surber Sampler
- [ ] Eckman
- [ ] Ponar
- [ ] Artificial Substrate
- [ ] Hess Sampler
- [ ] Other: _____

Habitat Sampled
- [ ] Riffle
- [ ] Run
- [ ] Pool
- [ ] Other
- [ ] Shoreline Composite
- [ ] Proportionally-Sampled Habitat
- [x] Littoral Zone
- [ ] Profundal Zone
- [ ] Wetland

Total Sampling Time (min)	Estimated Area Sampled (m²)	Number of Samples in Composite	Replicate No. of
1 min x 8 nets	200 x 30 ft	1 A	

Reason for Sampling
- [ ] Least Impacted Reference
- [x] Baseline
- [ ] Impact / Treatment Site
- [ ] Control Site
- [ ] Trend
- [ ] Other: _____

Water Temp. (C)	D.O. (mg/L)	D.O. (% sat.)	pH (su)	Conductivity (umhos/cm)	Transparency (cm)
					>120 cm

Water Color
- [x] Clear
- [ ] Turbid
- [ ] Stained

Estimated Stream Velocity (m/s)
- [ ] Current (0.1 m/s)
- [ ] Moderate (0.1-0.3 m/s)
- [ ] Fast (>0.3 m/s)

Measured Velocity _____ cfs

Average Stream Depth of reach (m): 2.10 ft

Average Stream Width of reach (m):

Composition of Substrate Sampled (Percent):

Bedrock: 0 Boulders (basketball or larger): 0 Rubble (tennisball or basketball): 20% Gravel (ladybug to tennisball.): 30%

Sand: 40% Clay: 0 Silt/Muck: 0% Overhanging Vegetation: 0%

Aquatic Macrophytes: 10% Leaf Snags: 0 Course Woody Debris: 0 Other (_____): _____

Embeddedness of Substrate at Sample Site (%) _____ **Canopy Cover at Sample Site (%)** 0

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Wadeable Macroinvertebrate Field Data Report

Form 3200-081 (R 08/14)

Instructions: **Bold** fields must be completed.

Station Summary

Waterbody Name	**Waterbody ID Code**	**Sample ID (YYYYMMDD-CY-FD)**
Geneva Lake	758300	GL-04 10/01/2024

Sampling Location 1:00pm

[redacted]	SWIMS Station Name [redacted]	[redacted]

Latitude	**Longitude**	**Lat/Long Determination method (circle)**	**Datum Used if using GPS**
42.562778	-88.473487	SWIMS SWDV (GPS)	NAD 27 or (NAD83)

[redacted]	Watershed Name [redacted]	**County**
		Walworth

Sample and Site Descriptors

Sample Collector (Last Name, First)	[redacted]
Doering Korin	

Sampling Device

☒ Kick Net ☐ Surber Sampler ☐ Eckman
☐ Ponar ☐ Artificial Substrate ☐ Hess Sampler ☐ Other: _____

Habitat Sampled

☐ Riffle ☐ Run ☐ Pool
☐ Other ☐ Shoreline Composite ☐ Proportionally-Sampled Habitat
☒ Littoral Zone ☐ Profundal Zone ☐ Wetland

Total Sampling Time (min)	**Estimated Area Sampled (m²)**	**Number of Samples in Composite**	[redacted]
1 mrn 8 nets	50 x 30	2 A & B	

Reason for Sampling

☐ Least Impacted Reference ☒ Baseline ☐ Impact / Treatment Site
☐ Control Site ☐ Trend ☐ Other: _____

[redacted]	**Transparency (cm)**
	7120 cm

Water Color

☒ Clear ☐ Turbid ☐ Stained

[redacted] ☐ Fast

[redacted]	**Average Stream Depth of reach (ft)**	[redacted]
	2.25 Ft	

Composition of Substrate Sampled (Percent):

Bedrock: 0 Boulders (basketball or larger): 0 Rubble (tennisball or basketball): 0 Gravel (ladybug to tennisball.): 70

Sand: 10 Clay: 0 Silt/Muck: 0 Overhanging Vegetation: 0

Aquatic Macrophytes: 20 Leaf Snags: 0 Course Woody Debris: 0 Other (_____): 0

Embeddedness of Substrate at Sample Site (%) _____ **Canopy Cover at Sample Site (%)** 0

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Wadeable Macroinvertebrate Field Data Report

Form 3200-081 (R 08/14)

Instructions: **Bold** fields must be completed.

Station Summary

Waterbody Name	**Waterbody ID Code**	**Sample ID (YYYYMMDD-CY-FD)**
Geneva Lake	758300	GL-05 10/01/2024

Sampling Location: #3 2:00 pm

SWIMS Station ID	SWIMS Station Name	Database Key

Latitude	**Longitude**	**Lat/Long Determination method (circle)**	**Datum Used if using GPS**
42.560439	-88.467168	SWIMS SWDV (GPS)	NAD 27 or (NAD83)

Basin (WMU)	Watershed Name	**County**
		Walworth

Sample and Site Descriptors

Sample Collector (Last Name, First)	Project Name
Doerns, Korin	

Sampling Device

☒ Kick Net ☐ Surber Sampler ☐ Eckman
☐ Ponar ☐ Artificial Substrate ☐ Hess Sampler ☐ Other: _____

Habitat Sampled

☐ Riffle ☐ Run ☐ Pool
☐ Other ☐ Shoreline Composite ☐ Proportionally-Sampled Habitat
☒ Littoral Zone ☐ Profundal Zone ☐ Wetland

8 nets 1 minute each

Total Sampling Time (min)	**Estimated Area Sampled (m²)**	**Number of Samples in Composite**	Replicate No.
1min 8nets	100 x 75 ft	1 A	

Reason for Sampling

☐ Least Impacted Reference ☒ Baseline ☐ Impact / Treatment Site
☐ Control Site ☐ Trend ☐ Other: _____

Water Temp. (C)	D.O. (mg/l)	D.O. (% sat.)	pH (su)	Conductivity (umhos/cm)	**Transparency (cm)**
					>120cm

Water Color

☒ Clear ☐ Turbid ☐ Stained

Estimated Stream Velocity (m/s) ☐ Slow ☐ Moderate ☐ Fast

Measured Velocity		**Average Stream Depth of reach (m)**	Average Stream Width of reach (m)
		2.5 ft	

Composition of Substrate Sampled (Percent):

Bedrock: 0 Boulders (basketball or larger): 0 Rubble (tennisball or basketball): 0 Gravel (ladybug to tennisball.): 80%

Sand: 10% Clay: 0 Silt/Muck: 0 Overhanging Vegetation: 0

Aquatic Macrophytes: 10% Leaf Snags: 0 Course Woody Debris: 0 Other (_____): 0

Embeddedness of Substrate at Sample Site (%) _____ **Canopy Cover at Sample Site (%)** 0

Appendix D Photographic Log

PHOTOGRAPHIC LOG

PHOTOGRAPH NO: 1	**DATE:** 10/1/2024	**GEI PROJECT NO:** **2405325**	**CLIENT:** Geneva Lake Environmental Agency
DIRECTION: SE	**SITE LOCATION: Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Gravel and sand substrate observed at survey location GL-01.			

PHOTOGRAPH NO: 2	**DATE:** 10/1/2024	**GEI PROJECT NO:** **2405325**	**CLIENT:** Geneva Lake Environmental Agency
DIRECTION: E	**SITE LOCATION: Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Students collecting macroinvertebrate substrate samples at survey location GL-01.			

PHOTOGRAPHIC LOG

PHOTOGRAPH NO: 3	**DATE:** 10/1/2024	**GEI PROJECT NO: 2405325**	**CLIENT:** Geneva Lake Environmental Agency
DIRECTION: N	**SITE LOCATION: Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Sorting trays used by students to practice sorting macroinvertebrates at survey location GL-01.			

PHOTOGRAPH NO: 4	**DATE:** 10/1/2024	**GEI PROJECT NO: 2405325**	**CLIENT:** Geneva Lake Environmental Agency
DIRECTION: W	**SITE LOCATION: Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Students collecting macroinvertebrate substrate samples at survey location GL-02.			

PHOTOGRAPHIC LOG

PHOTOGRAPH NO: 5	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: SE	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Student with crayfish collected in macroinvertebrate sample at survey location GL-02.			

PHOTOGRAPH NO: 6	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: S	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Gravel, sand, and rubble substrate observed at survey location GL-03.			

PHOTOGRAPHIC LOG

PHOTOGRAPH NO: 7	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: E	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Student with crayfish collected in macroinvertebrate sample at survey location GL-03.			

PHOTOGRAPH NO: 8	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: N	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Pontoon boat used to transport students, teachers, and GLEA volunteers between survey locations.			

PHOTOGRAPH NO: 9	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: SE	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Pontoon boat used to transport students, teachers, and GLEA volunteers between survey locations. Gravel and sand substrate observed at survey location GL-04.			

PHOTOGRAPH NO: 10	DATE: 10/1/2024	GEI PROJECT NO: 2405325	CLIENT: Geneva Lake Environmental Agency
DIRECTION: NE	SITE LOCATION: **Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Students collecting macroinvertebrate substrate samples at survey location GL-04.			

PHOTOGRAPHIC LOG

PHOTOGRAPH NO: 11	**DATE:** 10/1/2024	**GEI PROJECT NO:** **2405325**	**CLIENT:** Geneva Lake Environmental Agency
DIRECTION: E	**SITE LOCATION: Geneva Lake Macroinvertebrate Survey**		
DESCRIPTION: Students, volunteers, and WDNR staff collecting macroinvertebrate substrate samples at survey location GL-05.			

Appendix E Laboratory Report Memo

Consulting
Engineers and
Scientists

GEI Consultants

Memo

To: Korin Doering

From: Michelle Chadwick

Date: 11/25/2024

Re: Geneva Lake Environmental Agency

1.0 Summary

Attached are the results of the analyses of the five benthic macroinvertebrate samples collected for Geneva Lake Environmental Agency, October 1, 2024. Data are reported as number of organisms per sample. In addition, we identified *Dreissena bugensis* and *Dreissena polymorpha* as invasive species found at all sites. *Faxionus rusticus* were also identified as invasive species and were present in all sites, excluding Geneva Lake, GL-02.

Sixty percent of the samples were subsampled due to very large numbers of organisms (>300 individuals/sample) and forty percent were picked in their entirety. Subsampling consisted of sorting a minimum of 300 invertebrates from at least 5/10 of the sample using a modified Caton picking tray with the remainder of the sample searched for large and rare invertebrates not present in the subsample (Vinson and Hawkins 1996; Carter and Resh 2001).

2.0 QA/QC Summary

For quality assurance, the Laboratory QA Officer and/or the Macroinvertebrate Lab Manager checked all sorted samples, and the results were documented for ten percent of the samples. These procedures indicated over 97 percent thoroughness for sorting.

Quality assurance for identifications and enumerations (Whittaker 1975; Stribling et al. 2003) were randomly conducted on ten percent of the samples and indicated 100 percent agreement for taxonomic and count accuracy.

Date Received: 10/08/2024

Date Processing Started: 10/09/2024

GEI Consultants, Inc./Ecological Division
4601 DTC Boulevard, Suite L100, Denver, CO 80237
303.662.0100 fax: 303.662.8757
www.geiconsultants.com

Table 1: QA Requirement Summary

QA Requirement	Yes	No	Note
Chain of Custody received complete	x		
Macroinvertebrate Extraction QA within acceptable 5% difference	x		
Macroinvertebrate Identification QA within acceptable 5% difference	x		
Data entry/calculations checked against bench sheets	x		

Table 2: Macroinvertebrate QA Performance

# of Samples for QA	Extractions		Identifications	
	Sample %	Acceptable %	Sample %	Acceptable %
1	97.8	≥ 95	100	≥ 95

3.0 References

Carter, J. L., and V. H. Resh. 2001. After site selection and before data analysis: sampling, sorting, and laboratory procedures used in stream benthic macroinvertebrate monitoring programs by USA state agencies. *Journal of the North American Benthological Society* 20:658-682.

Stribling, J. B., S. R. Moulton II, and G. T. Lester. 2003. Determining the quality of taxonomic data. *Journal of the North American Benthological Society* 22:621-631.

Vinson, M. R., and C. P. Hawkins. 1996. Effects of sampling area and subsampling procedure on comparisons of taxa richness among streams. *Journal of the North American Benthological Society* 15:392-399.

Whittaker, R. H., 1975. *Communities and Ecosystems*, 2nd Edition. MacMillan Publishing Co., New York, NY.

4.0 Results

See attached Excel spreadsheet

Report approved by:

Michelle Chadwick,
Invertebrate Laboratory Manager

Jen Shanteau, Laboratory QA/QC Officer

Appendix F Laboratory Results Data Tables

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-01

TAXA	REP 1
INSECTA	
EPHEMEROPTERA	**1**
Baetidae	1
ODONATA	**4**
Argia sp.	2
Perithemis tenera	2
PLECOPTERA	**3**
Nemouridae	3
MEGALOPTERA	**3**
Sialis sp.	3
COLEOPTERA	**96**
Ectopria sp.	11
Peltodytes sp.	1
Stenelmis sp.	84
TRICHOPTERA	**21**
Helicopsyche borealis	12
Hydroptila sp.	1
Nectopsyche sp.	7
Oecetis sp.	1
DIPTERA	**19**
Cricotopus bicinctus	1
Cryptochironomus sp.	1
Dicrotendipes sp.	11
Hexatoma sp.	1
Molophilus sp.	1
Orthocladius/Cricotopus gr.	1
Pentaneurini sp.	1
Psilometriocnemus sp.	1
Rheotanytarsus sp.	1
HYDRACARINA	**2**
Hydrozetes sp.	2
CRUSTACEA	
AMPHIPODA	**19**
Gammarus sp.	19

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-01

TAXA	REP 1
INSECTA	
DECAPODA	**3**
Faxonius rusticus[1]	3
TURBELLARIA	**17**
Girardia sp.	17
ANNELIDA	
OLIGOCHAETA	**11**
Unid. Immature Tubificidae w/ Capilliform Chaetae	1
Unid. Immature Tubificidae w/o Capilliform Chaetae	1
Unid. Oligochaeta	9
HIRUDINIDA	**6**
Erpobdella melanostoma	4
Glossiphonia elegans	1
Helobdella sp.	1
MOLLUSCA	
GASTROPODA	**35**
Amnicola limosa	8
Elimia livescens	18
Ferrissia sp.	2
Gyraulus sp.	3
Planorbella truncata	3
Stagnicola stagnalis	1
PELECYPODA	**168**
Dreissena bugensis[1]	141
Dreissena polymorpha[1]	26
Pisidium sp.	1
TOTAL (#/sample)	408
NUMBER OF TAXA	40
SHANNON-WEAVER (H')	3.47
TOTAL EPT TAXA	6
EPT INDEX (% of Total Taxa)	15
EPHEMEROPTERA ABUNDANCE (% of Total Number)	<1

[1]Invasive species

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-02

TAXA	REP 1
INSECTA	
ODONATA	**3**
Coenagrion/Enallagma	3
TRICHOPTERA	**5**
Nectopsyche sp.	3
Oecetis sp.	2
DIPTERA	**11**
Cryptochironomus sp.	1
Paralauterborniella sp.	2
Polypedilum sp.	1
Procladius sp.	3
Rheotanytarsus sp.	3
Thienemanniella sp.	1
CRUSTACEA	
AMPHIPODA	**67**
Gammarus sp.	66
Hyalella sp.	1
DECAPODA	**1**
Cambaridae	1
ANNELIDA	
OLIGOCHAETA	**30**
Limnodrilus sp.	3
Unid. Immature Tubificidae w/o Capilliform Chaetae	5
Unid. Oligochaeta	22
HIRUDINIDA	**29**
Erpobdella sp.	22
Gloiobdella elongata	1
Helobdella stagnalis gr.	6
MOLLUSCA	
GASTROPODA	**10**
Amnicola limosa	5
Campeloma crassulum	3
Ferrissia sp.	1
Physa sp.	1

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-02

PELECYPODA	**46**
Dreissena bugensis[1]	42
Dreissena polymorpha[1]	2
Pisidium sp.	2
TOTAL (#/sample)	202
NUMBER OF TAXA	25
SHANNON-WEAVER (H')	3.22
TOTAL EPT TAXA	2
EPT INDEX (% of Total Taxa)	8
EPHEMEROPTERA ABUNDANCE (% of Total Number)	0

[1]Invasive species

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-03

TAXA	REP 1
INSECTA	
EPHEMEROPTERA	**1**
Stenacron interpunctatum	1
HEMIPTERA	**1**
Belostoma fluminea	1
COLEOPTERA	**1**
Ectopria sp.	1
TRICHOPTERA	**4**
Nectopsyche sp.	4
DIPTERA	**13**
Dicrotendipes sp.	4
Eukiefferiella sp.	1
Pseudochironomus sp.	7
Thienemanniella sp.	1
CRUSTACEA	
ISOPODA	**9**
Caecidotea sp.	9
AMPHIPODA	**121**
Gammarus sp.	121
DECAPODA	**1**
Faxonius rusticus[1]	1
TURBELLARIA	**39**
Girardia sp.	39
ANNELIDA	
OLIGOCHAETA	**6**
Eiseniella tetraedra	1
Limnodrilus sp.	3
Lumbriculidae	1
Unid. Immature Tubificidae w/o Capilliform Chaetae	1

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-03

HIRUDINIDA	**5**
Glossiphonia elegans	4
Helobdella stagnalis gr.	1
MOLLUSCA	
GASTROPODA	**82**
Amnicola limosa	54
Elimia livescens	27
Gyraulus sp.	1
Amnicola limosa	54
PELECYPODA	**162**
Dreissena bugensis[1]	109
Dreissena polymorpha[1]	53
TOTAL (#/sample)	445
NUMBER OF TAXA	24
SHANNON-WEAVER (H')	2.95
TOTAL EPT TAXA	2
EPT INDEX (% of Total Taxa)	8
EPHEMEROPTERA ABUNDANCE (% of Total Number)	<1

[1]Invasive species

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-04

TAXA	REP 1
INSECTA	
EPHEMEROPTERA	**22**
Caenis sp.	4
Stenacron interpunctatum	18
ODONATA	**3**
Coenagrionidae	2
Perithemis tenera	1
TRICHOPTERA	**30**
Agraylea sp.	2
Helicopsyche borealis	2
Hydroptila sp.	4
Leptocerus americanus	8
Nectopsyche sp.	14
DIPTERA	**290**
Cricotopus bicinctus	20
Cryptochironomus sp.	6
Dicrotendipes sp.	64
Hemerodromia sp.	2
Nanocladius sp.	10
Paratanytarsus sp.	16
Psectrocladius sp.	20
Pseudochironomus sp.	6
Rheotanytarsus sp.	38
Thienemanniella sp.	108
CRUSTACEA	
ISOPODA	**8**
Caecidotea sp.	8
AMPHIPODA	**156**
Gammarus sp.	148
Hyalella sp.	8
DECAPODA	**1**
Faxonius rusticus[1]	1
TURBELLARIA	**46**
Girardia sp.	46

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-04

TAXA	REP 1
ANNELIDA	
OLIGOCHAETA	**22**
Unid. Immature Tubificidae w/o Capilliform Chaetae	8
Unid. Oligochaeta	14
HIRUDINIDA	**6**
Helobdella stagnalis gr.	4
Placobdella phalera	2
MOLLUSCA	
GASTROPODA	**94**
Amnicola limosa	84
Elimia livescens	2
Promenetus exacuous	2
Valvata winnebagoensis	6
PELECYPODA	**220**
Dreissena bugensis[1]	138
Dreissena polymorpha[1]	82
TOTAL (#/sample)	898
NUMBER OF TAXA	34
SHANNON-WEAVER (H')	3.90
TOTAL EPT TAXA	7
EPT INDEX (% of Total Taxa)	21
EPHEMEROPTERA ABUNDANCE (% of Total Number)	2

[1]Invasive species

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-05

TAXA	REP 1
INSECTA	
EPHEMEROPTERA	**2**
Caenis sp.	1
Heptageniidae	1
COLEOPTERA	**1**
Stenelmis sp.	1
TRICHOPTERA	**15**
Agraylea sp.	3
Leptocerus americanus	3
Nectopsyche sp.	9
DIPTERA	**104**
Cricotopus sp.	1
Dicrotendipes sp.	24
Paratanytarsus sp.	11
Psectrocladius sp.	1
Pseudochironomus sp.	3
Rheotanytarsus sp.	10
Thienemanniella sp.	54
HYDRACARINA	**4**
Hydrozetes sp.	4
CRUSTACEA	
ISOPODA	**19**
Caecidotea sp.	19
AMPHIPODA	**174**
Gammarus sp.	173
Hyalella sp.	1
TURBELLARIA	**6**
Girardia sp.	6

DATA: MACROINVERTEBRATE DENSITY
Client: GENEVA LAKE ENVIRONMENTAL AGENCY
Sampled: 10/1/2024
Site: GL-05

TAXA	REP 1
ANNELIDA	
OLIGOCHAETA	**9**
Unid. Immature Tubificidae w/o Capilliform Chaetae	3
Unid. Oligochaeta	6
HIRUDINIDA	**7**
Helobdella stagnalis gr.	7
MOLLUSCA	
GASTROPODA	**83**
Amnicola limosa	31
Elimia livescens	49
Planorbella campanulata	3
PELECYPODA	**177**
Dreissena bugensis[1]	111
Dreissena polymorpha[1]	66
TOTAL (#/sample)	601
NUMBER OF TAXA	26
SHANNON-WEAVER (H')	3.32
TOTAL EPT TAXA	5
EPT INDEX (% of Total Taxa)	19
EPHEMEROPTERA ABUNDANCE (% of Total Number)	<1

[1]Invasive species