ASSESSMENT REPORT
FOR
BAY HARBOR LAKE
BAY HARBOR RESORT
RESORT TOWNSHIP, EMMET COUNTY, MICHIGAN

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This report was prepared by the participants of the Bay Harbor Lake Assessment Team (BHLAT), a multi-stakeholder work group. The BHLAT was formed in spring of 2006 to develop the scope of work for the Bay Harbor Lake assessment. The assessment field work was conducted in May, June, and October 2006. The content of this report represents the consensus among all participants of the work group. The BHLAT consisted of the following participants:

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EXECUTIVE SUMMARY

This report summarizes the methods and results of the field activities that were used to conduct the assessment of Bay Harbor Lake, a 90-acre lake located in Bay Harbor, Emmet County, Michigan. The overall objective of the Bay Harbor Lake assessment was to implement a phased monitoring and sampling approach to determine if cement kiln dust (CKD) or CKD leachate is present within or impacting Bay Harbor Lake. Based on the results of the Bay Harbor Lake assessment, there are no signs that CKD or CKD leachate is present in or is currently impacting Bay Harbor Lake. All the water quality measurements indicate normal conditions, and no unusual physical or biological features were encountered.

Assessment field activities included two rounds of shoreline surveys, two rounds of dive surveys, and the collection and taxonomic characterization of an “unknown white substance” and algal samples. Michigan surface water quality standards require surface water pH to be between 6.5 and 9.0 for human contact and aquatic ecosystem protection. All pH samples collected along the Bay Harbor Lake shoreline in May and October 2006 ranged from 7.4 to 8.3, which are within the range of acceptable water quality standards. The study involved 561 water quality measurements spread across two miles of shoreline. Measurements were collected near shore at depths of up to 18 inches and from boats offshore in water as deep as 14 feet. Several storm water drains were also sampled, with the results in a comparable pH range.

Over 15 hours of dive surveys were conducted in June and October 2006 to evaluate the off-shore and deeper portions of Bay Harbor Lake. Divers collected real time water quality data and inspected the walls and offshore bottom of select portions of the lake for CKD or CKD-related impacts to the physical and biological environment. Overall, the pH of Bay Harbor Lake during the dives ranged from 6.9 to 8.7. The species of fish, invertebrates, and algae observed during the dives, and in the laboratory following the dives, are common species that have been reported to occur in the near shore areas of Lake Michigan.

The Bay Harbor Lake assessment was conducted in accordance with the Bay Harbor Lake Conceptual Field Monitoring and Sampling Work Plan (Work Plan), dated May 16, 2006. The

Work Plan was developed through a collaborative effort with the United States Environmental Protection Agency (U.S. EPA), the United States Fish and Wildlife Service (U.S. FWS), the Michigan Department of Environmental Quality (MDEQ), the Little Traverse Bay Bands of Odawa Indians (LTBB), the Northwest Michigan Community Health Agency (NWMCHA), the Michigan Department of Community Health (MDCH), Tip of the Mitt Watershed Council, CMS Energy (CMS), and the Bay Harbor Company..

Since the visual and water quality monitoring results of the shoreline surveys and dive surveys and the algae characterization showed no evidence of the presence of CKD or CKD leachate within Bay Harbor Lake, and since all pH measurements were within the range of acceptable water quality standards, further lake assessment activities identified in the phased Work Plan are not required.

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SECTION 1
INTRODUCTION

1.1 Site Description

Bay Harbor Lake is an approximately 90-acre fresh water lake located within the Bay Harbor residential/commercial development in Resort Township, Emmet County, Michigan.

From east to west, Bay Harbor Lake is approximately 3,600 feet long at its longest point. From north to south, Bay Harbor Lake is roughly 1,200 feet wide and the maximum depth of the lake is about 80 feet. Bay Harbor Lake is connected to Lake Michigan through a 120-foot wide man-made channel along the north-central portion of the lake. This entry channel is protected by a riprap breakwater wall.

The area surrounding Bay Harbor Lake consists of single-lot residential properties, a mixed residential/commercial zone (including a swimming beach), private yacht club property (including piers extending approximately 365 feet into Bay Harbor Lake), about 120 private docks, a boat launch ramp, and a recreational golf course development. An unnamed creek (referred to as East-Unnamed Creek No. 2) is located roughly180 feet west of Bay Harbor Lake. The golf course development to the west of Bay Harbor Lake was built on top of a large cement kiln dust (CKD) pile. At its closest point, this CKD pile is located within 200 feet of Bay Harbor Lake. The location of Bay Harbor Lake and the surrounding area is shown on Figure 1.

1.2 Site History

The Bay Harbor Resort is located in an area that was used for mining and cement manufacturing operations from about 1870 through 1980. Bay Harbor Lake, referred to as the Central Limestone Quarry during mining operations, was created in 1995 as part of the property's redevelopment as the Bay Harbor Resort. A portion of the rock wall that separated the quarry area from Lake Michigan was breached, allowing water from the Little Traverse Bay of Lake Michigan to fill the former quarry and form Bay Harbor Lake.

Throughout the years of cement manufacturing, CKD was consolidated into large stockpiles and placed into previously mined areas; however, there are no historical records indicating CKD material was consolidated within the Central Limestone Quarry.

1.2.1 General CKD and CKD Leachate Characteristics

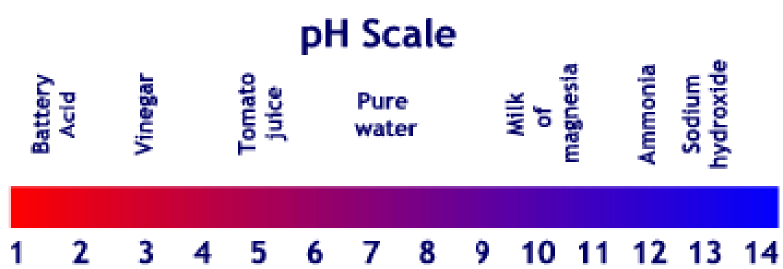
The process of making cement involves grinding limestone with other raw materials into a fine powder that is heated in a kiln at very high temperatures. The leftover material or waste produced during this cement manufacturing process is cement kiln dust.

When water comes into contact with the CKD, it can leach substances from the CKD and potentially contaminate adjacent waters. CKD leachate may be characterized by a change in the color (generally dark brown) and a change in the chemical characteristics of water. CKD leachate is highly alkaline and can contain heavy metals such as mercury, arsenic, and lead, which can pose adverse impacts to water quality, fish and other aquatic life, and human health.

1.2.2 CKD Leachate Characteristics at the Little Traverse Bay CKD Release Site

Measurements of pH and specific conductance outside of typically observed ranges can indicate the presence of CKD leachate within a body of water, since there is a discernible contrast between normal water and water affected by CKD.

The acidity or alkalinity of water is expressed by a measurement called pH. The pH scale ranges from 0 to14. A pH of 7 is considered neutral, while substances with a pH less than 7 are acidic and substances with a pH greater than 7 are basic (also known as alkaline). The pH scale is logarithmic, which means a substance with a pH of 6 is 10 times more acidic than a substance with a pH of 7. The pH of some common substances are shown below



Specific conductance is a measurement of how well water can conduct an electrical current, which is an indirect measurement of the presence of dissolved solids. Pure, distilled water, which contains very few dissolved solids, would exhibit a low specific conductance value, while water with a high concentration of dissolved substances would exhibit a higher specific conductance value.

Along the Lake Michigan shoreline near Bay Harbor Lake, typical pH values are about 8.3 and specific conductance values are about 250 to 300 micro Siemens per centimeter (µs/cm) in areas not impacted by CKD. In shoreline areas currently impacted by CKD leachate, the pH of the recovered leachate ranges from around 9 to 13.6 and the specific conductance values are typically between 500 and 5,500µs/cm. In addition to pH and specific conductance measurements, the CKD leachate identified along the Lake Michigan shoreline typically, but not always, exhibits a dark brown color. Based on the observable and easily quantifiable changes to color, pH, and specific conductance that are associated with CKD leachate, monitoring these parameters is an appropriate method to identify CKD leachate release areas.

1.3 Previous Investigations

Since May 2004, five separate field monitoring/sampling events have been conducted by various parties. Field activities have varied from surface water pH monitoring to sampling and analysis for pH, chloride, nitrate, total nitrogen, phosphorous, specific conductance, ammonia, fecal coliform bacteria, and gasoline constituents. The results of these monitoring and sampling activities were compiled by the Bay Harbor Company and are presented in Appendix A.

In recent years, a gelatin-like white substance has been observed in Bay Harbor Lake, especially during colder months. Due to concerns raised regarding the unknown nature of this material, the Bay Harbor Company had a sample of the white substance collected from rocks from the bottom of Bay Harbor Lake in March 2006 for biological assessment. The sample was collected from the northern shoreline at a depth of about 5 feet. It was found to contain a plant-like growth of naturally occurring fungus and algae. Analysis of the white substance was completed on behalf of Bay Harbor Company by GAP EnviroMicrobial Services. A copy of the biological assessment report can be found in Appendix B.

Water quality monitoring/sampling activities from previous investigations did not identify the presence of CKD leachate (such as elevated pH or specific conductance) in Bay Harbor Lake. However, the scope of the previous monitoring and sampling activities was limited and it was determined a more comprehensive study was needed to assess Bay Harbor Lake for CKD impacts.

1.4 Bay Harbor Lake Assessment

1.4.1 Objective

The overall objective of the Bay Harbor Lake assessment was to implement a phased monitoring and sampling approach to determine if CKD or CKD leachate is present within or impacting Bay Harbor Lake. This study was designed and conducted in a manner to provide results of sufficient rigor, quality, and detail to enable regulatory agencies, public health officials, responsible parties, and members of the public to make decisions regarding potential cleanup activities and health advisories.

1.4.2 Work Plan

The Bay Harbor Lake assessment was conducted in accordance with the Bay Harbor Lake Conceptual Field Monitoring and Sampling Work Plan (Work Plan), dated May 16, 2006. The Work Plan was developed through a collaborative effort with the United States Environmental Protection Agency (U.S. EPA), the United States Fish and Wildlife Service (U.S. FWS), the Michigan Department of Environmental Quality (MDEQ), the Little Traverse Bay Bands of Odawa Indians (LTBB), the Northwest Michigan Community Health Agency (NWMCHA), the Michigan Department of Community Health (MDCH), Tip of the Mitt Watershed Council, CMS Energy (CMS), and the Bay Harbor Company.

The Work Plan indicated the assessment would be phased with Phase II and Phase III activities triggered by the results of preceding Work Plan activities. Therefore, some Phase II and Phase

III activities, such as the detailed evaluation of suspect features, were not implemented as no unusual features were encountered. The Work Plan elements are outlined below:

- **Phase I Activities – Shoreline and Dive Surveys**
  - Visual survey and water quality monitoring along entire shoreline of Bay Harbor Lake
  - Visual survey and monitoring of the lake bottom by a certified dive team
  - Evaluate unknown white substance previously observed within Bay Harbor Lake

- **Phase II Activities – Diver-Assisted Targeted Monitoring**
  - Diver-assisted water quality monitoring of suspect features/areas identified in Phase I
  - Marking and mapping locations of any suspect features

- **Phase III Activities – Additional Potential Tasks**
  - Vertical water column monitoring
  - Targeted sampling of lake water
  - Diver-assisted taxonomic characterization of unknown white substance and algae

SECTION 2
FIELD ACTIVITIES

2.1 Overview

This section discusses the methods and procedures used to conduct the Bay Harbor Lake assessment. The field activities included visual and water quality monitoring shoreline and diver-assisted surveys and algae collection and taxonomic characterization. The shoreline and diver-assisted visual and water quality monitoring surveys were conducted twice, once in spring and once in fall 2006, whereas the algae collection and taxonomic characterization was conducted only in spring 2006.

The Work Plan indicated the assessment would be phased with Phase II and Phase III activities triggered by the results of preceding activities. However, some activities required no additional resources to perform and it was the decision of the investigation team to collect real time water quality data during the dives and to collect and evaluate algae as it was encountered. The collection of these data helped support decisions regarding the overall quality of the lake. In contrast, some Phase II and Phase III activities, such as the detailed evaluation of suspect features, were not implemented as none were encountered.

2.2 Shoreline Surveys

The Phase I shoreline surveys were conducted from May 9 to May 14, 2006 and again from October 23 to October 25, 2006 following the procedures outlined in the Work Plan.

The Phase I shoreline survey activities consisted of visual surveys and water quality monitoring. They were completed generally under quiescent lake conditions, which are defined as wave heights less than 2 inches. The visual surveys were conducted by personnel walking or piloting a boat around the perimeter of the Bay Harbor Lake shoreline looking for discolored water or any other evidence of CKD leachate. Water quality monitoring for pH and specific conductance was performed along the entire perimeter of the lake (every 25 feet in May 2006 and every 25 or 100 feet in October 2006) and in outfall/stormwater drains around the lake. Water quality monitoring results are discussed in Section 3. Geographic coordinate data were also collected at each monitoring point using a global positioning system (GPS) unit. Figures 2 and 3 show the locations where water quality monitoring data were collected. Photographs were taken using digital cameras for field documentation purposes (Appendix C).

Water quality parameters were recorded every 25 feet along the shoreline in May 2006. In October 2006, water quality parameters were recorded every 25 feet along the west end of Bay Harbor Lake and every 100 feet in all other areas. Measurements were not collected along the north shore during the October 2006 survey. A tape measure or a GPS unit was used to measure the distance between monitoring points. The near-shore surface water monitoring points were selected, to the extent possible, in water that was roughly 2 inches deep. If the 2-inch depth requirement was not met, the measurement point was selected as close to shore as possible along the bottom, and the approximate depth of the monitoring point was recorded.

During each day of the shoreline survey, information on the monitoring equipment and its calibration, the names and association of field monitoring personnel, and the water quality parameters and observations for each unique monitoring location was recorded within a site logbook.

Water quality measurements were made using a YSI MPS 556 meter or an Insitu Troll 9000 meter. The water quality instruments were operated per the manufacturer's operating manuals. Prior to initiating monitoring activities, the units were field-calibrated for pH and specific conductance in accordance with the manufacturer's instructions and the site-specific Quality Assurance Project Plan – Revision 1.0, dated April 26, 2005 and Addendum 1.0 dated August 5, 2005. At a minimum, the units were calibrated each day before monitoring activities and checked after completion of the day's work using the same calibration standards. During most days of work, a mid-day calibration check was also performed to test for instrumental drift.

All Phase I water quality monitoring locations were surveyed for horizontal controls using a GPS unit. The monitoring locations were identified using a Trimble Pro-XRS GPS unit equipped with a TSC1 Data Logger. This system was handheld, with a backpack-mounted battery system.

Global positioning data were differentially corrected onsite in real-time; therefore, no post processing was required. The real-time data were downloaded from the TSC1 Data Logger to Pathfinder Office software, were projected into the Michigan State Plane coordinate system, and were mapped (Figures 2 and 3).

2.3 Dive Surveys

2.3.1 Survey Events

The Phase I dive surveys along with the modified Phase II diver-assisted water quality monitoring surveys were conducted from June 5 to June 7, 2006, and again from October 17 to October 19, 2006 following the procedures outlined in the Work Plan. A Phase III diver-assisted algal collection and taxonomic evaluation was conducted in June 2006.

Certified scientific divers from the U.S. EPA Environmental Response Team conducted the dive surveys. In June, a total of 18 dives were made in four specific areas of Bay Harbor Lake (Figure 4). These areas were selected for characterization as they were the most likely to be affected by leachate and were broadly representative of the lake basin. The first area was the western finger and along the western shoreline and the beach area. The second area was in the vicinity of the Bay Harbor Yacht Club piers. The third area included the large and deep central portion of the basin and the south central shoreline. The fourth area consisted of the floating dock area in southeastern portion of the lake.

In October, a total of 12 dives were made in three specific areas of Bay Harbor Lake (Figure 5). The first two areas surveyed were similar to the June surveys, but the third was restricted to the near shore area. The southeastern floating dock area was not evaluated.

2.3.2 Dive Survey Techniques

Divers were dressed in vulcanized rubber Viking dry suits with integrated hoods and dry gloves, and used positive pressure full-face breathing masks. In this dress, the divers were completely encapsulated and no skin was exposed to the water. The divers were deployed using air supplied from the surface through a 300-foot umbilical line. The umbilical line also contained a hardwired communication system that enabled the divers to communicate in real time with surface team members.

For most dives, the dive vessel was moored to a dock or pier while a second vessel patrolled the periphery of the survey area. The diver entered the water from the vessel, swam on the surface to the survey area, and descended to the bottom. The diver proceeded slowly along the bottom as directed by the dive master, and at regular intervals, systematically traversed the survey area to fully characterize that lake bottom. When the diver reached the maximum length of umbilical line, he returned to the starting point and, as directed by the dive master, proceeded to survey in a different orientation from the same mooring, or the diver exited the water and dive vessel was repositioned in another area. The dive master tracked the divers' movements by observing surfacing exhalation bubbles and the direction and length of umbilical line deployed, and controlled changes in the survey orientation through direct communication with the diver.

During the June survey, the dives along the south central shore were conducted while live boating. While positioned along the south shore, the diver exited the boat and descended to the bottom. When the diver reached the bottom, slack umbilical line was played out and the boat slowly moved north as the diver swam along the bottom. The diver swam along the bottom at his own pace, which allowed for detailed observation of the subsurface environment and the freedom to stop and orally describe the bottom to the surface team. During the October deployment, the dives along the south central shore were conducted from a moored dive vessel and the central portion of the basin was not reevaluated.

Divers inspected the basin walls and offshore bottom of the lake to identify potential CKD leachate discharge areas, pockets of remnant CKD, and other features such as water discoloration, bedrock fracturing, dissolution cavities, and visible areas of upwelling groundwater and/or leachate. Additionally, divers looked for any abnormalities in physical and biological features that could result from exposure to CKD, CKD leachate, and elevated pH. These features could include the staining of sediment and rock, deposition of precipitate, and changes in normal behavioral patterns or unusual characteristics of species and biological communities. The divers were instructed to describe any of these features to the support boat crew via the diver communication system so that the observations and GPS coordinates could be recorded in a logbook.

2.3.3 Diver-Assisted Water Quality Evaluation

During the dive surveys, a YSI model 650 MDS multi-sensor water quality monitoring instrument or an In-Situ Troll 9000 Professional multi-sensor water quality monitoring instrument was used to collect real-time water quality measurements. The multi-sensor probes were hard wired using a 300-foot cable to a display and data logging unit on the surface. Both instruments contained sensors that measured pH, specific conductance, dissolved oxygen, oxidation-reduction potential (ORP), temperature, and depth. The multi-sensor probe was hand held by the diver, and the cable was fastened to the diver's umbilical line. This enabled the surface team to observe and record pH and other water quality parameters along with the diver's verbal description of the subsurface conditions. The monitoring results are discussed in Section 3. The water quality monitoring instruments were calibrated and operated as described in Section 2.2.

2.3.4 Diver-Assisted Unknown White Substance and Algae Sampling

Samples of material resembling the unknown white substance that was previously collected for the Bay Harbor Company and algae were collected on June 5 and June 6, 2006 by the dive team. Samples of the white substance were collected to confirm the identification and characteristics of the material that had been provided by GAP EnviroMicrobial Services. Samples were collected by hand or using forceps or a pipette, and were transferred to labeled plastic Petri dishes filled with lake water. Sample material was gathered from the lake bottom, hard structures such as rocks or pilings, or from mats floating on the lake surface. Portions of some samples, particularly the floating mats, were grey to white in color.

The sample material was evaluated in the field using a portable microscope. General characteristics of the samples were noted and a preliminary identification of the common species present was made. Following the field evaluation, the remaining sample material was transferred to a glass vial, preserved with ethanol alcohol, and returned to the laboratory for a more thorough evaluation. Descriptions and identification of the algal samples are provided in Section 3.

SECTION 3
RESULTS

3.1 Overview

This section presents a summary for the Bay Harbor Lake assessment field observations, water quality monitoring results, and white substance and algae evaluation.

3.2 Shoreline Surveys

3.2.1 Observations

During the Phase 1 shoreline surveys, field personnel did not observe any areas of discolored water. Algae were observed at most locations, both floating and attached to submerged rocks along the lakeshore. Zebra and/or quagga mussels were also observed at many locations.

3.2.2 Water Quality Monitoring

<u>May 9 to May 14, 2006 Shoreline Survey</u>

Water quality measurements were taken at 455 locations during the first round of the Phase I shoreline survey. The vast majority of the measurements were made along the shoreline of Bay Harbor Lake. There are seven stormwater, or outfall, drains located around the lake perimeter that also contained water. Water quality measurements were taken from the outfall drains at two locations when possible, at the outfall drain itself and at the shoreline location where the water from the drain discharged into the lake. Also, water quality measurements were collected in one shallow area of pooled water observed on the beach in the southwestern corner of Bay Harbor Lake. This was the only on-shore pool observed during the shoreline survey. Table 1 presents a summary of the shoreline survey monitoring measurements made in May 2006.

The pH of water along the lakeshore ranged from 7.8 to 8.3 and the pH of water in the outfall drains ranged from 7.7 to 8.1. The specific conductance recorded along the lakeshore was between 283 and 783 μs/cm and in the outfall drains was between 307 and 1,194 μs/cm. Specific conductance along the lakeshore had a tendency to be elevated if the location was adjacent to an outfall containing water with high suspended solids. However, at distances greater than 25 feet from the outfalls, the specific conductance fell into a narrow range between 283 and 342 μs/cm.

<u>October 23 to October 25, 2006 Shoreline Survey</u>

Water quality measurements were taken at 106 locations during the second round of the Phase I shoreline survey. Again, the vast majority of the measurements were made along the shoreline at Bay Harbor Lake. Only five out of seven outfall drains previously monitored contained enough water to obtain measurements. Shoreline locations where the drain water discharged into the lake were also monitored. Water quality measurements were also taken in two fountains on the beach of Bay Harbor Lake. Table 2 presents a summary of the shoreline survey monitoring measurements made in October 2006.

The pH of water along the lakeshore and in the outfall drains ranged from 7.4 to 8.1. The specific conductance recorded along the lakeshore was between 293 and 471 μs/cm and in the outfall drains was between 300 and 885 μs/cm. Specific conductance along the shoreline had a tendency to be slightly elevated near outfall locations containing water with high concentrations of solids; such results are normal for stormwater outfalls due to runoff.

3.3 Dive Surveys

3.3.1 Observations

For field documentation purposes, photographs were taken with digital cameras in several of the dive areas (Appendix C).

3.3.1.1 Physical Characteristics of Bay Harbor Lake

Seven dives totaling 247 minutes were conducted in the western finger, and along the western shoreline and beach area of Bay Harbor Lake (Figure 4 and Table 3, Dives 1-5; Figure 5 and Table 4, Dives 1-2). The depth in this area ranges from 11 to 14 feet. A rock riprap wall is present along most portions of the shoreline and the bottom is flat with little relief. The visibility in the area was typically greater than 35 feet which made clear observations of the subsurface environment possible. The rock riprap walls throughout most of the area were covered with a thick, biofilm mixed with fine sediment. A biofilm is a somewhat slimy layer of free-floating microorganisms that attach to and grow on any hard surface including, rocks, pilings and boat hulls. The lake bottom typically consisted of a ½- to 1-inch thick veneer of silty sand over a hard packed gravel and rock substrate with an occasional gravel to softball-sized piece of rock. The color of the sediment was generally light tan to brown and was uniformly flat and featureless. Small patches of disturbed and discolored sediment caused by the feeding activity of fish were noted throughout the area.

Fourteen dives totaling 482 minutes were conducted in the vicinity of the Bay Harbor Yacht Club piers (Figure 4 and Table 3, Dives 6-13 and Dive 18; Figure 5 and Table 4, Dives 5-8). The depth in this area ranged from 10 to 41 feet and the visibility was typically greater than 25 feet. The area between the piers is relatively flat with a uniform bottom, and the deeper areas were found near the central and eastern piers (Piers C, D, and E). The bottom consists of a 2- to 6-inch layer of silty sand over a hard packed gravel and rock substrate with an occasional gravel to softball-sized piece of rock or construction debris. As observed in the western area, small patches of disturbed and discolored sediment caused by the feeding activity of fish were noted throughout this area. In the central portion of the pier area, a forested patch remains and remnants of rooted trees rise 20 feet or more above the lake bottom.

North of Piers A and B, Bay Harbor Lake transitions across a rock ledge into to a deeper basin that slopes gently to the northeast. The rock ledge is an almost vertical cut that ranges up to 15 feet above the adjacent bottom and is a relict of the former quarrying operation. A former haul road bed appears to follow the northern base of the ledge. The face of the rock ledge is highly irregular with many deep cracks and crevices. Although sloping gently downward to the north, the lake bottom north of the rock ledge is relatively uniform in nature and a fine, silty sediment overlays a packed gravel and rock substrate. Even in the deepest areas surveyed, the visibility was typically greater than 25 feet. As observed near the piers, remnants of rooted trees are still present in this area.

Six dives totaling 143 minutes (Figure 4 and Table 3, Dives 14-16; Figure 5 and Table 4, Dives 9-11) were conducted in the central portion of Bay Harbor Lake and along the south central shoreline. This area is the deepest portion of the lake, with depths up to 70 feet or more less than

50 feet from shore. Due to the clarity of the water, visibility, even at the deepest depths, was greater than 15 feet. As observed north of the pier area, the bottom in the central portion of the lake showed signs of previous quarrying operations. The morphology in this area is fairly complex and former quarry haul roads or ridges, several feet above the adjacent bottom, are present and run parallel to the long axis of the lake basin. The bottom was covered by a layer of silty sand over a hard packed gravel and stone substrate. Remnants of rooted trees were observed sporadically across the bottom and large rocks and boulders are strewn about this area. While still somewhat undulating, the bottom slopes upward from mid-basin toward a steep and almost vertical rock wall that rises steeply from the lake bottom. This rock wall delineates the northern extent of the former quarry, and forms the shore of the lake.

In June, one dive totaling 36 minutes (Figure 4 and Table 3, Dive 17) was conducted around the floating dock area in the western portion of Bay Harbor Lake. This area was not surveyed during the October deployment. Although the maximum depth noted was 66 feet, the typical lake depth in the dock area was 30 feet or less. The bottom in this area was flat with little relief. The visibility was less than 25 feet because the sky was heavily overcast with light rain so there was less available light than during other dives. The sediment consisted of a ½- to 1-inch layer of silty sand over a hard packed gravel and rock substrate. The color of the sediment was light tan to brown and the bottom was flat and featureless. The rock and other structures throughout the area were covered with a thick biofilm and inorganic sediment.

3.3.1.2 Biological Characteristics of Bay Harbor Lake

Although a number of fish were occasionally observed, including bass, sunfish, and trout, the round goby (*Neogobius melanostomus*) was ubiquitous and present in high numbers throughout most of the areas less than 40 feet in depth. Round gobies are opportunistic bottom feeders and will often disturb the upper layers of sediment when feeding. The discolored patches of disturbed sediment observed by the divers were probably the result of goby feeding behavior while in contact with the bottom.

Crayfish, zebra and/or quagga mussels, and other benthic invertebrates were observed in the interstices of the rock riprap, on the pilings in the Bay Harbor Yacht Club area, and on submerged trees and hard substrate.

Discrete and isolated patches of filamentous green algae were noted on the lake bottom. These patches measured up to 24 inches in diameter and, when present, were relatively dense. Most hard substrates, including rocks, pilings, and remnant trees, were coated with a thick biofilm that consisted primarily of attached filamentous algae. Due to the shallow depth and clarity of the water, algae patches were actively photosynthesizing as evidenced by the release of oxygen bubbles. Occasionally, the bubbles became entrapped in the filamentous matrix and, due to the increased buoyancy, the patch was suspended in the water column or floated on the surface. In the deepest portions of the lake, the biofilm and algae patches noted in shallower areas were also present, but were less dense due to the increased water depth.

3.3.2 Water Quality Monitoring

Divers, equipped with the multi-sensor probe, surveyed the lake and described the subsurface environment as the surface team monitored the display unit and datalogger. Overall, the pH of Bay Harbor Lake ranged from 6.9 to 8.7 and the specific conductance was recorded between 142 and 844 µs/cm. A summary of the monitoring results are shown in Tables 3 and 4.

During the June dive survey, the pH in the western finger and along the western shoreline and beach area of Bay Harbor Lake ranged from 6.9 to 8.3 and the specific conductance was recorded between 211 and to 844 µs/cm. During the October dive survey, the pH in these areas ranged from 7.1 to 8.6 and the specific conductance was recorded between 302 and 725 µs/cm.

In the vicinity of the Bay Harbor Yacht Club piers during the June dive survey, the pH ranged from 6.9 to 8.5 and the specific conductance was recorded between 203 and 313 µs/cm. During the October dive survey, the pH ranged from 6.9 to 8.5 and the specific conductance was recorded between 142 and 559 µs/cm.

During the June dive survey, the pH in the central portion of Bay Harbor Lake and along the south central shoreline ranged from 7.5 to 8.7 and the specific conductance was recorded between 240 and 320 μs/cm. During the October dive survey, the pH in these areas ranged from 7.4 to 8.5 and the specific conductance was recorded between 254 and 285 μs/cm. In the vicinity of the floating dock area in the western portion of Bay Harbor Lake, the pH ranged from 7.4 to 8.3 and the specific conductance was recorded between 249 and 522 μs/cm during the June dive survey.

3.3.3 Algal Matter Evaluation

Samples of biofilm, attached filamentous algae, and floating green and white to grey material were collected from a number of locations in Bay Harbor Lake. These samples were qualitatively evaluated in the field and laboratory and were taxonomically characterized (Table 5). In general, most samples were dominated by the green filamentous algae *Spirogyra*; however, *Ulothrix*, *Microspore*, *Oedogonium*, and *Cladophoria* were noted as well. A number of small, microscopic organisms were present in the biofilm and the filamentous algal matrix. These included single-celled and colonial green algae, and diatoms. Dense patches of the green algae *Chara* were noted in the deeper portions of the lake north of the Bay Harbor Yacht Club piers. Although many of the taxa observed in previous studies were noted in the current investigation, the fungus *Alternaria* which made up the majority of the white organic matter described in the GAP EnviroMicrobial Services Report, was not observed in the current investigation.

SECTION 4
CONCLUSIONS AND RECOMMENDATIONS

4.1 Overview

This section presents the Bay Harbor Lake assessment conclusions and recommendations, which are based on the results of the conducted shoreline survey and dive survey activities and biological observations.

4.2 Conclusions

4.2.1 Visual Observations

No unusual visual observations were noted during the shoreline or dive surveys.

4.2.2 Water Quality Monitoring Summary

The results of the water quality monitoring (Tables 1–4) conducted during the shoreline surveys and dive surveys show pH and specific conductance measurements were below the expected range of values associated with CKD or CKD leachate (pH of 9 to 12 and specific conductance between 500 to 5,500 μs/cm).

Michigan surface water quality standards require surface water pH to be between 6.5 and 9 for human contact and aquatic ecosystem protection. Measurements of pH ranged from 7.4 to 8.3 in the near shore water, as measured during the shoreline surveys, and ranged from 6.9 to 8.7 in the deeper portions of Bay Harbor Lake, as measured during the dive survey. All pH measurements were within the range of acceptable water quality standards and indicate that CKD or CKD leachate are not present in Bay Harbor Lake.

Generally, specific conductance values were within the range of 280 to 340 μs/cm. Specific conductance readings were observed as high as 1,194 μs/cm in the near shore water and 844 μs/cm in the deeper portions of Bay Harbor Lake. These elevated readings may be the result of stormwater runoff which can carry a significant amount of dissolved and suspended solids from the surrounding land surfaces into the lake. Although these higher measurements of specific conductance were occasionally made, the readings were not observed in conjunction with elevated pH, and do not by themselves indicate the presence of CKD or CKD leachate.

4.2.3 Substrate Ecology

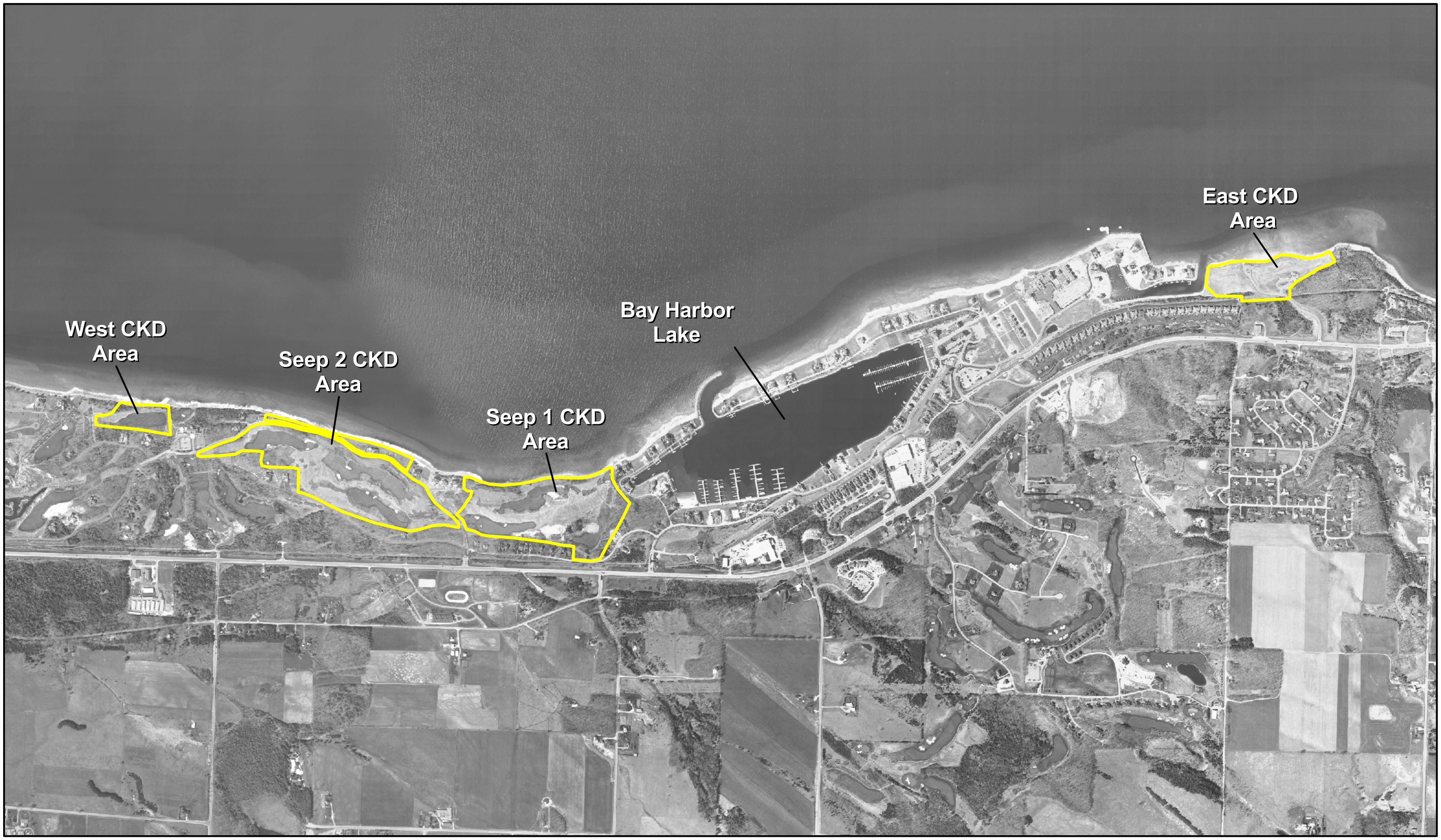
A number of fish species were noted in Bay Harbor Lake including bass, sunfish, and trout. The round goby is an introduced species and is the dominant fish observed throughout the study area. Algae, biofilm, and white substance samples were collected and qualitatively evaluated in the field and in a laboratory. The samples were dominated by green filamentous algae along with single-celled and colonial green algae species and diatoms.

With a number of exceptions, and based on the data collected in this investigation, the ecological condition of Bay Harbor Lake reflects the characteristics of the Great Lakes in general. However, it is important to keep in mind that the lake is man-made and less than 10 years old, and does not support the biological growth commonly observed in natural or more mature water bodies. The sediment, even in shallow, near shore areas is highly mineral in nature and does not support the diversity and abundance of organisms that may be observed in Little Traverse Bay. This is understandable; the lake was a former quarry and lake conditions reflect the water quality as well as the physical and biological characteristics of a newly created water body.

4.3 Recommendations

Since the visual and water quality monitoring results of the shoreline surveys and dive surveys and the algae characterization showed no evidence of the presence of CKD or CKD leachate in Bay Harbor Lake, and since all pH measurements were within the range of acceptable water quality standards, further lake assessment activities identified in the phased Work Plan are not required. Additional monitoring may be required if lake conditions change that could affect the findings of this report.

FIGURES



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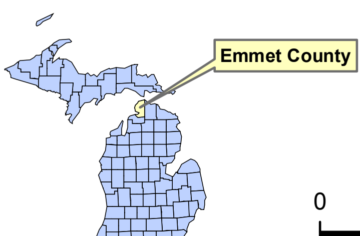
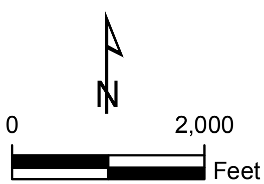




WESTON SOLUTIONS

2501 Jolly Road
Suite 100
Okemos, Michigan
48864

Figure: 1

SITE LOCATION MAP
Bay Harbor Lake
Little Traverse Bay CKD Site
Petoskey, Michigan

G:\GIS_Projects\LittleTraverseBay_CKD_Site\mxds\BayHarborLake\Fig1_SiteLocation_rev.mxd

LEGEND

Bay Harbor Lake pH Monitoring Locations

- pH value less than 9.0
- pH value greater than 9.0
- Outfall Drain location pH value less than 9.0
- Outfall Drain location pH value greater than 9.0

Notes:
Source of Data and Image: Barr Engineering

N

0 150 300 600 Feet
1:3,600

WESTON SOLUTIONS

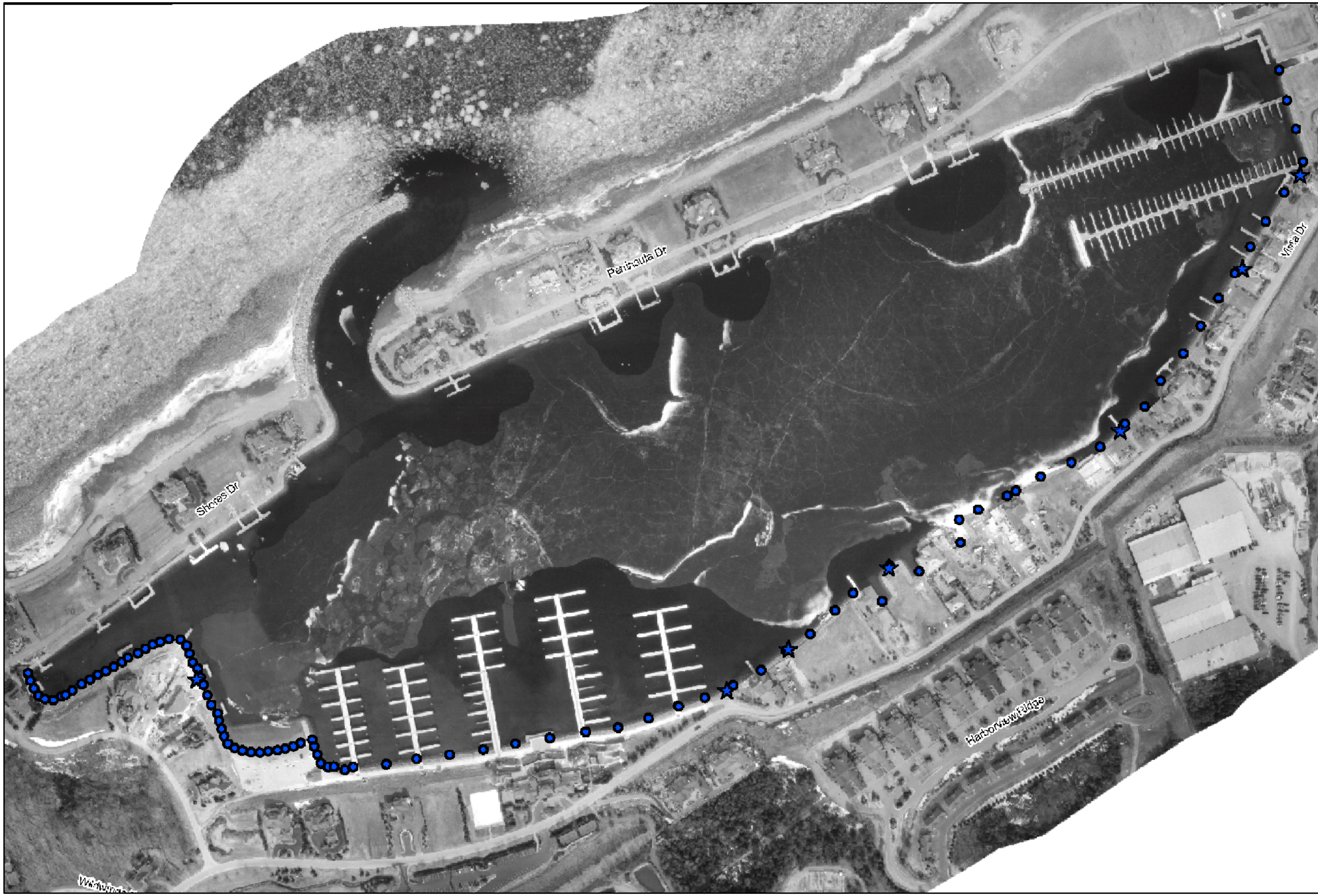
2501 Jolly Road
Suite 100
Okemos, Michigan

Shoreline Survey
Bay Harbor Lake
May, 2006
Little Traverse Bay CKD Site
Petoskey, Michigan

Figure:
2

J:\GIS_Projects\LittleTraverseBay_CKD_Site\mxds\BayHarborLake\Fig2_ShorelineSurvey_May06.mxd

Prepared By: KRB   Revised: 05/17/07



LEGEND

Bay Harbor Lake pH Monitoring Locations

- ● pH value less than 9.0 (blue)
- ● pH value greater than 9.0 (red)
- ★ Outfall Drain and Fountain Locations - pH value less than 9.0 (blue)
- ★ Outfall Drain and Fountain Locations - pH value greater than 9.0 (red)

Notes:
Source of Data and Image: Barr Engineering

N

0 150 300 600 Feet
1:3,600

WESTON SOLUTIONS
2501 Jolly Road
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Okemos, Michigan

Shoreline Survey
Bay Harbor Lake
October, 2006
Little Traverse Bay CKD Site
Petoskey, Michigan

Figure: **3**

J:\GIS_Projects\LittleTraverseBay_CKD_Site\mxds\BayHarborLake\Fig3_ShorelineSurvey_Oct06.mxd

Prepared By: KRB Revised: 05/17/07

LEGEND

- GPS Location
- Path of Diver Survey Completed With Boat Underway
- Dive Survey Completed From Fixed Point
- **18** Trip Dive Number
- A Harbor Pier Identifier

Notes:
Date of Aerial Photograph: 2004

N

0 150 300 600 Feet
1:3,600

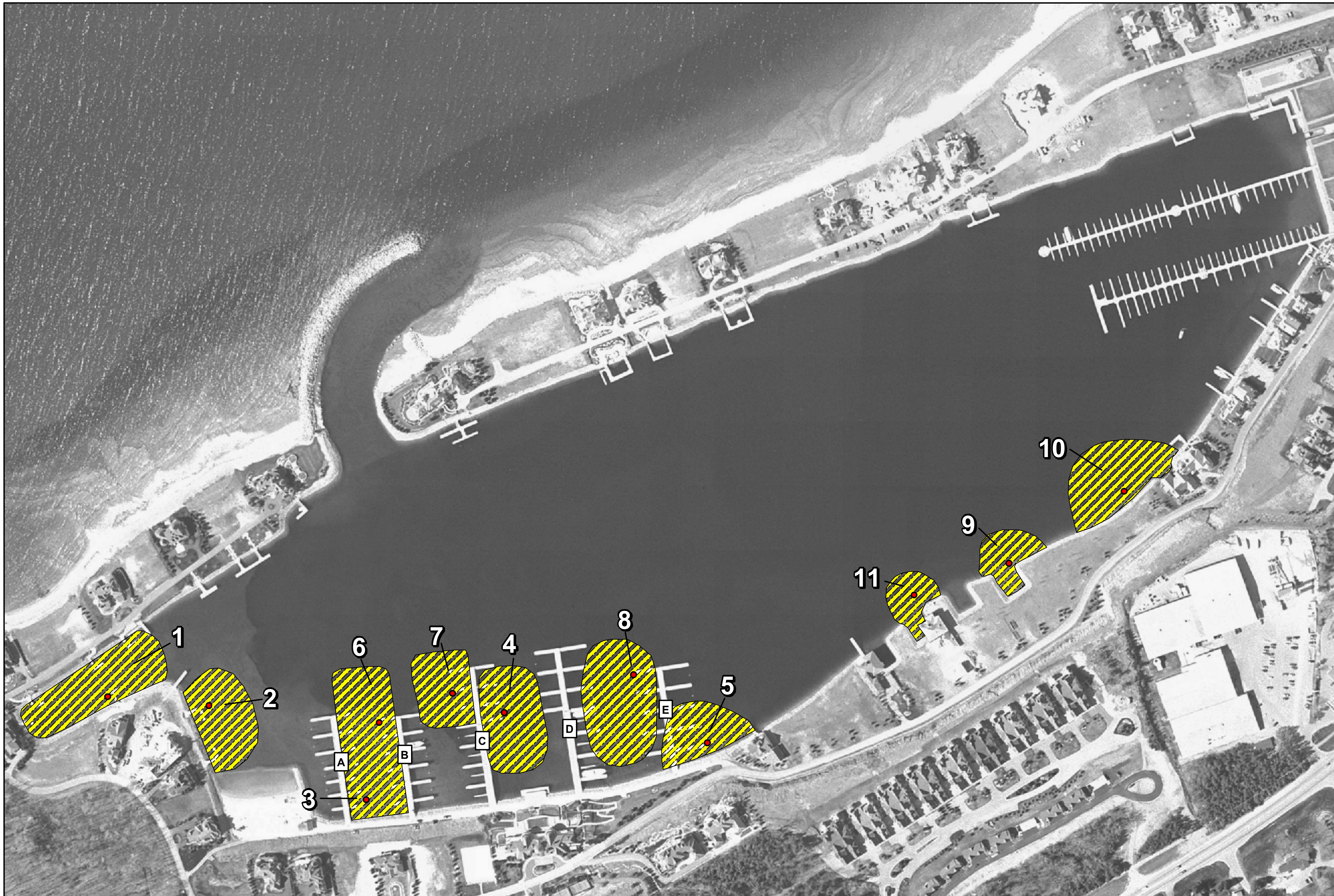
WESTON SOLUTIONS
2501 Jolly Road
Suite 100
Okemos, Michigan

Dive Survey
Bay Harbor Lake
June, 2006
Little Traverse Bay CKD Site
Petoskey, Michigan

Figure: 4

G:\GIS_Projects\LittleTraverseBay_CKD_Site\mxds\BayHarborLake\Fig4_DiveSurvey_June06.mxd

Prepared By: KRB   Revised: 06/07/07



LEGEND

GPS Location

Approximate Dive Survey Area

10 Trip Dive Number

A Harbor Pier Identifier

Notes:
Date of Aerial Photograph: 2004

N

0 150 300 600 Feet
1:3,600

WESTON SOLUTIONS

2501 Jolly Road
Suite 100
Okemos, Michigan

Dive Survey
Bay Harbor Lake
October, 2006
Little Traverse Bay CKD Site
Petoskey, Michigan

Figure:
5

G:\GIS_Projects\LittleTraverseBay_CKD_Site\mxds\BayHarborLake\Fig5_DiveSurvey_Oct06.mxd

Prepared By: KRB   Revised: 06/07/07

TABLES

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A0000.00.00	05/09/2006	8.1	306
BHLL.A0000.00.00	05/09/2006	7.9	312
BHLL.A0000.00.05	05/09/2006	8.1	306
BHLL.A0025.00.00	05/09/2006	8.2	309
BHLL.A0050.00.00	05/09/2006	8.2	300
BHLL.A0075.00.00	05/09/2006	8.3	309
BHLL.A0100.00.00	05/09/2006	8.2	309
BHLL.A0125.00.00	05/09/2006	8.3	309
BHLL.A0150.00.00	05/09/2006	8.2	309
BHLL.A0175.00.00	05/09/2006	8.2	309
BHLL.A0200.00.00	05/09/2006	8.2	309
BHLL.A0225.00.00	05/09/2006	8.2	310
BHLL.A0250.00.00	05/09/2006	8.2	310
BHLL.A0275.00.00	05/09/2006	8.2	310
BHLL.A0300.00.00	05/09/2006	8.2	311
BHLL.A0325.00.00	05/09/2006	8.3	310
BHLL.A0350.00.00	05/09/2006	8.2	310
BHLL.A0375.00.00	05/09/2006	8.3	309
BHLL.A0400.00.00	05/09/2006	8.2	309
BHLL.A0425.00.00	05/09/2006	8.2	310
BHLL.A0450.00.00	05/09/2006	8.2	310
BHLL.A0475.00.00	05/09/2006	8.2	309
BHLL.A0500.00.00	05/09/2006	8.3	310
BHLL.A0525.00.00	05/09/2006	8.3	310
BHLL.A0550.00.00	05/09/2006	8.3	309
BHLL.A0575.00.00	05/09/2006	8.3	311
BHLL.A0600.00.00	05/09/2006	8.3	317
BHLL.A0625.00.00	05/09/2006	8.2	323
BHLL.A0650.00.00	05/09/2006	8.3	316
BHLL.A0662.00.00	05/09/2006	8.2	460
BHLL.A0675.00.00	05/09/2006	8.2	310
BHLL.A0700.00.00	05/09/2006	8.3	309
BHLL.A0725.00.00	05/09/2006	8.2	305
BHLL.A0750.00.00	05/09/2006	8.2	310
BHLL.A0775.00.00	05/09/2006	8.2	311

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A0800.00.00	05/09/2006	8.2	310
BHLL.A0825.00.00	05/09/2006	8.2	310
BHLL.A0850.00.00	05/09/2006	8.2	312
BHLL.A0875.00.00	05/09/2006	8.2	312
BHLL.A0900.00.00	05/11/2006	8.1	301
BHLL.A0925.00.00	05/11/2006	8.1	304
BHLL.A0950.00.00	05/11/2006	8.0	302
BHLL.A0975.00.00	05/11/2006	8.0	302
BHLL.A1000.00.00	05/11/2006	8.1	301
BHLL.A1025.00.00	05/11/2006	8.1	302
BHLL.A1050.00.00	05/11/2006	8.1	310
BHLL.A1075.00.00	05/11/2006	8.1	305
BHLL.A1100.00.00	05/11/2006	8.0	306
BHLL.A1125.00.00	05/11/2006	8.1	302
BHLL.A1150.00.00	05/13/2006	8.1	304
BHLL.A1150.00.05	05/13/2006	8.1	304
BHLL.A1150.00.10	05/13/2006	8.1	305
BHLL.A1175.00.00	05/13/2006	8.1	304
BHLL.A1175.00.05	05/13/2006	8.1	305
BHLL.A1200.00.00	05/11/2006	8.0	306
BHLL.A1225.00.00	05/11/2006	8.0	303
BHLL.A1250.00.00	05/11/2006	8.1	303
BHLL.A1275.00.00	05/11/2006	8.0	305
BHLL.A1300 (Outfall Drain)	05/11/2006	7.9	892
BHLL.A1300.00.00	05/11/2006	8.0	783
BHLL.A1325.00.00	05/11/2006	8.1	337
BHLL.A1350.00.00	05/11/2006	8.1	321
BHLL.A1375.00.00	05/11/2006	8.1	307
BHLL.A1400.00.00	05/13/2006	8.1	304
BHLL.A1400.00.05	05/13/2006	8.1	305
BHLL.A1425.00.00	05/11/2006	8.1	303
BHLL.A1450.00.00	05/11/2006	8.1	305
BHLL.A1475.00.00	05/11/2006	8.1	303
BHLL.A1500.00.00	05/11/2006	8.0	304
BHLL.A1525.00.00	05/11/2006	8.0	306

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A1550.00.00	05/11/2006	7.9	311
BHLL.A1575.00.00	05/11/2006	8.0	304
BHLL.A1600.00.00	05/11/2006	8.1	303
BHLL.A1625.00.00	05/11/2006	8.1	303
BHLL.A1650.00.00	05/12/2006	7.8	306
BHLL.A1675.00.00	05/12/2006	7.9	303
BHLL.A1700.00.00	05/12/2006	7.9	304
BHLL.A1725.00.00	05/13/2006	8.1	305
BHLL.A1725.00.05	05/13/2006	8.1	305
BHLL.A1725.00.10	05/13/2006	8.1	305
BHLL.A1750.00.00	05/13/2006	8.1	305
BHLL.A1750.00.05	05/13/2006	8.1	305
BHLL.A1775.00.00	05/13/2006	8.1	305
BHLL.A1775.00.05	05/13/2006	8.1	305
BHLL.A1800.00.00	05/12/2006	8.1	303
BHLL.A1825.00.00	05/12/2006	8.0	305
BHLL.A1850.00.00	05/12/2006	8.0	307
BHLL.A1875.00.00	05/12/2006	8.0	303
BHLL.A1900.00.00	05/12/2006	8.1	303
BHLL.A1925.00.00	05/12/2006	8.0	301
BHLL.A1950.00.00	05/13/2006	8.1	305
BHLL.A1950.00.05	05/13/2006	8.1	306
BHLL.A1950.00.10	05/13/2006	8.1	305
BHLL.A1975.00.00	05/13/2006	8.1	304
BHLL.A1975.00.05	05/13/2006	8.1	305
BHLL.A1975.00.10	05/13/2006	8.1	306
BHLL.A2000.00.00	05/13/2006	8.1	306
BHLL.A2025.00.00	05/13/2006	8.1	308
BHLL.A2050.00.00	05/13/2006	8.1	308
BHLL.A2075.00.00	05/13/2006	8.1	309
BHLL.A2075.00.05	05/13/2006	8.1	309
BHLL.A2100.00.00	05/12/2006	8.1	305
BHLL.A2125.00.00	05/12/2006	8.1	305
BHLL.A2150.00.00	05/12/2006	8.1	305
BHLL.A2175.00.00	05/12/2006	8.1	302

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A2200.00.00	05/12/2006	8.1	299
BHLL.A2225.00.00	05/12/2006	8.2	303
BHLL.A2239 (Outfall Drain)	05/12/2006	7.9	759
BHLL.A2250.00.00	05/12/2006	8.2	308
BHLL.A2275.00.00	05/12/2006	8.1	303
BHLL.A2300.00.00	05/12/2006	8.1	303
BHLL.A2325.00.00	05/12/2006	8.1	303
BHLL.A2350.00.00	05/12/2006	8.1	283
BHLL.A2375.00.00	05/12/2006	8.1	308
BHLL.A2400.00.00	05/13/2006	8.1	305
BHLL.A2400.00.05	05/13/2006	8.1	305
BHLL.A2425.00.00	05/13/2006	8.2	305
BHLL.A2425.00.05	05/13/2006	8.1	305
BHLL.A2450.00.00	05/13/2006	8.2	304
BHLL.A2450.00.05	05/13/2006	8.1	304
BHLL.A2475.00.00	05/13/2006	8.2	306
BHLL.A2500.00.00	05/12/2006	8.0	323
BHLL.A2500.00.00	05/13/2006	8.1	305
BHLL.A2525.00.00	05/12/2006	8.1	307
BHLL.A2550.00.00	05/12/2006	8.1	306
BHLL.A2575.00.00	05/12/2006	8.1	305
BHLL.A2600.00.00	05/12/2006	8.1	306
BHLL.A2625.00.00	05/12/2006	8.1	306
BHLL.A2650.00.00	05/12/2006	8.0	316
BHLL.A2675.00.00	05/12/2006	8.1	306
BHLL.A2700.00.00	05/12/2006	8.1	308
BHLL.A2725.00.00	05/12/2006	8.1	305
BHLL.A2735 (Outfall Drain)	05/12/2006	8.0	766
BHLL.A2735.00.00	05/12/2006	8.1	761
BHLL.A2750.00.00	05/12/2006	8.2	324
BHLL.A2775.00.00	05/12/2006	8.1	306
BHLL.A2800.00.00	05/12/2006	8.1	304
BHLL.A2825.00.00	05/12/2006	8.2	302
BHLL.A2850.00.00	05/12/2006	8.2	302
BHLL.A2875.00.00	05/12/2006	8.1	303

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A2900.00.00	05/12/2006	8.1	305
BHLL.A2925.00.00	05/12/2006	7.9	311
BHLL.A2950.00.00	05/12/2006	8.1	303
BHLL.A2960 (Outfall Drain)	05/12/2006	8.0	320
BHLL.A2960.00.00	05/12/2006	8.0	511
BHLL.A2975.00.00	05/12/2006	8.0	308
BHLL.A3000.00.00	05/12/2006	8.0	301
BHLL.A3025.00.00	05/12/2006	8.0	298
BHLL.A3050.00.00	05/12/2006	8.0	296
BHLL.A3075.00.00	05/12/2006	7.9	302
BHLL.A3100.00.00	05/12/2006	8.1	295
BHLL.A3125.00.00	05/12/2006	8.0	295
BHLL.A3150.00.00	05/12/2006	8.0	294
BHLL.A3175.00.00	05/12/2006	8.0	295
BHLL.A3200.00.00	05/12/2006	8.1	296
BHLL.A3225.00.00	05/12/2006	8.0	296
BHLL.A3250.00.00	05/12/2006	8.0	301
BHLL.A3275.00.00	05/12/2006	8.0	297
BHLL.A3300.00.00	05/12/2006	8.0	299
BHLL.A3325.00.00	05/12/2006	7.8	308
BHLL.A3350.00.00	05/12/2006	8.0	297
BHLL.A3375.00.00	05/12/2006	8.1	296
BHLL.A3400.00.00	05/12/2006	8.0	296
BHLL.A3425.00.00	05/12/2006	7.8	299
BHLL.A3450.00.00	05/12/2006	8.0	296
BHLL.A3475.00.00	05/12/2006	8.0	297
BHLL.A3500.00.00	05/12/2006	7.8	321
BHLL.A3525.00.00	05/12/2006	8.1	297
BHLL.A3525.00.05	05/12/2006	8.1	297
BHLL.A3525.00.10	05/12/2006	8.0	303
BHLL.A3550.00.00	05/12/2006	8.1	297
BHLL.A3550.00.05	05/12/2006	8.1	301
BHLL.A3550.00.10	05/12/2006	8.1	307
BHLL.A3575.00.00	05/12/2006	8.1	301
BHLL.A3575.00.05	05/12/2006	8.1	304

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A3575.00.10	05/12/2006	8.1	305
BHLL.A3600.00.00	05/12/2006	8.1	308
BHLL.A3625.00.00	05/12/2006	8.1	309
BHLL.A3650.00.00	05/12/2006	8.1	313
BHLL.A3667.00.00	05/12/2006	7.9	411
BHLL.A3670 (Outfall Drain)	05/12/2006	7.8	417
BHLL.A3670.00.00	05/12/2006	7.8	417
BHLL.A3675.00.00	05/12/2006	7.9	415
BHLL.A3700.00.00	05/12/2006	8.0	297
BHLL.A3725.00.00	05/12/2006	8.2	295
BHLL.A3750.00.00	05/12/2006	8.1	296
BHLL.A3775.00.00	05/12/2006	8.2	296
BHLL.A3800.00.00	05/12/2006	8.1	295
BHLL.A3825.00.00	05/12/2006	8.1	296
BHLL.A3850.00.00	05/12/2006	8.1	296
BHLL.A3875.00.00	05/12/2006	8.1	296
BHLL.A3900.00.00	05/12/2006	8.2	296
BHLL.A3925.00.00	05/12/2006	8.2	296
BHLL.A3950.00.00	05/12/2006	8.2	296
BHLL.A3975.00.00	05/12/2006	8.2	298
BHLL.A4000.00.00	05/12/2006	8.2	297
BHLL.A4025.00.00	05/12/2006	8.0	302
BHLL.A4050.00.00	05/12/2006	8.1	297
BHLL.A4075.00.00	05/12/2006	8.1	300
BHLL.A4100.00.00	05/12/2006	8.1	298
BHLL.A4125.00.00	05/13/2006	8.1	307
BHLL.A4150.00.00	05/13/2006	8.1	307
BHLL.A4175.00.00	05/13/2006	8.1	308
BHLL.A4200.00.00	05/13/2006	8.1	307
BHLL.A4225.00.00	05/13/2006	8.1	306
BHLL.A4250.00.00	05/13/2006	8.1	307
BHLL.A4275.00.00	05/13/2006	8.1	307
BHLL.A4300.00.00	05/13/2006	8.1	307
BHLL.A4325.00.00	05/13/2006	8.1	307
BHLL.A4350.00.00	05/13/2006	8.2	307

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A4375.00.00	05/13/2006	8.1	308
BHLL.A4400.00.00	05/13/2006	8.1	308
BHLL.A4425.00.00	05/13/2006	8.1	309
BHLL.A4450.00.00	05/13/2006	8.1	308
BHLL.A4475.00.00	05/13/2006	8.1	308
BHLL.A4500.00.00	05/13/2006	8.1	309
BHLL.A4525.00.00	05/13/2006	8.1	308
BHLL.A4550.00.00	05/13/2006	8.1	308
BHLL.A4575.00.00	05/13/2006	8.1	308
BHLL.A4586.P1 (Pool)	05/13/2006	8.1	307
BHLL.A4600.00.00	05/13/2006	8.1	305
BHLL.A4625.00.00	05/13/2006	8.1	308
BHLL.A4650.00.00	05/13/2006	8.1	309
BHLL.A4675.00.00	05/13/2006	8.1	308
BHLL.A4700.00.00	05/13/2006	8.1	307
BHLL.A4725.00.00	05/13/2006	8.1	308
BHLL.A4750.00.00	05/13/2006	8.1	308
BHLL.A4775.00.00	05/13/2006	8.1	307
BHLL.A4800.00.00	05/13/2006	8.1	308
BHLL.A4825.00.00	05/13/2006	8.1	306
BHLL.A4830 (Outfall Drain)	05/13/2006	8.1	307
BHLL.A4850.00.00	05/13/2006	8.1	306
BHLL.A4875.00.00	05/13/2006	8.1	307
BHLL.A4900.00.00	05/13/2006	8.1	306
BHLL.A4925.00.00	05/13/2006	8.1	307
BHLL.A4950.00.00	05/13/2006	8.1	309
BHLL.A4975.00.00	05/13/2006	8.1	308
BHLL.A5000.00.00	05/13/2006	8.1	314
BHLL.A5025.00.00	05/13/2006	8.1	312
BHLL.A5050.00.00	05/13/2006	8.1	318
BHLL.A5075.00.00	05/13/2006	8.1	318
BHLL.A5100.00.00	05/13/2006	8.1	318
BHLL.A5125.00.00	05/13/2006	8.1	318
BHLL.A5150.00.00	05/13/2006	8.1	319
BHLL.A5175.00.00	05/13/2006	8.0	319

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.A5200.00.00	05/13/2006	8.0	319
BHLL.A5225.00.00	05/13/2006	8.0	322
BHLL.A5250.00.00	05/13/2006	8.0	323
BHLL.AP1 (Outfall Drain)	05/09/2006	7.7	1194
BHLL.B0000.00.00	05/09/2006	8.2	342
BHLL.B0000.00.00	05/09/2006	8.2	311
BHLL.B0000.00.05	05/09/2006	8.2	311
BHLL.B0025.00.00	05/09/2006	8.2	310
BHLL.B0050.00.00	05/09/2006	8.3	309
BHLL.B0075.00.00	05/09/2006	8.3	311
BHLL.B0100.00.00	05/09/2006	8.2	310
BHLL.B0125.00.00	05/09/2006	8.0	335
BHLL.B0150.00.00	05/09/2006	8.2	315
BHLL.B0175.00.00	05/09/2006	8.2	310
BHLL.B0200.00.00	05/09/2006	8.2	310
BHLL.B0225.00.00	05/09/2006	8.1	309
BHLL.B0250.00.00	05/09/2006	8.1	309
BHLL.B0275.00.00	05/09/2006	8.1	308
BHLL.B0300.00.00	05/09/2006	8.1	307
BHLL.B0325.00.00	05/09/2006	8.2	308
BHLL.B0350.00.00	05/09/2006	8.1	308
BHLL.B0375.00.00	05/09/2006	8.1	308
BHLL.B0400.00.00	05/09/2006	8.2	308
BHLL.B0425.00.00	05/09/2006	8.2	308
BHLL.B0450.00.00	05/09/2006	8.1	307
BHLL.B0475.00.00	05/09/2006	8.2	308
BHLL.B0500.00.00	05/09/2006	8.3	309
BHLL.B0525.00.00	05/09/2006	8.3	308
BHLL.B0550.00.00	05/09/2006	8.3	306
BHLL.B0575.00.00	05/09/2006	8.3	306
BHLL.B0600.00.00	05/09/2006	8.3	308
BHLL.B0625.00.00	05/09/2006	8.3	305
BHLL.B0650.00.00	05/09/2006	8.3	309
BHLL.B0675.00.00	05/09/2006	8.3	308
BHLL.B0700.00.00	05/09/2006	8.3	308

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.B0725.00.00	05/09/2006	8.3	305
BHLL.B0750.00.00	05/09/2006	8.3	306
BHLL.B0775.00.00	05/09/2006	8.3	305
BHLL.B0800.00.00	05/09/2006	8.3	307
BHLL.B0825.00.00	05/09/2006	8.3	309
BHLL.B0850.00.00	05/09/2006	8.3	302
BHLL.B0875.00.00	05/09/2006	8.3	307
BHLL.B0900.00.00	05/09/2006	8.2	309
BHLL.B0925.00.00	05/09/2006	8.3	307
BHLL.B0950.00.00	05/09/2006	8.3	307
BHLL.B0975.00.00	05/09/2006	8.3	307
BHLL.B1000.00.00	05/09/2006	8.3	306
BHLL.B1025.00.00	05/09/2006	8.3	305
BHLL.B1050.00.00	05/09/2006	8.2	309
BHLL.B1075.00.00	05/09/2006	8.2	307
BHLL.B1100.00.00	05/09/2006	8.3	307
BHLL.B1125.00.00	05/09/2006	8.3	305
BHLL.B1150.00.00	05/09/2006	8.2	377
BHLL.B1175.00.00	05/09/2006	8.3	305
BHLL.B1200.00.00	05/09/2006	8.2	319
BHLL.B1225.00.00	05/09/2006	8.3	313
BHLL.B1250.00.00	05/09/2006	8.3	307
BHLL.B1275.00.00	05/09/2006	8.3	305
BHLL.B1300.00.00	05/09/2006	8.2	313
BHLL.B1325.00.00	05/09/2006	8.3	308
BHLL.B1350.00.00	05/09/2006	8.3	308
BHLL.B1375.00.00	05/09/2006	8.3	305
BHLL.B1400.00.00	05/09/2006	8.3	305
BHLL.B1425.00.00	05/09/2006	8.3	305
BHLL.B1450.00.00	05/09/2006	8.3	306
BHLL.B1475.00.00	05/09/2006	8.3	306
BHLL.B1500.00.00	05/09/2006	8.3	305
BHLL.B1525.00.00	05/10/2006	8.0	306
BHLL.B1550.00.00	05/10/2006	8.0	307
BHLL.B1575.00.00	05/10/2006	8.1	307

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.B1600.00.00	05/10/2006	8.0	307
BHLL.B1625.00.00	05/10/2006	8.1	306
BHLL.B1650.00.00	05/10/2006	8.1	307
BHLL.B1675.00.00	05/10/2006	8.1	307
BHLL.B1700.00.00	05/10/2006	8.1	307
BHLL.B1725.00.00	05/10/2006	8.1	307
BHLL.B1750.00.00	05/10/2006	8.1	307
BHLL.B1775.00.00	05/10/2006	8.0	307
BHLL.B1800.00.00	05/10/2006	8.1	308
BHLL.B1825.00.00	05/10/2006	8.1	307
BHLL.B1850.00.00	05/10/2006	8.0	311
BHLL.B1875.00.00	05/10/2006	8.1	307
BHLL.B1900.00.00	05/10/2006	8.1	310
BHLL.B1925.00.00	05/10/2006	8.1	308
BHLL.B1950.00.00	05/10/2006	8.1	308
BHLL.B1975.00.00	05/10/2006	8.1	310
BHLL.B2000.00.00	05/10/2006	8.1	308
BHLL.B2025.00.00	05/10/2006	8.1	307
BHLL.B2050.00.00	05/10/2006	8.1	307
BHLL.B2075.00.00	05/10/2006	8.1	307
BHLL.B2100.00.00	05/10/2006	8.1	308
BHLL.B2125.00.00	05/10/2006	8.1	306
BHLL.B2150.00.00	05/10/2006	8.1	308
BHLL.B2175.00.00	05/10/2006	8.1	308
BHLL.B2200.00.00	05/10/2006	8.1	307
BHLL.B2225.00.00	05/10/2006	8.1	307
BHLL.B2250.00.00	05/10/2006	8.1	305
BHLL.B2275.00.00	05/10/2006	8.1	307
BHLL.B2300.00.00	05/10/2006	8.1	307
BHLL.B2325.00.00	05/10/2006	8.2	307
BHLL.B2350.00.00	05/10/2006	8.1	307
BHLL.B2375.00.00	05/10/2006	8.2	307
BHLL.B2400.00.00	05/10/2006	8.2	307
BHLL.B2425.00.00	05/10/2006	8.1	309
BHLL.B2450.00.00	05/10/2006	8.1	307

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.B2475.00.00	05/10/2006	8.1	308
BHLL.B2500.00.00	05/10/2006	8.1	309
BHLL.B2525.00.00	05/10/2006	8.1	309
BHLL.B2550.00.00	05/10/2006	8.1	308
BHLL.B2575.00.00	05/10/2006	8.1	310
BHLL.B2600.00.00	05/10/2006	8.2	306
BHLL.B2625.00.00	05/10/2006	8.2	306
BHLL.B2650.00.00	05/10/2006	8.1	307
BHLL.B2675.00.00	05/10/2006	8.1	307
BHLL.B2700.00.00	05/10/2006	8.1	307
BHLL.B2725.00.00	05/10/2006	8.1	306
BHLL.B2750.00.00	05/10/2006	8.1	306
BHLL.B2775.00.00	05/10/2006	8.2	306
BHLL.B2800.00.00	05/10/2006	8.2	303
BHLL.B2825.00.00	05/10/2006	8.2	308
BHLL.B2850.00.00	05/10/2006	8.1	306
BHLL.B2875.00.00	05/10/2006	8.1	307
BHLL.B2900.00.00	05/10/2006	8.2	305
BHLL.B2925.00.00	05/10/2006	8.2	308
BHLL.B2950.00.00	05/10/2006	8.2	305
BHLL.B2975.00.00	05/10/2006	8.2	306
BHLL.B3000.00.00	05/10/2006	8.2	307
BHLL.B3025.00.00	05/10/2006	8.2	312
BHLL.B3050.00.00	05/14/2006	8.2	284
BHLL.B3050.00.05	05/14/2006	8.0	303
BHLL.B3050.00.10	05/14/2006	8.1	303
BHLL.B3075.00.00	05/14/2006	8.2	287
BHLL.B3075.00.05	05/14/2006	8.0	302
BHLL.B3075.00.10	05/14/2006	8.1	303
BHLL.B3100.00.00	05/14/2006	8.1	284
BHLL.B3100.00.05	05/14/2006	8.1	302
BHLL.B3100.00.10	05/14/2006	8.1	303
BHLL.B3125.00.00	05/14/2006	8.1	283
BHLL.B3125.00.05	05/14/2006	7.8	302
BHLL.B3125.00.10	05/14/2006	7.9	303

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.B3150.00.00	05/14/2006	8.1	298
BHLL.B3150.00.05	05/14/2006	8.1	303
BHLL.B3150.00.10	05/14/2006	8.1	303
BHLL.B3175.00.00	05/14/2006	8.1	294
BHLL.B3175.00.05	05/14/2006	8.0	303
BHLL.B3175.00.10	05/14/2006	8.0	303
BHLL.B3200.00.00	05/14/2006	8.1	303
BHLL.B3200.00.05	05/14/2006	8.1	303
BHLL.B3200.00.10	05/14/2006	8.0	303
BHLL.B3225.00.00	05/10/2006	8.1	302
BHLL.B3250.00.00	05/10/2006	8.1	303
BHLL.B3275.00.00	05/10/2006	8.2	303
BHLL.B3300.00.00	05/10/2006	8.2	304
BHLL.B3325.00.00	05/10/2006	8.2	304
BHLL.B3350.00.00	05/10/2006	8.2	303
BHLL.B3375.00.00	05/10/2006	8.2	303
BHLL.B3400.00.00	05/10/2006	8.2	304
BHLL.B3425.00.00	05/10/2006	8.1	304
BHLL.B3450.00.00	05/10/2006	8.1	302
BHLL.B3475.00.00	05/10/2006	8.1	303
BHLL.B3500.00.00	05/10/2006	8.2	303
BHLL.B3525.00.00	05/10/2006	8.2	303
BHLL.B3550.00.00	05/10/2006	8.2	303
BHLL.B3575.00.00	05/10/2006	8.2	303
BHLL.B3600.00.00	05/10/2006	8.2	303
BHLL.B3625.00.00	05/10/2006	8.2	303
BHLL.B3650.00.00	05/10/2006	8.2	303
BHLL.B3675.00.00	05/10/2006	8.2	306
BHLL.B3700.00.00	05/10/2006	8.2	304
BHLL.B3725.00.00	05/10/2006	8.2	303
BHLL.B3750.00.00	05/10/2006	8.2	303
BHLL.B3775.00.00	05/10/2006	8.2	306
BHLL.B3800.00.00	05/10/2006	8.2	302
BHLL.B3825.00.00	05/10/2006	8.2	304
BHLL.B3850.00.00	05/10/2006	8.2	304

Table 1
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
May 2006

Location	Date	pH standard units	Specific Conductance µs/cm
BHLL.B3875.00.00	05/10/2006	8.2	303
BHLL.B3900.00.00	05/10/2006	8.2	303
BHLL.B3925.00.00	05/10/2006	8.2	304
BHLL.B3950.00.00	05/10/2006	8.2	302
BHLL.B3975.00.00	05/10/2006	8.2	306
BHLL.B4000.00.00	05/10/2006	8.2	309
BHLL.B4025.00.00	05/10/2006	8.2	307
BHLL.B4050.00.00	05/10/2006	8.2	306
BHLL.B4075.00.00	05/10/2006	8.1	305
BHLL.B4100.00.00	05/10/2006	8.1	307
BHLL.B4125.00.00	05/10/2006	8.2	308
BHLL.B4150.00.00	05/10/2006	8.2	308
BHLL.B4175.00.00	05/10/2006	8.2	308
BHLL.B4200.00.00	05/10/2006	8.1	308
BHLL.B4225.00.00	05/10/2006	8.1	310
BHLL.B4250.00.00	05/10/2006	8.1	312
BHLL.B4275.00.00	05/10/2006	8.1	323
BHLL.B4300.00.00	05/10/2006	8.1	311
BHLL.B4325.00.00	05/10/2006	8.2	311
BHLL.B4350.00.00	05/10/2006	8.2	310
BHLL.B4375.00.00	05/10/2006	8.1	310
BHLL.B4400.00.00	05/10/2006	8.1	288
BHLL.B4425.00.00	05/10/2006	8.1	305
BHLL.B4450.00.00	05/10/2006	8.2	308
BHLL.B4475.00.00	05/10/2006	8.2	318
BHLL.B4500.00.00	05/10/2006	8.2	309
BHLL.B4525.00.00	05/10/2006	8.2	320
BHLL.B4550.00.00	05/10/2006	8.2	316
BHLL.B4575.00.00	05/10/2006	8.1	320
BHLL.B4600.00.00	05/10/2006	8.2	316
BHLL.B4625.00.00	05/10/2006	8.1	316
BHLL.B4650.00.00	05/10/2006	8.2	310
BHLL.B4675.00.00	05/10/2006	8.1	315
BHLL.B4700.00.00	05/10/2006	8.1	312
BHLL.B4725.00.00	05/10/2006	8.1	306

Table 2
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
October 2006

Location	Date	pH standard units	Specific Conductance µs/cm	Wave Height inches
BHLL.C0000.00.00	10/23/2006	8.0	317	0.25
BHLL.C0025.00.00	10/23/2006	7.8	334	0.25
BHLL.C0050.00.00	10/23/2006	7.4	434	0.25
BHLL.C0075.00.00	10/23/2006	7.5	406	0.25
BHLL.C0100.00.00	10/23/2006	7.6	347	0.25
BHLL.C0125.00.00	10/23/2006	7.9	319	0.25
BHLL.C0150.00.00	10/23/2006	7.8	316	0.25
BHLL.C0175.00.00	10/23/2006	7.9	323	0.25
BHLL.C0200.00.00	10/23/2006	7.9	319	0.25
BHLL.C0225.00.00	10/23/2006	7.9	328	0.25
BHLL.C0250.00.00	10/23/2006	7.7	358	0.25
BHLL.C0275.00.00	10/23/2006	7.8	312	0.25
BHLL.C0300.00.00	10/23/2006	7.9	305	0.25
BHLL.C0325.00.00	10/23/2006	8.0	305	0.25
BHLL.C0350.00.00	10/23/2006	8.0	303	0.25
BHLL.C0375.00.00	10/23/2006	8.0	303	0.25
BHLL.C0400.00.00	10/23/2006	8.0	303	0.25
BHLL.C0425.00.00	10/23/2006	8.0	302	0.25
BHLL.C0450.00.00	10/23/2006	8.0	305	0.25
BHLL.C0475.00.00	10/23/2006	7.9	302	0.25
BHLL.C0500.00.00	10/23/2006	8.0	301	0.25
BHLL.C0525.00.00	10/23/2006	7.9	301	0.25
BHLL.C0550.00.00	10/23/2006	8.0	302	0.25
BHLL.C0575.00.00	10/23/2006	8.0	302	0.25
BHLL.C0600.00.00	10/23/2006	8.0	303	0.25
BHLL.C0625.00.00	10/23/2006	7.9	300	0.25
BHLL.C0650 (Fountain)	10/23/2006	8.1	299	0.25
BHLL.C0650.00.00	10/23/2006	8.1	300	0.25
BHLL.C0675.00.00	10/23/2006	8.1	303	0.25
BHLL.C0700.00.00	10/23/2006	8.0	301	0.25
BHLL.C0725.00.00	10/23/2006	8.1	302	0.25
BHLL.C0750.00.00	10/23/2006	8.0	301	0.25
BHLL.C0775.00.00	10/23/2006	8.0	301	0.25

Table 2
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
October 2006

Location	Date	pH standard units	Specific Conductance µs/cm	Wave Height inches
BHLL.C0800.00.00	10/23/2006	8.1	301	0.25
BHLL.C0825.00.00	10/23/2006	8.1	301	0.25
BHLL.C0850.00.00	10/23/2006	8.1	307	0.25
BHLL.C0875.00.00	10/23/2006	8.0	297	0.25
BHLL.C0900.00.00	10/23/2006	8.1	300	0.25
BHLL.C0925.00.00	10/23/2006	8.1	291	0.25
BHLL.C0950.00.00	10/23/2006	8.1	300	1.25
BHLL.C0975.00.00	10/23/2006	8.0	299	1.25
BHLL.C1000.00.00	10/23/2006	8.1	301	1.25
BHLL.C1025.00.00	10/23/2006	8.1	300	1.25
BHLL.C1050.00.00	10/23/2006	8.1	297	1.25
BHLL.C1075.00.00	10/23/2006	8.1	299	1.25
BHLL.C1100.00.00	10/23/2006	8.0	298	1.25
BHLL.C1125.00.00	10/23/2006	8.1	300	1.25
BHLL.C1150.00.00	10/23/2006	8.1	301	1.25
BHLL.C1175.00.00	10/23/2006	8.1	301	1.25
BHLL.C1200.00.00	10/23/2006	7.9	323	1.25
BHLL.C1225 (Outfall Drain)	10/23/2006	8.1	300	1.25
BHLL.C1250.00.00	10/23/2006	8.1	300	1.25
BHLL.C1275.00.00	10/23/2006	8.0	307	1.25
BHLL.C1375.00.00	10/23/2006	8.1	302	1.25
BHLL.C1475.00.00	10/23/2006	8.1	301	1.25
BHLL.C1575.00.00	10/23/2006	8.1	301	1.25
BHLL.C1675.00.00	10/23/2006	8.0	311	1.25
BHLL.C1775.00.00	10/23/2006	8.1	304	1.25
BHLL.C1875.00.00	10/23/2006	8.0	324	1.25
BHLL.C1975.00.00	10/23/2006	8.0	302	1.25
BHLL.C2075.00.00	10/23/2006	8.1	302	1.25
BHLL.C2175.00.00	10/23/2006	8.1	301	1.25
BHLL.C2275.00.00	10/23/2006	8.1	301	1.25
BHLL.D0000.00.00	10/24/2006	8.0	303	0
BHLL.D0000.00.05	10/24/2006	8.0	303	0
BHLL.D0100.00.00	10/24/2006	7.9	321	0

Table 2
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
October 2006

Location	Date	pH standard units	Specific Conductance µs/cm	Wave Height inches
BHLL.D0200.00.00	10/24/2006	8.0	306	0
BHLL.D0300.00.00	10/24/2006	8.0	303	0
BHLL.D0345 (Fountain)	10/24/2006	8.0	300	0
BHLL.D0400.00.00	10/24/2006	8.0	299	0
BHLL.D0500.00.00	10/24/2006	8.0	299	0
BHLL.D0600.00.00	10/24/2006	8.0	298	0
BHLL.D0672 (Outfall Drain)	10/24/2006	7.4	700	0
BHLL.D0700.00.00	10/24/2006	8.0	311	0
BHLL.D0800.00.00	10/24/2006	8.0	300	0
BHLL.D0900.00.00	10/24/2006	8.0	308	0.5
BHLL.D1000.00.00	10/24/2006	7.9	323	0.5
BHLL.D1100.00.00	10/24/2006	8.0	301	0.5
BHLL.D1200.00.00	10/24/2006	8.0	307	0.5
BHLL.D1300.00.00	10/24/2006	7.7	358	0.5
BHLL.D1321 (Outfall Drain)	10/24/2006	8.0	885	0.5
BHLL.D1400.00.00	10/24/2006	7.9	319	0.5
BHLL.D1500.00.00	10/24/2006	8.0	298	0.5
BHLL.D1600.00.00	10/24/2006	7.9	307	0.5
BHLL.D1700.00.00	10/24/2006	8.0	302	0.5
BHLL.D1800.00.00	10/24/2006	8.0	302	0.5
BHLL.D1900.00.00	10/24/2006	8.0	303	0.5
BHLL.D2000.00.00	10/24/2006	7.9	308	0.5
BHLL.D2100.00.00	10/24/2006	7.9	305	0.5
BHLL.D2200.00.00	10/24/2006	7.8	312	0.5
BHLL.D2300.00.00	10/24/2006	8.0	305	0.5
BHLL.D2305 (Outfall Drain)	10/24/2006	7.8	557	0.5
BHLL.D2400.00.00	10/24/2006	7.7	345	0.5
BHLL.D2500.00.00	10/24/2006	8.0	305	0.5
BHLL.D2600.00.00	10/24/2006	7.8	330	0.5
BHLL.D2700.00.00	10/24/2006	7.9	322	1.5
BHLL.D2790 (Outfall Drain)	10/24/2006	7.9	794	1.5
BHLL.D2800.00.00	10/24/2006	8.0	471	1.5
BHLL.D2900.00.00	10/24/2006	8.0	303	2.5

Table 2
Shoreline Survey Data Summary
Bay Harbor Lake
Bay Harbor, Michigan
October 2006

Location	Date	pH standard units	Specific Conductance µs/cm	Wave Height inches
BHLL.D3000.00.00	10/24/2006	8.0	313	2.5
BHLL.D3033	10/24/2006	8.0	425	2.5
BHLL.D3100.00.00	10/24/2006	8.0	301	2.5
BHLL.E0000.00.00	10/25/2006	8.0	293	0.25
BHLL.E0100.00.00	10/25/2006	8.0	299	0.25
BHLL.E0200.00.00	10/25/2006	8.0	285	0.25
BHLL.E0300.00.00	10/25/2006	7.9	300	0.25

Table 3
Dive Log Summary
Bay Harbor Dive Assessment
Bay Harbor, Michigan
June 2006

Trip Dive Number	Date	Diver	Dive Master	Start Time	End Time	Bottom Time	Maximum Depth feet	Mode	Comments	Field Monitoring pH Min s.u.	pH Max s.u.	Specific Conductance Min umhos@25°C	Specific Conductance Max umhos@25°C
1	5-Jun-2006	Henry	Humphrey	13:11	13:40	0:29	12	Surface Supplied Air	West finger and shore	7.92	8.16	269.0	365.0
2	5-Jun-2006	Henry	Humphrey	14:02	14:28	0:26	11	Surface Supplied Air	West finger and shore	6.78	8.29	296.0	844.0
3	5-Jun-2006	Humphrey	Grossman	15:06	15:47	0:41	14	Surface Supplied Air	West finger and shore	8.12	8.23	284.0	305.0
4	5-Jun-2006	Humphrey	Grossman	16:08	16:40	0:32	14	Surface Supplied Air	West finger and shore	8.14	8.29	292.0	311.0
5	5-Jun-2006	Holderness	Humphrey	17:11	17:36	0:25	13	Surface Supplied Air	West finger and shore	7.52	8.25	211.0	308.0
6	5-Jun-2006	Holderness	Humphrey	17:53	18:18	0:25	11	Surface Supplied Air	Bay Harbor Yacht Club	8.18	8.27	203.0	306.0
7	6-Jun-2006	Grossman	Humphrey	9:03	9:45	0:42	30	Surface Supplied Air	Bay Harbor Yacht Club	7.47	7.92	237.0	268.0
8	6-Jun-2006	Grossman	Humphrey	10:00	10:46	0:44	30	Surface Supplied Air	Bay Harbor Yacht Club	6.92	8.51	241.0	283.0
9	6-Jun-2006	Henry	Humphrey	11:24	11:40	0:16	30	Surface Supplied Air	Bay Harbor Yacht Club	7.72	7.76	247.0	262.0
10	6-Jun-2006	Henry	Humphrey	11:55	12:48	0:53	38	Surface Supplied Air	Bay Harbor Yacht Club	7.58	8.18	225.0	282.0
11	6-Jun-2006	Humphrey	Henry	14:08	15:08	1:00	41	Surface Supplied Air	Bay Harbor Yacht Club	7.49	8.28	238.0	313.0
12	6-Jun-2006	Humphrey	Holderness	15:12	15:25	0:13	38	Surface Supplied Air	Bay Harbor Yacht Club	7.51	8.22	236.0	291.0
13	6-Jun-2006	Holderness	Humphrey	16:10	16:52	0:42	36	Surface Supplied Air	Bay Harbor Yacht Club	7.56	8.24	240.0	298.0
14	7-Jun-2006	Grossman	Humphrey	9:30	9:56	0:26	65	Surface Supplied Air	Central basin and south central shore	7.46	8.18	241.0	320.0
15	7-Jun-2006	Henry	Humphrey	10:35	10:58	0:23	70	Surface Supplied Air	Central basin and south central shore	7.46	8.24	240.0	292.0
16	7-Jun-2006	Humphrey	Henry	11:40	12:11	0:31	73	Surface Supplied Air	Central basin and south central shore	7.79	8.67	242.0	318.0
17	7-Jun-2006	Holderness	Humphrey	12:58	13:34	0:36	66	Surface Supplied Air	Western floating dock area	7.44	8.31	249.0	522.0
18	7-Jun-2006	Humphrey	Henry	15:44	16:14	0:30	31	SCUBA	Photography Pier B	8.00	8.27	247.0	281.0

Equipment: Surface Supplied Air, AGA Mask, Viking Dry Suit w/ Dry Gloves, Hardwired Communications
TROLL 9500 Pro with Rugged Reader Instrument Controller and 300' Rugged Twist Lock Cable, and
Outland UWS-3110 Underwater Video System

Table 4
Dive Log Summary
Bay Harbor Dive Assessment
Bay Harbor, Michigan
October 2006

Trip Dive Number	Date	Diver	Dive Master	Start Time	End Time	Bottom Time	Maximum Depth feet	Mode	Comments	Field Monitoring pH Min s.u.	pH Max s.u.	Specific Conductance Min umhos@25°C	Specific Conductance Max umhos@25°C
1	18-Oct-2006	Rhame	Humphrey	11:28	12:25	0:57	--	Surface Supplied Air	West finger and shore	7.05	8.63	724.8	303.9*
2	18-Oct-2006	Humphrey	Grossman	13:23	14:00	0:37	--	Surface Supplied Air	West finger and shore	7.99	8.31	368.6	302.1
3	18-Oct-2006	Grossman	McBurney	15:41	16:15	0:34	10	Surface Supplied Air	Bay Harbor Yacht Club	8.01	8.46	380.1	290.2
4	18-Oct-2006	Grossman	McBurney	16:26	16:52	0:26	30	Surface Supplied Air	Bay Harbor Yacht Club	7.72	8.34	559.0	297.6
5	18-Oct-2006	Grossman	McBurney	17:10	17:43	0:33	33	Surface Supplied Air	Bay Harbor Yacht Club	7.69	8.32	508.7*	296.7*
6	19-Oct-2006	McBurney	Grossman	10:00	10:30	0:30	20	Surface Supplied Air	Bay Harbor Yacht Club	7.80	8.15	265.0	141.7
7	19-Oct-2006	Humphrey	Grossman	11:10	11:40	0:30	30	Surface Supplied Air	Bay Harbor Yacht Club	7.77	8.30	293.9	253.1
8	19-Oct-2006	Humphrey	Grossman	11:55	12:29	0:34	40	Surface Supplied Air	Bay Harbor Yacht Club	6.91	8.21	540.5	149.0
9	19-Oct-2006	Rhame	Humphrey	14:38	15:08	0:30	65	Surface Supplied Air	South central shore	7.39	8.49	272.9	253.5
10	19-Oct-2006	Rhame	Humphrey	15:30	15:40	0:10	63	Surface Supplied Air	South central shore	8.02	8.39	285*	255*
11	19-Oct-2006	Rhame	Humphrey	16:06	16:29	0:23	47	Surface Supplied Air	South central shore	8.09	8.37	268.4	255.4

-- Not available
Equipment: Surface Supplied Air, AGA Mask, Viking Dry Suit w/ Dry Gloves, Hardwired Communications
TROLL 9500 Pro with Rugged Reader Instrument Controller and 300' Rugged Twist Lock Cable, and
Outland UWS-3110 Underwater Video System
* Data outliers were removed

Table 5
Taxa Observed in Unknown White Substance and Algal Samples
Collected from Bay Harbor Lake
Bay Harbor, Michigan
June 2006

Division Chlorophyta

Ulothrix

Microspora

Stigeoclonium

Oedogonium

Cladophora

Scenedesmus

Spirogyra

Chara

Division Chrysophyta

Dinobryon

Melosira

Stephanodiscus

Rhizosolenia

Tabellaria

Fragilaria

Synedra

Asterionella

Cocconeis

Navicula

Gomphonema

Division Pyrrhophyta

Gymnodinium

Peridinium

Division Cryptophyta

Cryptomonas

Division Cyanophyta

Aphanocapsa

Taxonomic References:

Stoermer, E.F., Kreis, R.G. Jr. and Andresen, N.A. 1999. Checklist of diatoms from the Laurentian Great lakes. II. J. Great Lakes Res. 25:515-566.

Makarewicz, J.C., T. Lewis and P. Bertram. 1994. Plankton in Lake Michigan 1983 - 1992. EPA/GLNPO. Epilimnetic Phytoplankton and Zooplankton Biomass and Species Composition in Lake Michigan 1983 to 1992.

Patrick, R. and C.W. Reimer. 1966. The Diatoms of the United States, Exclusive of Alaska and Hawaii. Volume One: Fragilariaceae, Eunotiaceae, Achnanthaceae, Naviculaceae. Philadelphia, PA: The Academy of Natural Sciences.

Patrick, R. and C.W. Reimer. 1975. The Diatoms of the United States, Exclusive of Alaska and Hawaii. Volume Two, Part One: Entomoneidaceae, Cymbellaceae, Gomphonemaceae,

Epithemiaceae. Philadelphia, PA: The Academy of Natural Sciences.

Prescott, G.W. 1962. Algae of the Western Great Lakes Area. Wm. C. Brown Co., Inc.

Whitford, L.A. and G.J Schumacher. 1973. A Manual of Fresh-Water Algae. Sparks Press, In

APPENDIX A

PREVIOUS WATER QUALITY MONITORING DATA

COMPILED BY BAY HARBOR COMPANY

Bay Harbor Lake
Water Quality Sampling Chronology

- 1 Sample Collected by Voice Environmental on May 13, 2004
  Analyzed for pH, chloride, nitrate, total nitrogen, phosphorus, specific conductivity, ammonia, coliform, E. Coli, and gasoline constituents

- 3 Samples Collected by Tip of the Mitt Watershed Council on May 19, 2004
  Analyzed for pH, chloride, nitrate, total nitrogen, phosphorus, and specific conductivity

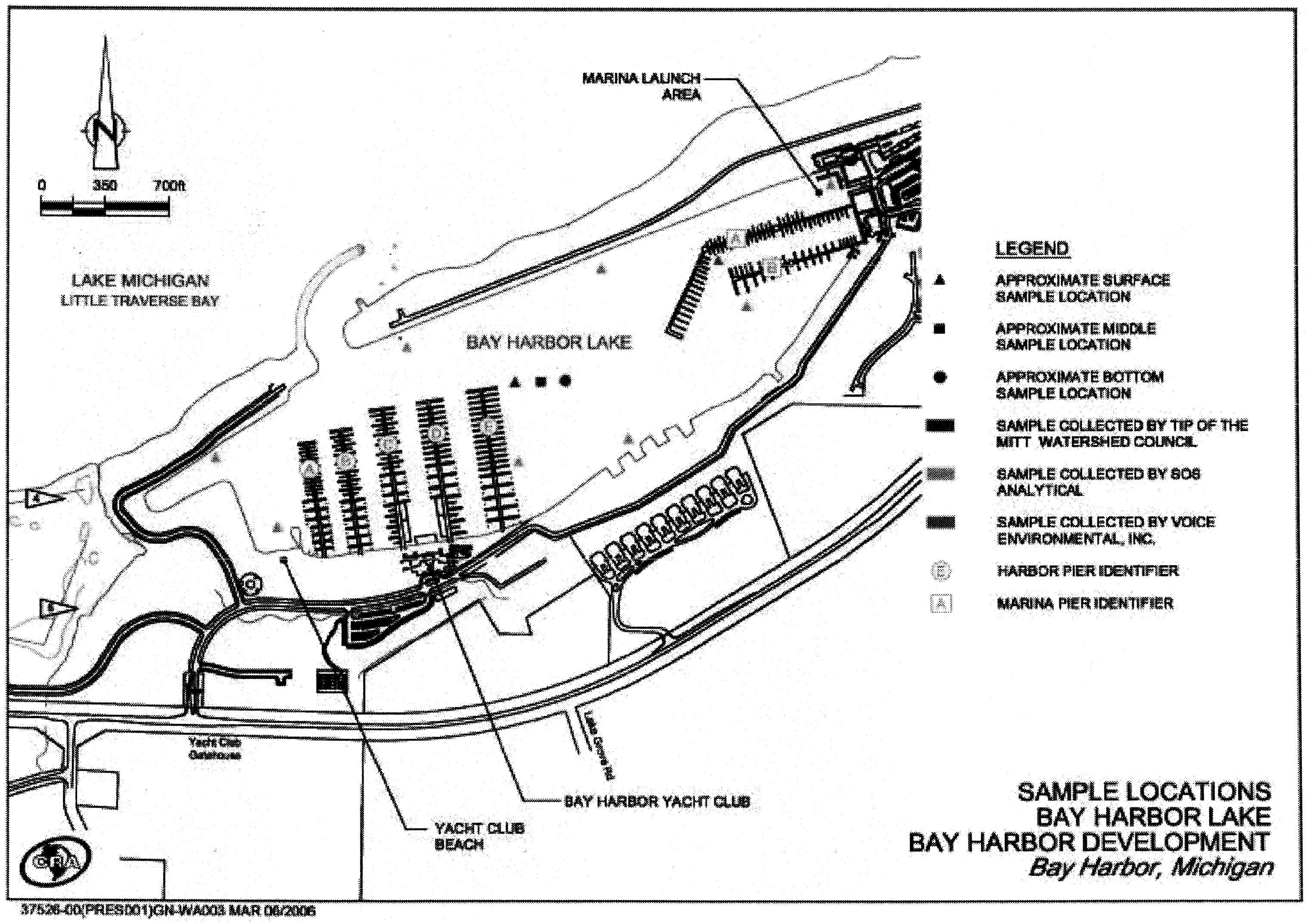
- 8 Samples Collected by SOS Analytical on July 9, 2004, August 9, 2004, and September 15, 2004
  Analyzed for nitrate, total nitrogen, phosphorus, ammonia, and E. Coli

- 8 pH Readings Taken by Conestoga-Rovers & Associates on October 11, 2004 and October 12, 2004

- 11 Samples Collected by SOS Analytical on April 21, 2005 and July 14, 2005
  Analyzed for pH, chloride, nitrate, nitrite, phosphorus, specific conductivity, ammonia, and E. Coli

All Results: None exceed the Michigan Water Quality Standards for drinking water or total body contact.

Bay Harbor Lake
Water Quality Sample Location Map



Bay Harbor Lake
Biological Data Summary/Evaluation

- One Sample Analyzed for Total Coliform Bacteria, by Voice Environmental
  Result of 5 CFU / 100 mL (Very Low Result)

- 19 Samples Analyzed for E. Coli, by SOS Analytical
  Results Ranged from 0 to 102 CFU / 100 mL
  No Criteria (130/300 CFU/100mL – 30 Day Geometric Mean/Beach Closure Limit) Exceeded

Biological Data is indicative of High Quality Water.

Bay Harbor Lake
Water Quality Data Summary

- pH (7.4 to 8.20 Standard pH Units)
- Chloride (11.9 to 16.1 mg/L)
- Nitrate (0.22 to 2.35 mg/L)
- Nitrite (Non-detect)
- Nitrogen (0.009 to 2.46 mg/L)
- Phosphorus (0.0027 to 0.09 mg/L)
- Specific Conductivity (149 to 341 uS/cm)
- Ammonia (Non-detect to 0.08 mg/L)
- Gasoline (Non-detect)

All Results: None exceed the Michigan Water Quality Standards for drinking water or total body contact.

Bay Harbor Lake
Water Quality Data Evaluation

- pH Levels Consistent with Background (i.e., No CKD Seeps)
- No Indication of CKD Located in Bay Harbor Lake

Analytical Results: None exceed the Michigan Water Quality Standards for drinking water or total body contact.

Water Quality Data is indicative of High Quality Water.

Water Quality Analysis
Bay Harbor Lake
2004

Site	Date	Sampler	Depth meters	Temp Celsius	DO mg/l	pH	SpCond uhmo/cm2	Nitrate mg/l	Total Nitrogen mg/l	Chloride mg/l	Total Phosphorus ug/l	Coliform Bacteria cfu/100ml	E. coli cfu/100ml	Fuel mg/l	Ammonia mg/l
Marina Pier A	5.13.04	SOS	surface			7.4	179	2.35	2.46	12	90	5	ND	ND	0.06
	10.12.04	CRA	surface			7.94									
Launch	7.9.04	SOS	surface					0.36	0.009		ND		2		ND
	8.9.04	SOS	surface					0.31	0.37		ND		102		0.06
	9.15.04	SOS	surface					0.26	0.26		ND		7		ND
	10.12.04	CRA	surface			7.94									
Yacht Club	7.9.04	SOS	surface					0.31	ND		ND		6		ND
	8.9.04	SOS	surface					0.33	0.39		ND		70		0.06
	9.15.04	SOS	surface					0.31	0.37		ND		29		0.06
Beach 2	8.9.04	SOS	surface					0.33	0.4		ND		42		0.07
	9.15.04	SOS	surface					0.3	0.03		ND		20		ND
Entry Channel	10.12.04	CRA	surface			8.17									
	10.12.04	CRA	surface			8.16									
end of Peninsula	10.12.04	CRA	surface			7.94									
end of Shores	10.12.04	CRA	surface			7.98									
Bay Harbor Lake	5.19.04	TOMWC	surface	10.54	10.98	8.17	279	0.264	0.33	12.3	2.8				
Little Traverse Bay	9.15.04	TOMWC	surface	8.69	11.46	8.23	260	0.238	0.32	10.4	3.1				
Grand Traverse Bay	5.7.04	TOMWC	surface	2.94	13.34	8.26	273	0.253	0.355	10.8	2.6				
Lake Charlevoix	5.11.04	TOMWC	surface	9.97	10.93	8.36	314.8	0.33	0.506	9.2	1.2				
Walloon Lake basin	5.15.04	TOMWC	surface	12.32	10.42	8.33	268	0.116	0.461	8.9	5.1				
(Wildwood Basin)															

Chloride drinking water limit	250	mg/L
E. coli beach closure limit	300	colonies/100mL
Nitrate drinking water limit	10	mg/L
Nitrite drinking water limit	1	mg/L
pH drinking water limit	6.5 - 8.5	
pH surface water limit	9	

DO = Dissolved Oxygen
SpCond = Specific Conductance
ND = Non Detect
SOS = SOS Analytical
TOMWC = Tip of The Mitt Watershed Council
CRA = Conestoga-Rovers & Associates

Tip Of The Mitt Watershed Council

Water quality sample data from Lake Michigan for 2004

Water Body	Date	Depth meters	Sample	Temp Celsius	DO mg/l	pH	SpCond uhmo/cm2	Nitrate mg/l	Nitrogen mg/l	Chloride mg/l	Phosphorus ug/l
Michigan, Little Traverse Bay	05/19/04	0.2	Surface	8.69	11.46	8.23	260.0	0.238	0.319	10.4	3.1
	05/19/04	27.1	Middle	4.06	12.51	8.22	255.3	0.250	0.336	10.6	2.3
	05/19/04	53.1	Bottom	3.92	12.19	8.41	255.1	0.241	0.312	10.7	2.5
Michigan, Grand Traverse Bay	05/07/04	0.0	Surface	2.94	13.34	8.26	273.5	0.253	0.355	10.8	2.6
	05/07/04	42.2	Middle	2.86	13.15	8.28	273.9	0.255	0.352	10.5	2.3
	05/07/04	105.5	Bottom	2.91	13.33	8.28	274.1	0.245	0.356	10.5	2.3
Michigan, Bay Harbor	05/19/04	0.1	Surface	10.54	10.98	8.17	279.4	0.264	0.330	12.3	2.8
	05/19/04	11.1	Middle	7.04	11.87	8.16	278.4	0.251	0.336	11.9	3.9
	05/19/04	21.4	Bottom	6.29	11.62	8.15	286.3	0.269	0.391	12.6	2.7

Chloride drinking water limit	250	mg/L
E. coli beach closure limit	300	colonies/100mL
Nitrate drinking water limit	10	mg/L
Nitrite drinking water limit	1	mg/L
pH drinking water limit	6.5 - 8.5	
pH surface water limit	9	

DO = Dissolved Oxygen
SpCond = Specific Conductance
ND = Non Detect

VOICE
Environmental Inc.
Science / Expertise / Creativity / Solutions

Ecological Consulting
Wetland Determinations & Permitting
Site & Project Planning

September 1, 2004

Dennis Brya
Construction Manager, Bay Harbor LLC
4000 Main Street
Bay Harbor, MI 49770

Re: Marina water quality samples

Mr. Brya:

Per you request, I sampled and tested the harbor/marina at Bay Harbor, on May 13, 2004. This letter outlines the results of this and other water samples.

Table 1. Results from samples taken May 13 and July 9, 2004. Also included are the results of two samples taken by the Tip of the Mitt Watershed Council (TMWC) within the Harbor and in Little Traverse Bay of Lake Michigan.

	Coliform Bacteria	E. coli	Gasoline mg/l	pH	Conductivity uhmo/cm^2	Chloride mg/l	Ammonia mg/l	Nitrate mg/l	Total Nitrogen mg/l	Total Phosphorus µg/l
May 13	5	ND	ND	7.4	179	12	0.06	2.35	2.46	90
July 9 Yacht		2					ND	.36	0.37	ND
Aug 9 Launch		102					.06	0.31	0.37	ND <50
Aug 9 Yacht		70					.06	.33	.39	ND <50
Aug 9 Beach 2		42					.07	.33	.4	ND <50
May 19 (TMWC)				8.17	279	12.3		0.264	0.33	2.8
L.T. Bay May 19 (TMWC)				8.23	260	10.4		0.238	0.32	3.1

ND – Not-Detected, ie. below detection limit

2004 pH Water Quality Data
As Reported on the Tip of the Mitt Watershed Council Web Site

Water Body	Test Date	pH Range
Bay Harbor Lake	05.19.04	8.15 - 8.17
Little Traverse Bay	05.19.04	8.22 - 8.41
Lake Charlevoix	05.11.04	8.29 - 8.36
Grand Traverse Bay	05.07.04	8.26 - 8.28
Walloon Lake (mutlple basins)	05.15.04	8.17 - 8.41
Torch Lake	05.06.04	8.29 - 8.31
Elk Lake	05.07.04	8.23 - 8.26
Lake Skegemog	05.07.04	8.37 - 8.38
Mullett Lake	05.05.04	8.23 - 8.26
Lake Bellaire	05.12.04	8.17 - 8.27
Douglas Lake	05.19.04	7.89 - 8.61

2005 pH Water Quality Data
Tests by SOS Analytical

Water Body	Test Date	pH Range
Bay Harbor Lake Data - 2005	4.21.05	8.0 - 8.1
Bay Harbor Yacht Club Beach	7.14.05	7.6 - 7.9
Little Traverse Bay Data - 2005	4.21.05	8.2 - 8.3
Village Harbor Lake Data - 2005	5.10.05	7.5 - 8.2

See attached map for test locations.

pH Drinking Water Limits 6.5 - 8.5

pH Surface Water Limits 6.5 - 9.0

Water Quality Analysis
Bay Harbor Lake and Village Harbor
2005

Site	Site #	Date	Sampler	Depth meters	Temp F	DO mg/l	pH	SpCond uhmo/cm2	Nitrate mg/l	Total Nitrogen mg/l	Chloride mg/l	Total Phosphorus ug/l	Coliform Bacteria cfu/100ml	E. coli cfu/100ml	Fuel mg/l	Ammonia mg/l
Bay Harbor Lake																
launch	1	4.21.05	SOS	surface	44.9		8	223	0.32	ND	15.2	0.09	not	0	not	ND
Marina pier b	2	4.21.05	SOS	surface	47.2		8.1	208	0.36	ND	16.1	ND	sampled	0	sampled	ND
mid Peninsula	3	4.21.05	SOS	surface	45.6		8.1	234	0.32	ND	15.3	ND		0		ND
end Peninsula	4	4.21.05	SOS	surface	44.8		8.1	149	0.33	ND	15.6	0.06		0		ND
mid Shores	5	4.21.05	SOS	surface	44.6		8.1	235	0.33	ND	15.4	ND		0		ND
YC beach	6a	4.21.05	SOS	surface	45.3		8.1	160	0.33	ND	15.5	ND		0		ND
	6a	7.14.05	SOS	surface			7.6	306	0.29	ND	12	ND		2		
	6b	4.21.05	SOS	surface	45.8		8.1	212	0.33	ND	15.5	ND		1		ND
	6b	7.14.05	SOS	surface			7.6	317	0.22	ND	12	ND		5		
	6c	7.14.05	SOS	surface			7.9	341	0.29	ND	12	ND		3		
YC pier E	7	4.21.05	SOS	surface	47.4		8.1	213	0.34	ND	16	ND		0		ND
Harborside	8	4.21.05	SOS	surface	47.1		8.1	207	0.33	ND	14.9	ND		0		ND
Village Harbor																
north docks	1	5.10.05	SOS	surface	45.2		7.5	446	0.37	ND	22	ND		ND		0.16
south docks	2	5.10.05	SOS	surface	44.5		7.9	435	0.39	ND	21	0.05		ND		0.21
mid entry	3	5.10.05	SOS	surface	45.8		8.1	432	0.39	ND	18	ND		ND		0.14
entry channel	4	5.10.05	SOS	surface	45.5		8.2	415	0.38	ND	18	0.06		ND		0.14
Little Traverse Bay																
mid Shores	9	4.21.05	SOS	surface	46.2		8.2	191	0.25	ND	12.1	ND		25		ND
entry channel	10	4.21.05	SOS	surface	43.1		8.2	192	0.26	ND	11.8	ND		0		ND
mid Peninsula	11	4.21.05	SOS	surface	42.4		8.3	176	0.26	ND	12.3	ND		1		0.06
2004 Results by Tip of The Mitt					c											
Bay Harbor Lake		5.19.04	TOMWC	surface	10.54	10.98	8.17	279	0.264	0.33	12.3	2.8				
Little Traverse Bay		9.15.04	TOMWC	surface	8.69	11.46	8.23	260	0.238	0.32	10.4	3.1				
Grand Traverse Bay		5.7.04	TOMWC	surface	2.94	13.34	8.26	273	0.253	0.355	10.8	2.6				
Lake Charlevoix		5.11.04	TOMWC	surface	9.97	10.93	8.36	314.8	0.33	0.506	9.2	1.2				
Walloon Lake (Wildwood Basin)		5.15.04	TOMWC	surface	12.32	10.42	8.33	268	0.116	0.461	8.9	5.1				

Chloride drinking water limit	250	mg/L
E. coli beach closure limit	300	colonies/100mL
Nitrate drinking water limit	10	mg/L
Nitrite drinking water limit	1	mg/L
pH drinking water limit	6.5 - 8.5	
pH surface water limit	9	

DO = Dissolved Oxygen
SpCond = Specific Conductance
ND = Non Detect
SOS = SOS Analytical
TOMWC = Tip of The Mitt Watershed Council
CRA = Conestoga-Rovers & Associates

APPENDIX B

PREVIOUS WHITE SUBSTANCE ANALYSIS REPORT

CONESTOGA-ROVERS
& ASSOCIATES

14496 Sheldon Road, Suite #200, Plymouth, MI 48170
Telephone: 734·453·5123 Facsimile: 734·453·5201
www.CRAworld.com

May 2, 2006

Reference No. 037526

Mr. Dennis Brya
Construction Manager
Bay Harbor Company
4000 Main Street
Bay Harbor, MI 49770

Dear Mr. Brya:

Re: "White Organic Matter" Biological Assessment
GAP EnviroMicrobial Services
Bay Harbor Lake

Consistent with your earlier request, we have had GAP EnviroMicrobial Services (GAP) conduct a biological assessment of a sample of the "white organic material" collected from the rocks at the bottom of Bay Harbor Lake.

The "white organic material" is a naturally occurring "plant like" organic growth found commonly in pristine water throughout the Great Lakes. It is indicative of the excellent water quality which exists in Bay Harbor Lake.

A copy of GAP's letter report, which presents a detailed assessment of the nature of the "white organic matter", is presented in Attachment A.

Should you have any questions regarding this attached letter report, please do not hesitate to contact me at (519) 884-0510.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Glenn Turchan, P. Eng.
Executive Vice President

GTT/cnb/1
Encl.

ATTACHMENT A

GAP LETTER REPORT

MAY 1, 2006

GAP EnviroMicrobial Services
a division of Conestoga-Rovers & Associates Ltd.

1020 Hargrieve Road, Unit 14
London, Ontario, Canada N6E 1P5
Telephone: (519) 681-0571
Fax: (519) 681-7150
Email: info@gapenviromic.com
Website: www.gapenviromic.com

CRA# 037526/GAP Project # 017500-A5450

May 1, 2006

Glenn Turchan, P. Eng.
Conestoga-Rovers & Associates
14496 Sheldon Rd. Suite 200
Plymouth, MI 48170

PROJECT NAME: ANALYSIS OF BAY HARBOR LAKE BIOLOGICAL SAMPLE

GAP EnviroMicrobial Services (GAP), a division of Conestoga-Rovers & Associates, received a biological sample from Bay Harbor Lake on March 31, 2006 for microscopic examination (GAP sample #2594). The sample matrix consisted of a gelatinous and slimy material that was partially a greenish-brown color with some portions being white or colorless. The sample material was aseptically removed from the sample bottle and placed into a sterile petri plate for macroscopic examination.

Figures 1 and 2 identify the appearance of the greenish-brown slimy material in the base of the petri dish. In comparison, Figure 3 presents an image of the same material recovered from bottom debris at Bay Harbor Lake immediately following sample collection. As an environmental microbiologist, it is my opinion that the sample received at the laboratory is very similar in color and structure to that shown on Figure 3. Digital images of the sample taken at the laboratory were obtained with a Nikon Coolpix 4500 camera.

Figure 1. Macroscopic image of gelatinous, slimy material in petri plate (Bay Harbor Lake sample, March 2006).

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Figure 2. Macroscopic image of gelatinous, slimy material, close up (Bay Harbor Lake sample, March 2006).

Figure 3. Macroscopic image of gelatinous, slimy material as observed immediately following sampling (Bay Harbor Lake sample, March 2006).

Following initial observation of the sample in the petri plate, the digital camera was fitted to a Nikon SMZ-1B stereomicroscope for examination at 8 to 35 × magnifications. Figure 4 shows the gelatinous, slimy material as it separates from the algal growth. Figure 5 shows that the gelatinous, slimy material is composed of a water mold. The large opaque spherical object to the right of the image is the sexual form of the mold. *Allomyces* can produce gametangia (sex cells) that appear very similar to what is observed in the sample.

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Figure. 4. Image of sample as observed with the stereomicroscope and black background at 8 × magnification (Bay Harbor Lake sample, March 2006)

Figure 5. Image of sample as observed with the stereomicroscope and black background at 35 × magnification (Bay Harbor Lake sample, March 2006).

The next phase of the examination involved aseptically placing several pieces (1 cm^2) of the slimy material onto a clean glass microscope slide and teasing the material apart using sterile examination needles in order to reveal each component of the material for identification purposes. Thirty µL aliquots of water from the sample bottle were dispensed onto each of the fragments of sample material on the microscope slide. Glass cover slips were then placed over the watery fragments for microscopic examination.

A Nikon Eclipse E600 microscope, providing phase contrast microscopy and Kohler illumination, was used for the examination. At 200 × magnification, each piece of sample material was examined. It was immediately evident that the slimy greenish-brown material

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consisted of decomposing chlorophyll from filaments of the green algae (*Ulothrix)* and from the many diatoms of *Navicula* spp. and *Fragilaria* spp. The diatom pigments appeared brownish which is consistent with the appearance of diatoms in fresh water. The filamentous green algae and diatoms however were only one component of the slimy, gelatinous material in which they were bound. The hyphae (colorless filaments) of *Alternaria* sp. make up the majority of the gelatinous slimy matrix.

Figures 6, 7, and 8 show the hyphae of the water mold with the green algae filaments and the diatoms amongst the gelatinous material at a magnification of 400 ×. Further examination at 1000 × magnification shows the water mold hyphae.

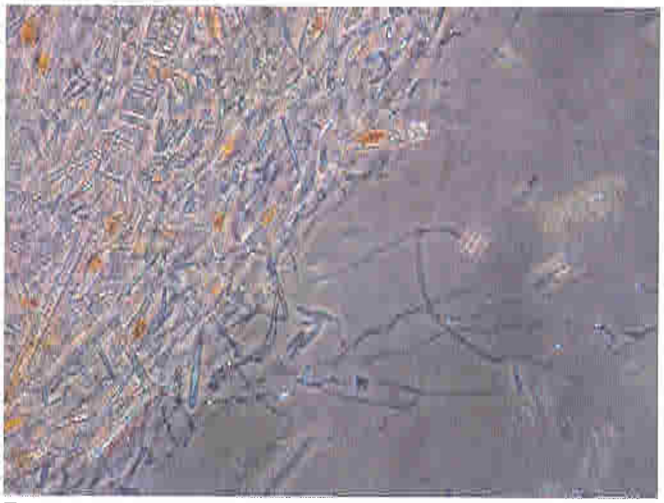

Figure 6. Microscopic image using phase contrast microscopy at 400 × magnification (Bay Harbor Lake sample, March 2006).

Figure 7. Microscopic image of diatoms using phase contrast microscopy at 400 × magnification (Bay Harbor Lake sample, March 2006).

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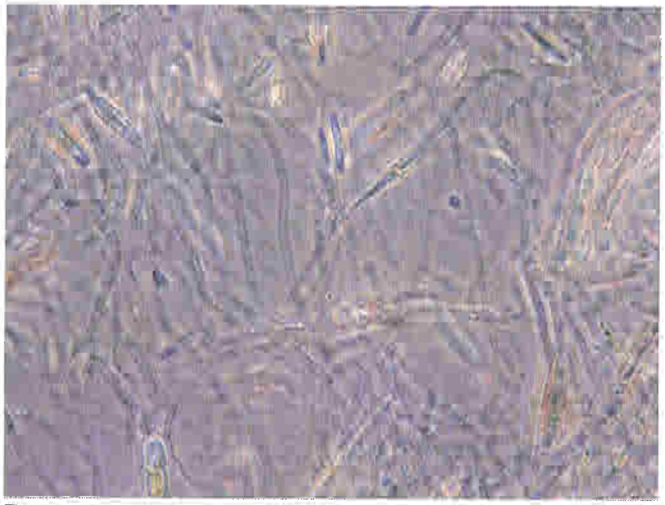

Figure 8. Microscopic image of water mold filaments (hyphae), diatoms and algae as observed at 400 × magnification (Bay Harbor Lake sample, March 2006).

Figure 9 shows the predominant diatoms in the sample at 1000 × magnification. Figure 10 again shows the gelatinous, slimy mass of hyphae of the water mold observed growing on the stones, pebbles, etc. on the bottom of Bay Harbor Lake.

Figure 9. Microscopic image of diatoms as observed at 1000 × magnification (Bay Harbor Lake sample, March 2006).

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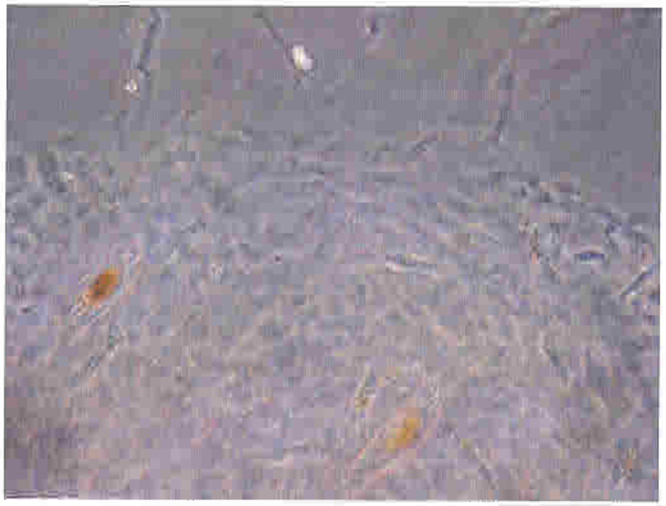

Figure 10. Microscopic image of the water mold hyphae as observed at 1000 × magnification (Bay Harbor Lake sample, March 2006).

Culturing and identification of the water mold was conducted in the laboratory using sterilized lake water (from Lake Huron) and pond water to mimic the natural growth environment. The organism was identified as *Alternaria* sp. and has been thoroughly examined using phase contrast microscopy and staining with lacto-aniline blue stain.

Figure 11 shows a microscopic image of the hyphae, which are long filaments of a mold that grows over the surface to which the mold is attached. Figure 12 shows the conidia under phase contrast microscopy at 400 × magnification. Conidia are asexual nucleate spores that are produced at the ends of the hyphae and are released into the environment.

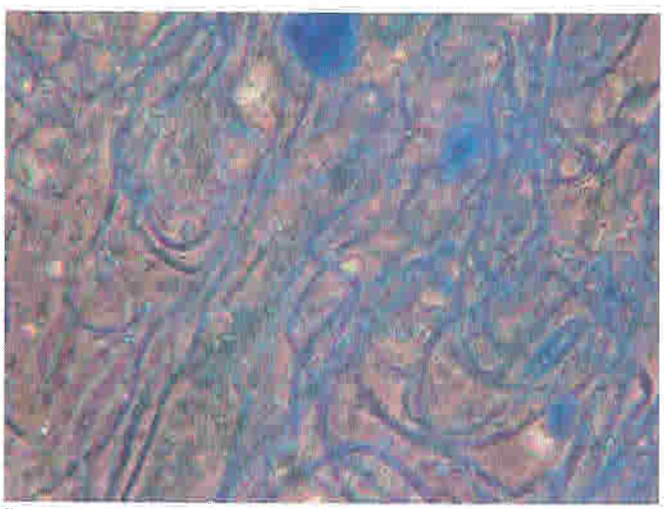

Figure 11. Hyphae of *Alternaria* sp. as observed at 400 × magnification (recovered from Bay Harbor Lake sample, March 2006 and grown in sterilized Lake Huron water).

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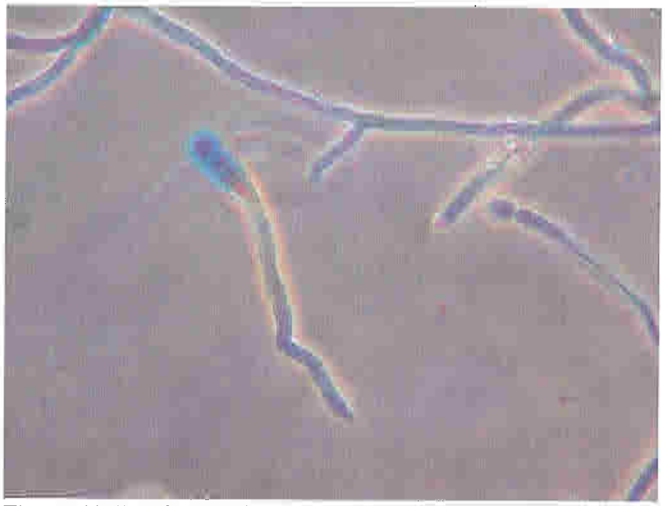

Figure 12. Hyphae and conidia of *Alternaria* sp. as observed at 400 × magnification (recovered from Bay Harbor Lake sample, March 2006 and grown in sterilized Lake Huron water).

This type of mold is known to grow in fresh water lakes including the Great Lakes. The reasons for the proliferation of molds of this nature include:

1) They are naturally found in fresh waters and soil;
2) Water temperatures that are less than 10 - 15°C allow them to compete with bacteria for nutrients such as carbon, nitrogen, and phosphorous. Higher temperatures in excess of 20°C are preferable for bacteria to out-compete mold for nutrients; and
3) Water molds grow where algae may be in a "die-off" phase due to a lack of nutrients or light. The green algae observed in the sample were in fact in a state of decomposition. Chemical parameters such as ammonia and phosphorus would not support the proliferation of green algae. The water molds can then compete for low levels of nutrients as saprophytes, which includes feeding on the decaying algae, as observed in the sample.

In summary, the proliferation of water molds in the Great Lakes, from Lake Superior through to Lake Ontario, has been observed over the years. This type of growth is unrelated to polluted waters, as compared to the growth of blue-green algae, or cyanobacteria, that grow up in littoral waters and is reported in the press from time to time. The growth of blue-green algae often occurs when surface run-off, which contains high levels of agricultural waste or waste from urban sources, enters a watercourse.

The water mold growth observed in the sample from Bay Harbor Lake is also related to littoral currents of the Great Lakes as well as other seasonal impacts. However, it is not the result of significant nutrient-rich point source or non-point source contamination into Bay Harbor Lake. The water mold observed is a natural phenomenon that occurs in fresh water lakes and rivers worldwide.

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mlr

APPENDIX C

SHORELINE AND DIVE SURVEY PHOTOGRAPHS

Photo Description: Shoreline conditions observed during May 2006 Shoreline Survey.

Photo Description: Barr and U.S. EPA START contractor personnel collecting shoreline water quality measurements – May 2006

Photo Description: Dive support boat utilized during Bay Harbor Lake Dive Survey – June 2006

Photo Description: U.S. EPA Environmental Response Team (ERT) diver entering the water to commence visual and water quality monitoring survey – June 2006

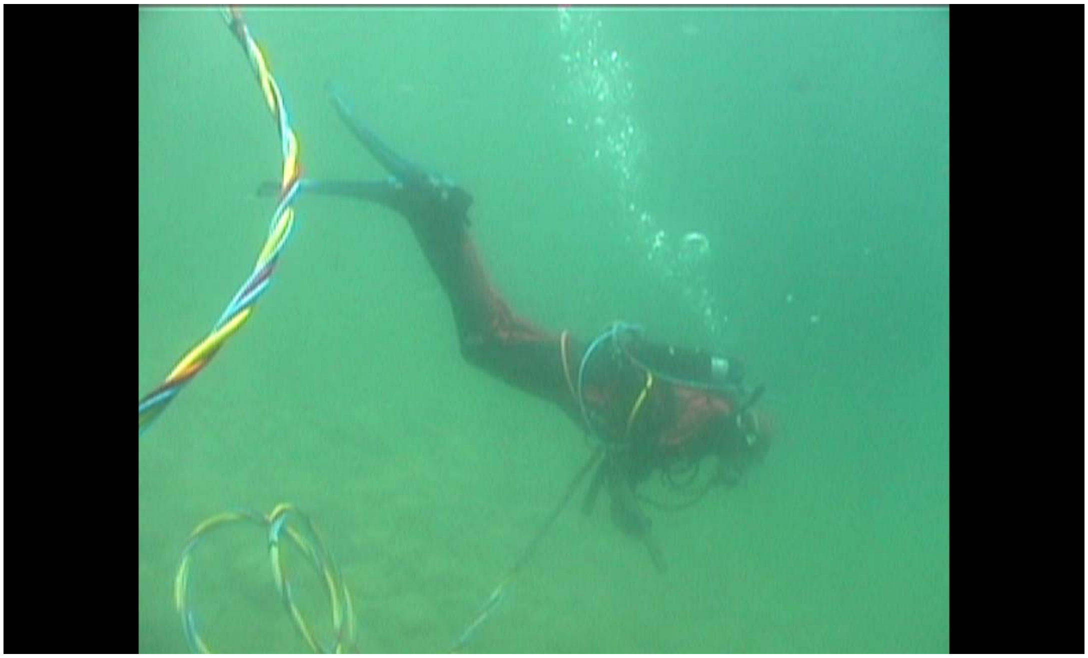

Photo Description: ERT diver performing visual survey and water quality monitoring with YSI probe used to collect pH and conductivity measurements – June 2006

Photo Description: ERT diver conducting water quality monitoring with YSI probe in Bay Harbor Lake – June 2006.

Photo Description: Observation along bottom of Bay Harbor Lake – June 2006.

Photo Description: ERT diver conducting visual and water quality monitoring near dock pier in Bay Harbor Lake – June 2006

Photo Description: ERT diver preparing to conduct second round of dive survey – October 2006

Photo Description: ERT diver preparing to enter water to commence collection of water quality monitoring data – October 2006

Photo Description: ERT diver with Troll 9000 monitoring probe utilized to collect pH and conductivity measurements – October 2006

Photo Description: Buoys marking dive transect from Bay Harbor Lake shoreline – October 2006