



## J & L CONSULTING SERVICES

- Environmental Assessments
- Mitigation Plans and Permits
- Site Evaluation and Analyses
- Wetlands Mapping

32 N. Clubview Drive  
Ypsilanti, MI 48197-3753

October 19, 2007

Mr. John Arevalo  
Cadillac District Supervisor  
Land & Water Management Division  
Michigan DEQ  
2100 West M-52  
Gaylord, MI 49735-9282

Re: Wetlands and Nearshore Investigation, On 8-13-07, by J & L Consulting Services  
Of Missaukee Lakes Master Homes, LLC, Lake Missaukee, Missaukee County, MI

Dear John Arevalo:

As an agent for the Missaukee Lakes Association, LLC, I investigated the wetlands and the nearshore area of the 12-lot proposed residential development along the west shore of Lake Missaukee in Missaukee County, MI, on 8-13-07. The access road, known as Arrowhead Trail West, was been constructed in 2001, and Lot # 1 has already been sold (to Mr. Jack Bales). Accompanying me were Mr. David Thompson and Mr. Richard Morrow of the Missaukee Lakes Association. We investigated the wetlands, water depths, and habitat characteristics of the area about the proposed floating boat dock and dredging proposal area near Lot # 8 as well as the ecology of the west end of Lake Missaukee.

Lot # 8 has a house on it, which is reportedly owned by Mr. Harry Mohny, the President of Missaukee Lakes Master Homes, LLC. We approached the subject nearshore area of Lot # 8 (of Lake Missaukee) in a boat, and also checked the Lot # 8 area and some of the other lots from Arrowhead Trail West. David Thompson had a GPS system on board the boat so that locations could be determined and recorded.

### **A. Wetlands in the Nearshore and near Lot # 8**

Based on observations from the boat and from Arrowhead Trail West, the drawing in enclosed Figure # 1 was compiled.

We observed White Water Lilies (*Nuphar odorata*) in the nearshore area growing out to a distance of 180 to 185 feet from the shoreline. See Plate 1. Some small patches of White Water Lily were found even farther out, e.g., a distance of 300 feet from the shoreline (Appendix A). David Thompson created Appendix A from observations we made on site on 8-13-07. In this nearshore area we also observed Water-shield (*Brasenia schreberi*), Floating-Leaved Pondweed (*Potamogeton natans*), as well as a bit of Muskgrass (*Chara* sp.) and Broadleaved Arrowhead (*Sagittaria latifolia*). Hence, based on the floating-leaved and submersed aquatic plants present in this nearshore zone, this area should be classified as a wetland. That nearshore wetland area includes the 200-ft long by 50-ft wide proposed boat dock and dredging area.

Along the shoreline, out lakeward to 35 to 40 ft., we observed a soft, muddy zone that was a mix of muck and quartz sand. In this area directly lakeward of the shoreline, we

documented the following emergent marsh plant species: Tussock Sedge (*Carex stricta*), Wild Mint (*Mentha arvensis*), Bluejoint Grass (*Calamagrostis canadensis*), Water Smartweed (*Polygonum amphibium*), Meadow Sweet (*Spiraea alba*), Three Square (*Scirpus americana*), Stipa Sedge (*Carex sartwellii?*), and Hardstem Bulrush (*Scirpus acutus*). See Plate 2. These emergent marsh plant species are very indicative of an alkaline wetland soil that consists of a mix of sand and muck.

Extending up the beach face, i.e., toward the uplands for a distance of approximately 35 ft from the shoreline, a somewhat brushy wetland community was encountered. Where this brushy vegetation was not cleared, one could see thickets of Speckled Alder (*Alnus rugosa*). In addition, there was some Trembling Aspen (*Populus tremula*), small Red Maple (*Acer rubrum*), Willow (*Salix* sp.), Meadow Sweet (*Spiraea alba*), Bluejoint Grass (*Calamagrostis canadensis*), and Sensitive Fern (*Onoclea sensibilis*) in this wetland community as well. It appeared from our field observations that perhaps some of this wetland vegetation on the slope leading upslope to the uplands (toward the house on Lot # 8) was cleared and then filled with sand. See Plate 3. A wetland permit would have been needed for the filling of the cleared wetlands with sand.

The upland woodlands, in contrast, consisted largely of a mix of Red Maple (*Acer rubrum*), White Oak (*Quercus alba*), Northern Red Oak (*Quercus rubra*), and American Beech (*Fagus grandifolia*) trees, along with an sparse understory of Bracken Fern (*Pteridium aquilinum*) and Sweet Gale (*Myrica gale*). Some Sugar Maple trees (*Acer saccharum*) were also present in this upland woodland vegetation.

**Key Points:**

It appears from a review of the documents submitted by the developer to the Michigan DEQ, as part of DEQ File # 06-57-0002-P, as well as earlier permit applications # 02-57-0001-P and 02-57-0001-M, that the developer did NOT accurately delineate and map the existing shrub, emergent marsh, and floating-leaved/submersed (lacustrine) wetlands on the 12-lot Indian Lakes West property, i.e., along western Lake Missaukee.

Our observations indicate that 30 to 35 feet of shrub wetlands exist along the slope of the 12 lots (from the shoreline upslope to the uplands), 25 to 45 feet of emergent marsh wetlands occur lakeward of the shorelines, and 50 to 200 feet of floating-leaved and submersed lacustrine wetland vegetation exist in the nearshore area as well (i.e., beyond the emergent marsh). Emergent marsh and lacustrine wetlands are clearly present within the proposed 200 ft by 50 ft floating dock and proposed dredging area. Because of the significance of these shoreline wetlands to the fish and wildlife ecology of Missaukee Lake, as well as to the sport fishing and passive recreational uses of the lake, these wetlands must be accurately delineated in the field and plotted on the site plan drawings.

**B. Water Depths and Sediment Thickness in the proposed Boat Dock Area**

On 2-28-07, a group of DEQ personnel led by Ms. Robyn L. Schmidt, along with Mr. Dale Boughner of Missaukee Lakes Master Homes LLC, conducted a survey of the

water depths and sediment thicknesses in the proposed boat dock area offshore of Lot 8. See Appendix B. This shallow boat dock area is to be dredged to an average depth of 2.5 ft (into the bottom sediments) in order to accommodate the boats that would belong to the owners of the lots in the small, nearby 12-lot residential community. The structure of the dock, which is to be 60 ft in length and 3 ft in width, is to be removable.

This sampling by the group of DEQ staff people occurred through the ice cover on Lake Missaukee on 2-28-07 in the presence of a member of the developer's team. Using a pole with a 2.5-inch diameter and graduated markings, water depth and thickness of the soft sediments were measured as indicated in Table 1, below. The goal of this sampling was to document the presence of relatively thick, fine-grained sediments in the area of the proposed floating boat dock, and more importantly, in the area of proposed dredging.

A total of 21 sampling stations were established leading lakeward out from the shoreline. Each sampling point was approximately 10 feet (horizontally) apart. At each station, the water depth and the sediment thickness of the fine-grained sediments were recorded. Station # 1 was approximately 10 ft from the shoreline, and the last station, i.e., Station # 21, ended at a distance of 225.5 ft from Station # 1 (lakeward of Lot # 8) and in a water depth of 3.42 feet.

**Table # 1**  
**Water Depths and Sediment Thicknesses, Proposed Dredging Area**

<u>Station #</u>	<u>Water Depths in Feet</u>	<u>Thickness of Soft Sediments, ft</u>	<u>Depth to bottom of Soft Sediments</u>
1 (10 ft from shore)	0.85 ft	1.0 ft	1.85 ft
2	1.12	3.25	4.97
3	1.42	4.15	5.57
4	2.02	5.35	7.37
5	2.15	5.00	7.15
6	2.30	5.24	7.54
7	2.35	5.12	7.47
8	2.10	5.60	7.70
9	2.62	6.22	8.84
10	2.78	7.08	9.86
11	3.70	7.40	11.10
12	3.52	7.46	10.98
13	3.14	7.62	10.76
14	3.26	7.66	10.92
15	3.86	7.66	11.52
16	4.20	7.80	12.00
17	3.80	7.16	10.96
18	4.70	6.88	11.58
19	4.18	6.86	11.04
20	3.40	7.00	10.90
21 (225.5 ft from 1)	3.42	7.10	10.52

**Key Points:**

Table 1 shows that the water depths in the proposed dredging area range from a minimum of 0.85 feet at 10 feet lakeward of the shoreline to a maximum depth of 4.70 feet at a distance of approximately 180 feet of the shoreline. See Appendix B for the source document. At a distance of 200 feet from the shoreline, i.e., at the lakeward end of the 200-ft long proposed dredging area, the water depth was 3.9 feet. Hence, the water depths in the proposed boat dock area, which is also the proposed dredging area, are relatively shallow – average about 2.5 feet in depth, and as indicated in Item A, support emergent marsh and lacustrine wetland vegetation.

If the proposed boat dock area of 200 ft by 50 ft, which amounts to 10,000 sq ft, is to be dredged to an average depth of 2.5 feet (per permit application), and assuming an average water depth of 2.5 feet in the boat dock area, then approximately 555.55 cubic yards (CY) are to be removed. Moreover, if a hydraulic dredge is to be employed to remove these sediments, which apparently is the plan, then a mix of water and sediments will be extracted by the cutter head of the hydraulic dredge. Since the hydraulic dredge takes up a mixture that is 75 to 85 % water, and only 15 to 25 % solids, then the total dredging volume would be about 999.99 CY.

What is of even more concern to the Missaukee Lakes Association Inc. than the projected volume of nearly 1,000 CY, is the nature of the soft, bottom sediments to be hydraulically dredged. As has been indicated in Section C, below, these lake bottom sediments are not only part of the lacustrine wetlands, but appear to very loose, and somewhat organic and rather fine-grained in nature. Hence, the probable suspension of both organic and inorganic silt & clay sediments during the dredging process is of great concern to the ecology and water quality of Missaukee Lake.

**C. Nature of the Bottom Sediments to be Dredged in Boat Dock Area**

The grain size and organic composition of the sediments to be dredged appear to be poorly determined at this time. Whereas Ms. Robyn L. Schmidt of the Michigan DEQ, was able to push a pole down into the bottom sediments of the proposed boat dock area (offshore of Lot # 8) to depths ranging between 1.0 ft (at 10 feet lakeward of the shoreline) to a depth of 6.86 feet into the bottom sediments, at a distance of about 200 ft from the shoreline (see Station # 19, Table 1), while standing on ice, a grain size analysis of the sediments (to be dredged) by Great Lakes Boat and Materials Company indicated that the sediments in the proposed boat dock area consist largely of “light colored sand”. See Appendix C for analytical report by the Great Lakes Boat and Materials Company, dated 6-20-02.

Six sediment samples were reportedly collected by this company on 6-12-02. Following washing, which could have removed the organic sediments and much of the fines, the remaining sediment, which was reported to be sand, was dried and then sieved using a standard sieve analysis. What is most surprising about the preparation of the samples is that the weight of the six samples before washing (see “Initial” weight) and after “Washing” was exactly the same, i.e., 115.52 grams (presumed units of weight). In

addition, the reported "fractional components" yielded "99.8 % sand" and only "0.2 % Fines". This reported analysis of the grain sizes of the sediments in the proposed dredging area strongly conflicts with the field sampling of Robyn Schmidt of the DEQ, and that of Lakeshore Environments Inc (see below), as well as with my field observations of western Lake Missaukee on 9-6-98 and on 8-13-07.

**1. Sediment Analysis by Lakeshore Environments, Inc.**

On 8-11-02 a sediment sample collected by Lakeshore Environments Inc., in cooperation with Mr. Richard Morrow of the Missaukee Lake Association, consisting of 38.5 grams, derived from the nearshore area of Lake Missaukee. This sediment sample was extracted lakeward of Lot # 11, at an approximate distance of 50 feet from the shoreline, at a depth of 3.0 feet below the water surface, and 0.85 ft below the surface of the lake bottom. As shown in Appendix D, the grain size analysis of the sample revealed that 91.9 % of the sample consisted of fines and that the fibrous organic content was 4.2%. Lakeshore Environments Inc classified the sample as "organic silt (OL)".

**Discussion:**

The grain size analysis by the Great Lakes Boat and Materials Company may be misleading because of conflicts with the sampling results by Lakeshore Environments Inc. and due to the fact that one can not push a pole down into sandy sediments using hand methods, whether through an ice cover or from the edge of a small boat. The pole employed by Robyn Schmidt was reported to be a 2.5-inch diameter wooden pole with graduations on it. It is believed that one or two persons could not physically push a pole downward into a sand sediment under ordinary means. In addition, on 9-6-98, and again on 8-13-07, the undersigned (singled handedly) was also able to push a wooden oar from a boat 3 to 6 feet down into the nearshore bottom sediments of western Lake Missaukee, i.e., offshore of Indian Lakes West (Figure 2).

Sand sediments are relatively firm, and therefore can not easily be penetrated with a wooden pole at a diameter of 2.5 inches. The sand sediment reported by the Great Lakes Boat and Materials Company was at an average grain size of 0.452 mm, which corresponds to a medium sand (according to standard geologic grain sizes). However, in my professional judgment, the bottom sediments within the proposed dredging area of the boat dock area may not consist of "99.8 % sand". Rather it is believed that these sediments are largely fine-grained, i.e., consist of a mix of organic matter, silt, and clay, with only a small fraction of sand. Therefore, additional grain size analysis, by a third party firm, should be conducted in order to obtain reliable sediment grain size results.

**Key Points:**

If the sediments are indeed comprised of considerable organic matter, along with silts and clays, then the suspension of sediments during the proposed hydraulic dredging will be a serious problem. The potential problem of suspended sediments could, in itself, cause the dredging permit application to be denied, particularly in regard to negative effects on the dissolved oxygen content of the water next to the dredging operation. Lake Missaukee has a viable sport fishery, including for Walleye, Northern Pike, Smallmouth

Bass, and Bluegill. In addition, Walleye growth rates in Lake Missaukee exceed rates reported in most other lakes (according to the Fisheries Division, Michigan DNR).

In reviewing the dredging permit application, the Michigan DEQ would have to critically examine the proposed method of dredging, as well as the need for strict erosion control, including the probable use of silt screens about the dredging operation, scheduling of the dredging during the non-spawning period of the fish, and the careful monitoring of the turbidity and dissolved oxygen during the actual dredging operation. The Michigan DEQ could even require a security deposit, least the dredging cause ecological damage to western Lake Missaukee that would have to be restored. In brief, the approval of the dredging permit by the Michigan DEQ is most serious, given the previous damage caused by the Redman Island dredging in Lake Missaukee during the mid-1960s time period.

Members of the Lake Association of Lake Missaukee believe that the dredging of the proposed 10,000 sq ft boat dock area is only the beginning of a number of likely dredging permit applications by the Missaukee Lakes Master Homes, LLC, as it intends to fully develop the ecologically-sensitive shorelands it owns on the western side of Lake Missaukee. Missaukee Lakes Master Homes, LLC, owns two large segments of lakeshore property along the western side of Lake Missaukee. That is precisely why the Michigan DEQ has the insight to require a conservation easement over the remaining nearshore wetlands of western Lake Missaukee owned by and/or located nearby Missaukee Lakes Master Homes, LLC, i.e., outside of the 10,000 sq ft proposed boat dock area of Indian Lakes West, as a necessary condition to any approval of the current dredging permit application (DEQ File # 06-57-0002-P).

**D. Water Elevations of Lake Missaukee in relation to the Proposed Dredging**

Given the proposed dredging of the 10,000 sq ft (0.229-acre) boat dock area in the nearshore area of Lot # 8 to an average depth (into the bottom sediments), it is important to understand the current water level fluctuations of Lake Missaukee. On 5-31-74 the water level of Lake Missaukee was officially set at 1,238.5 feet (above MSL). A control structure, which is located on the east side of the lake, has been established south of the long pier near the M-66 Highway. This lake outlet drains into Mosquito Creek which is a tributary of Clam Creek. Thus, the water level of Lake Missaukee is controlled, and therefore its water level fluctuations are relatively small, and dependent on the annual precipitation. On the other hand, the current data on the lake indicates a 9-year flushing rate, which means if nutrient loading occurs in western Lake Missaukee, due to heavily fertilized yards and landscaping plantings, as regards the flushing out of those nutrients.

Overall, Lake Missaukee is a relatively shallow lake, consisting of about 2,000 acres, with an average depth of only 10.5 feet. Hence, this lake is an excellent lake for fishing as well as for boating and swimming. The west side, which is marshy and contains important wetlands, is the area of significant ecological concern as described in Section E, below. Fish spawning and juvenile fish nursery, along with wildlife habitat, are most important in the lacustrine wetlands and shallows along the western shorelines.

### **E. Significance of the Ecology of Western Lake Missaukee**

As indicated in the previous report on Lake Missaukee by J & L Consulting Services, which was dated 3-6-99, Lake Missaukee supports a diversity of warmwater game fish, including Walleye, Largemouth Bass, Northern Pike, and Bluegill. Some Smallmouth Bass, Yellow Perch, and Black Crappie are also present. A fish survey in 1994 by the Cadillac District Office of the Fisheries Division of the Michigan DNR revealed that Walleye in Lake Missaukee exhibited faster growth rates and attained larger sizes than in other lakes of Michigan. In addition, a summer 1987 study of Lake Missaukee by the Institute of Fisheries Research, University of Michigan, revealed the occurrence of Walleye 16 to 25 inches in length, Northern Pike up to 35 inches long, and Largemouth and Smallmouth Bass up to 15 inches in length. Hence, Lake Missaukee is a most productive and high-quality, sport fishing lake.

A productive sport fishing lake must necessarily have significant fish spawning and fish nursery areas. During our 8-13-07 inspection of the nearshore area and lacustrine wetlands of western Lake Missaukee, we observed several schools of forage minnows, including those of the genus *Notropis*, as well as a number of Northern Pike and Bass feeding on small fish in the lily pad areas along the shorelines. The floating-leaved and submersed aquatic plants provide the periphyton, algae, and macro plants that the zooplankton, invertebrates (including insect larvae of Damelflies and Dragonflies), and crustacea need for food. The large zooplankton, invertebrates and crustacean (e.g., aquatic snails, scuds, and fingernail clams), in turn, provide food items for the forage minnows and small fish that many of the game fish feed on. In short, the food web for juvenile and adult fish in Lake Missaukee is highly dependent on the wetlands located along the western shore.

In addition, the western side of Lake Missaukee provides important wildlife habitats and breeding areas, along with the occurrence of unique plant species. The Common Loon (*Gavia immer*) nests along the western shores of the lake, and this past year a breeding pair raised one young. In addition, Mallard Ducks and Wood Ducks nest in western Lake Missaukee, and duck hunting is locally important in the fall. Bald Eagles (*Haliaeetus leucocephalus*) are occasionally observed in this area, as are the more frequent wading birds and shorebirds, including Great Blue Herons, Green Herons, White Egrets, and Black Terns. Also, the potential for endangered and threatened plant species in the forested wetlands and bogs of western Lake Missaukee is very high, even though detailed investigations had not yet been undertaken. In this regard, a listed species search should have been performed by Missaukee Lakes Master Homes, LLC, in relation to Indian Lakes West.

### **Key Points:**

Given its shallowness and the extent of significant wetlands along the western side of Lake Missaukee, the ecology of this lake area in regard to fisheries, wildlife habitat, and threatened & endangered species is most important. Boating in the lake is extremely important in summer as well, especially on weekends, and some of these boaters party in the shallow "islands" of Hardstem Bulrushes of western Lake Missaukee. Dredging of additional boat docks and boat access channels in western Lake Missaukee for the present

boating interests constitutes a serious threat to the lake's ecology. Two public boating access points (Green Road and County Park) already exist in Lake Missaukee. Indian Lakes Land Development (now Missaukee Lakes Master Homes) could have developed a small marina in Lot # 1 (of Indian Lakes West), but did not pursue that alternative. Furthermore, given the apparent unwillingness of Missaukee Lakes Master Homes to accept a conservation easement over properly mapped wetlands in western Lake Missaukee, outside of the proposed boat dock area near Lot # 8, suggests that additional dredging and boat access permits may be submitted by the developer (Missaukee Lakes Master Homes, LLC).

**F. Summary and Recommendation**

Missaukee Lakes Master Homes, LLC (formerly Indian Lakes Land Development) applied for permits in 2000 to construct a cul-de-sac roadway about the southwest end of Lake Missaukee. Although being informed that it would be difficult to receive approval for a marina, given the extent and quality of the nearshore wetlands, the developer apparently ignored the potential marina location in Lot # 1 in lieu of a more centrally located marina / boat dock area situated offshore of Lot # 8. Even at this time when being advised by the Michigan DEQ, in a Letter to Mr. Dale Boughner, dated 1-19-07, that a conservation area would be required over the lacustrine wetlands outside of the proposed 10,000 sq ft boat dock area, the developer appears unwilling to cooperate with state officials.

It is apparent to the Missaukee Lakes Association, Inc., that the developer has not accurately mapped the wetlands in the 12 proposed lots, nor in the nearshore area. See Section A, above. These wetlands have been shown to be of high quality and critical to the general ecology of the lake. Also, it appears as though the true nature of the sediments in the proposed 10,000 sq ft dredging area have been misrepresented. See Section C, above. Furthermore, if Lot # 8 is some indication of the lack of concern for wetland protection (see Figure 1 and Section A, above), then it seems that a level of trust has not been established between Missaukee Lakes Master Homes, the Michigan DEQ, and the citizens currently located along the lakeshore.

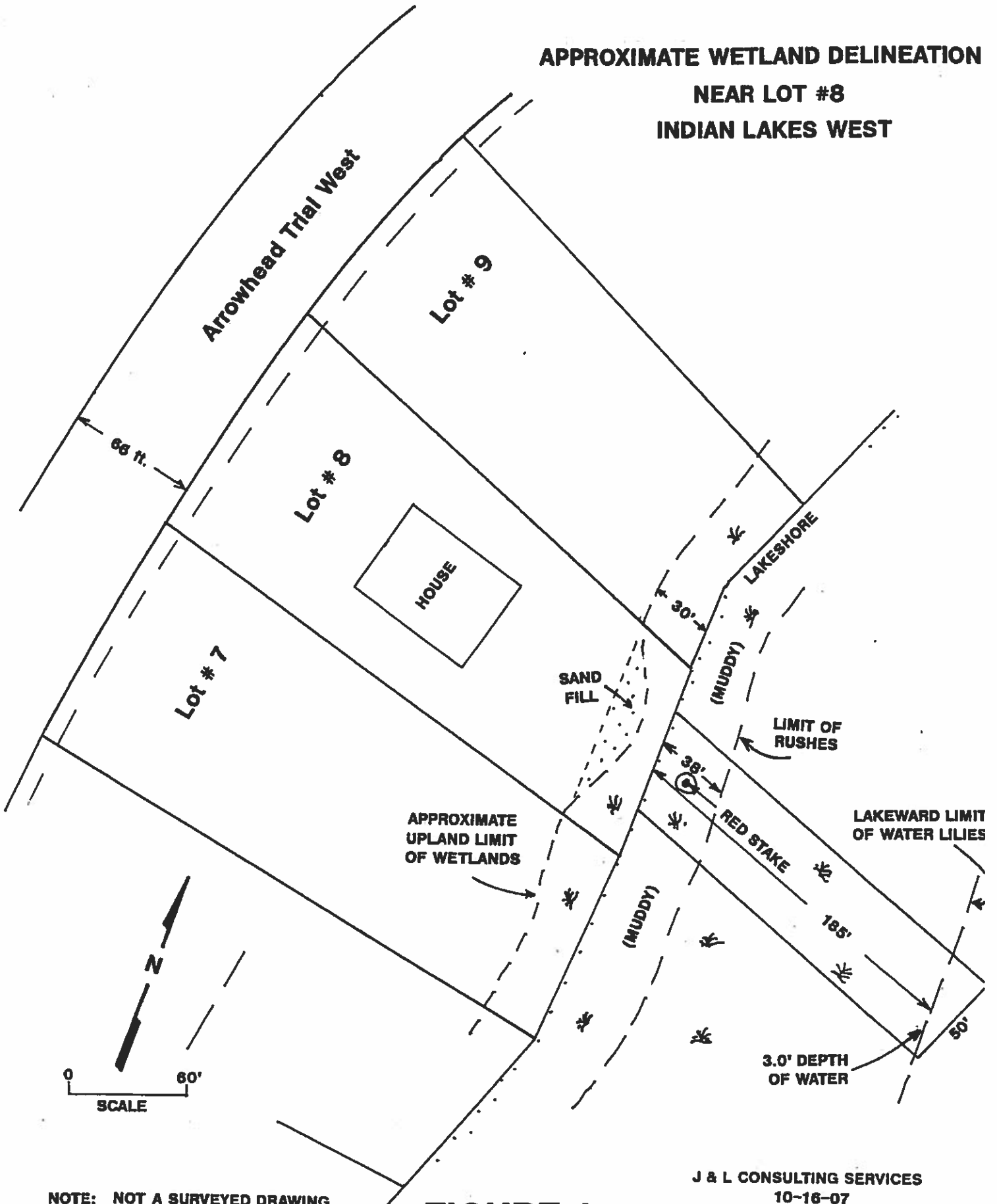
**In conclusion**, the wetlands in western Lake Missaukee are part of the public trust, and as such must be protected by the MDEQ when real environmental threats arise. Moreover, if the wetlands can not be strictly avoided, as demonstrated by a "no feasible and prudent alternative analysis", then wetland mitigation must be provided. In our review of the permit application (DEQ File # 06-57-0002-P), the Missaukee Lakes Association members did not find an adequate alternative analysis, nor a wetland mitigation plan. For all the reasons cited herein, particularly the incomplete mapping of the wetlands and the misrepresentation of the nature of the sediments to be dredged, the Missaukee Lakes Association recommends that you continue to deny the dredging permit application.

Eugene Jaworski, PhD  
Principal, J & L Consulting Services, and  
Agent for Missaukee Lakes Association, Inc.



**Enclosures: Figure 1 – Approximate Wetland Delineation near Lot 8, Indian Lakes West  
Figure 2 – Cross Section, of shallow Water & Sediments, from 1999 Report  
Plates 1 thru 4: Color Photographs taken on site on 8-13-07, by undersigned  
Appendix A – Map of the Extent of Lacustrine Wetlands, David Thompson  
Appendix B – Water Depths & Sediment Thicknesses, by Robyn L. Schmidt  
Appendix C – Sediment Analytical Report, Great Lakes Boat & Materials  
Appendix D – Sediment Analysis Report, by Lakeshore Environments Inc.**

**APPROXIMATE WETLAND DELINEATION  
NEAR LOT #8  
INDIAN LAKES WEST**

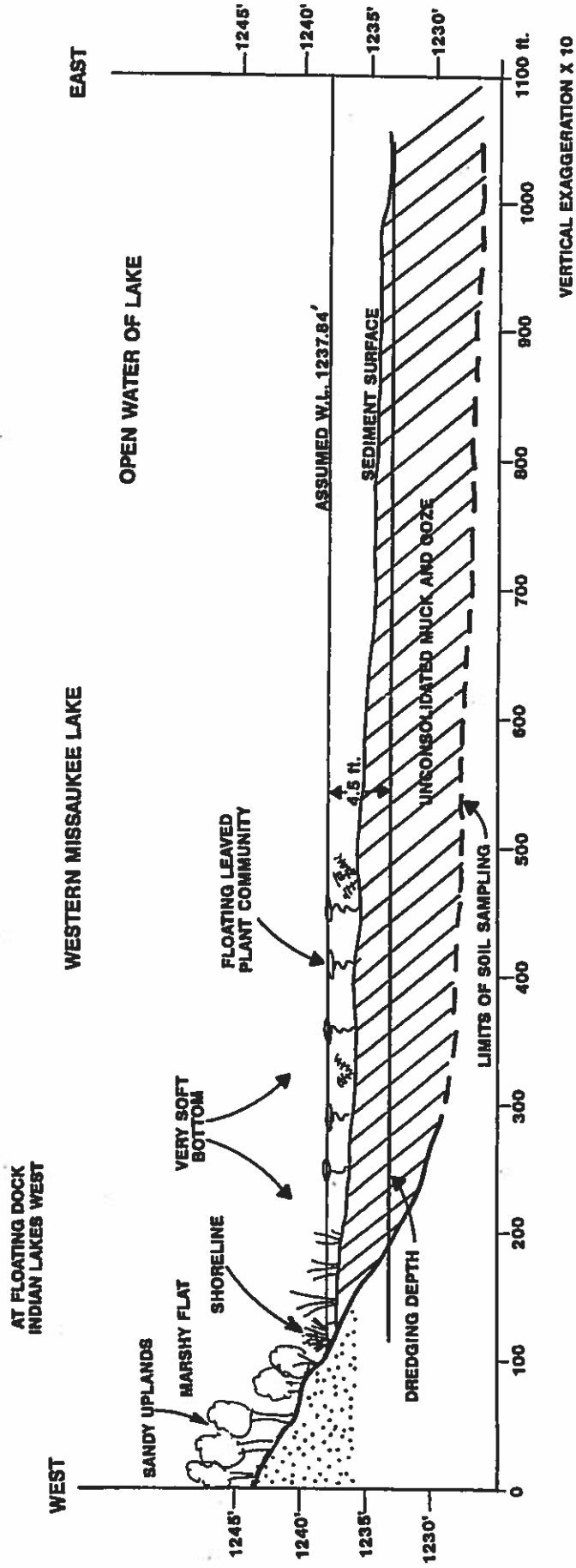


**FIGURE 1.**

**NOTE: NOT A SURVEYED DRAWING.**

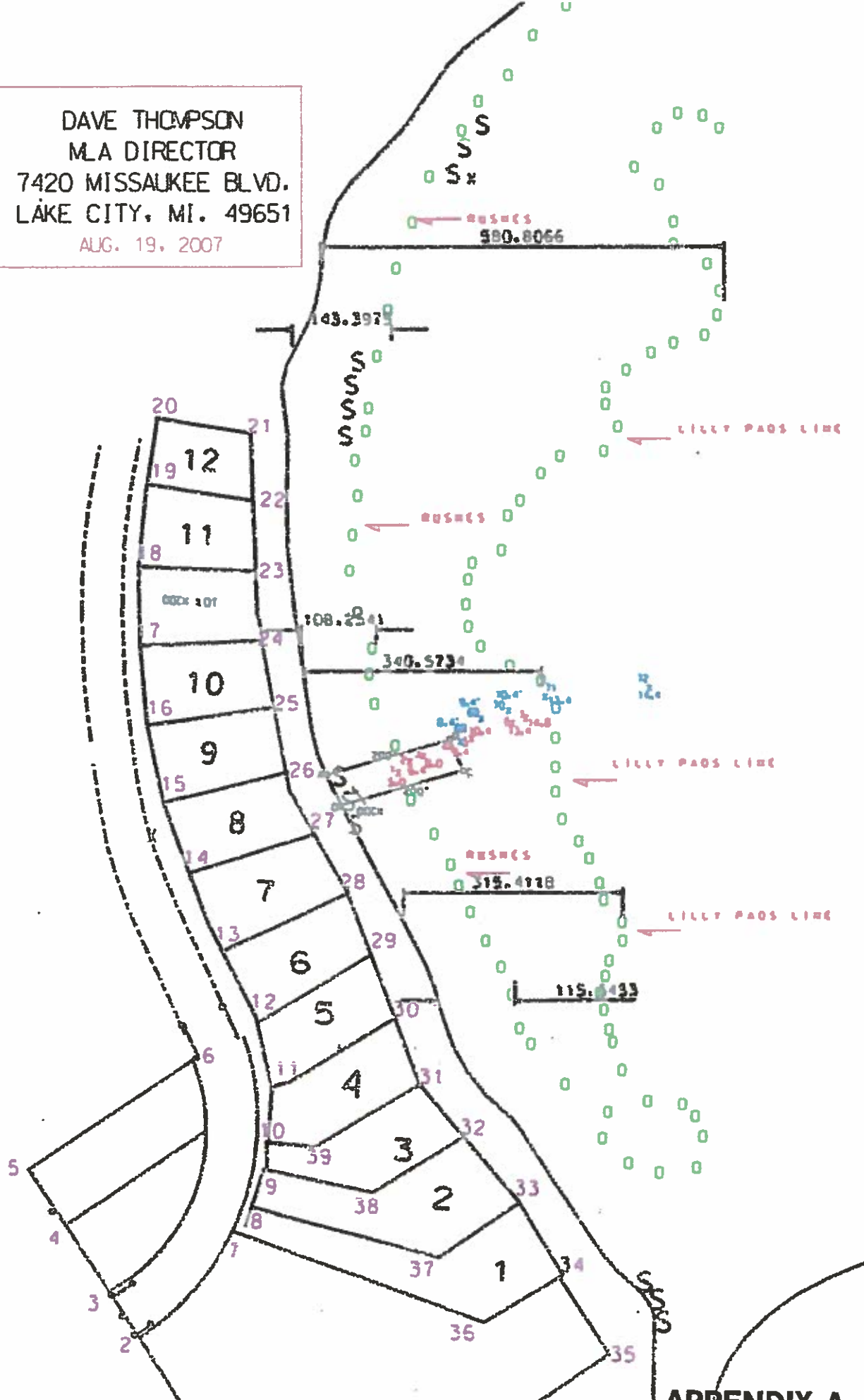
**J & L CONSULTING SERVICES  
10-16-07**

**CROSS SECTION SHOWING  
 WATER DEPTH, DREDGING DEPTH, AND SOFT SEDIMENT DEPTH  
 MISSAUKEE LAKE, AT INDIAN LAKES WEST**



**Figure 2.**  
**CROSS SECTION MODIFIED FROM 1999 J & L REPORT**

DAVE THOMPSON  
 M.A. DIRECTOR  
 7420 MISSAUKEE BLVD.  
 LAKE CITY, MI. 49651  
 AUG. 19, 2007





Water and Muck  
 Depths collected  
 on 2/28/07

<u>W20</u>	<u>MUCK</u>
1. 0.85'	1.0' = 1.85'
2. 1.12'	3.85' = 4.97'
3. 1.42'	4.15' = 5.57'
4. 2.02'	5.35' = 7.37'
5. 2.15'	5.0' = 7.15'
6. 2.3'	5.24' = 7.54'
7. 2.35'	5.12' = 7.47'
8. 2.1'	5.6' = 7.7'
9. 2.62'	6.22' = 8.84'
10. 2.78'	7.08' = 9.86'
11. 3.7'	7.4' = 11.1'
12. 3.52'	7.46' = 10.98'
13. 3.14'	7.62' = 10.76'
14. 3.26'	7.66' = 10.92'
15. 3.86'	7.66' = 11.52'
16. 4.2'	7.8' = 12.0'
17. 3.8'	7.16' = 10.96'
18. 4.7'	6.88' = 11.58'
19. 4.18'	6.86' = 11.04'
20. 3.9'	7.0' = 10.9'
21. 3.42'	7.1' = 10.52'

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06-57-0002-f

- Notes -

- ice on lake approx. 8-12" x
- 225.5' to last hole from fir hole.
- 19ft from "shoreline" to red stakes.
- 10' from red stake to fir hole
- ~~• 10' from red stake to fir hole~~
- 10' mason reflects distance from shore to 1st hole
- holes approx 10ft apart

- R.L. Schmitt

2-28-07

Lot 8  
MISSAUKEE LAKE

Robyn

0"	SHORE LINE TOP	DEPTH Bottom
10	.85	1.0
20	1.12	3.85
30	1.42	4.15
40	2.02	5.35
50	2.15	5.0
60	2.3	5.24
70	2.35	5.12
80	2.1	5.6
90	2.62	6.22
100	2.78	7.08
110	3.7	7.4
120	<del>3.66</del> 3.66	7.46
130	3.44	7.62
140	3.26	7.66
150	3.86	7.66
160	4.2	7.8
170	3.8	7.16
180	4.7	6.88
190	4.18	6.86
200	3.9	7.0
	3.42	7.1

RECEIVED  
FEB 28 2007  
DEQ/LWMD-CADILLAC

nr 331-773-5998  
jvcc 800-773-5998  
331-773-5937

Trace Analytical Laboratories, Inc.  
2241 Black Creek Road  
Muskegon, MI 49444-2673  
traceanalytical@msd.tetamgmt.com



June 20, 2002

Mr. John Bultema & Mr. Joe Bailey  
Great Lakes Dock & Materials  
1920 Lakeshore Drive  
Muskegon, MI 49441

RE: Trace ID CF138

Dear Mr. Bultema & Mr. Bailey:

Enclosed are your analytical results.

---

This information was examined through Trace's validation process to ensure that all requirements for quality and completeness were satisfied. All reported analytical results were obtained in accordance with the methods referenced on the reports. Every practical effort was made to meet the reporting limit specifications for this work. However, if there are exceptions, they will be noted at the bottom of the appropriate report page.

Thank you for working with Trace. If you have questions regarding this data, please contact Ann Preston, our client services manager, at (231) 773-5998, ext. 224.

Sincerely



Ray V. Buhl  
Laboratory Manager

RVB/kkm  
Enclosures

**RECEIVED**

JUL 12 2002

ENVIRONMENTAL QUALITY  
LAND & WATER MGMT - PCU

TRACE IS VALIDATED BY THE U.S. ARMY CORPS OF ENGINEERS

F-431 10-1 P. 002/015

231-773-5937

FROM TRACE ANALYTICAL LABS JUN-21-2002 02:30PM

**APPENDIX C**





**ANALYTICAL SERVICES AUTHORIZATION  
CHAIN-OF-CUSTODY RECORD**

PLEASE COMPLETE STEPS 1 THRU 3. TRACE PERSONNEL WILL COMPLETE SECTIONS SHADED BLUE Page 6/20 of 15

2181 Black Creek Road • Auburgn, AL 36833  
Phone 231-773-3998 • Fax 231-773-0377

Client Name: Great Lakes Dock and Materials  
 Contact Person: John B. Williams & Joe Beasley  
 Mailing Address: 1920 Lake Shore Drive  
 City, State, Zip Code: Muskegon, MI, 49441  
 Phone: (231) 756-2330 ext 233 Fax: (231) 755-8410  
 Email Address: J.BWilliams@GreatLakesMarina.com  
 Client Job #: J. Sir. Lab: 10257 P.O. #: Trace Order #: 00000000

Logged By: T. Shuck Checked By: J.S  
 Received on lot: Yes  No

Cooler Temp (°C): 11.9 ph Checked: Yes  No   
 Volatiles Preserved: HCl  MeOH  En Core  Metals Pres: Yes  No

Item #	RELEASED BY	DATE	TIME	Item #	RELEASED BY	DATE	TIME
1	T. Shuck	6/13/02	10:15	1			
2				2			
3				3			
4				4			
5				5			
6				6			

Item #	RELEASED BY	DATE	TIME	Item #	RELEASED BY	DATE	TIME
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			

**ANALYSIS REQUESTED**

Sludge 9100"  
 PCB 88  
 PNA 90  
 15 Metals 170

*Verba*

REGULATORY REQUIREMENTS	TURNAROUND REQUIREMENTS	MATRIX KEY	MATRIX	NUMBER OF CONTAINERS
MERA TMDL'S <input type="checkbox"/> RCRA <input type="checkbox"/> NPDES <input type="checkbox"/> USAGE <input type="checkbox"/> Wholesaler <input type="checkbox"/>	Standard <input checked="" type="checkbox"/> 5 Day (RUSH) <input type="checkbox"/> 2-4 Day (RUSH) <input type="checkbox"/> 24 Hour (RUSH) <input type="checkbox"/> Requires prior approval <input type="checkbox"/>	DW = Drinking Water S = Soil W = Water O = Oil A = Air X = Other	1 1 3 4 5 6	5 5 5 5 5 5

Client Sample ID: **RECEIVED**  
 JUL 1 2 2002  
 ENVIRONMENTAL QUALITY  
 LAND & WATER MGMT. PCU

Report Results To: UT 71  
 Step 2 Sample Identification / Request for Analytical Services  
 Step 3 Chain of Custody

**GRAIN SIZE DISTRIBUTION TEST DATA**

Client: Great Lakes Dock and Materials  
 Project: Great lakes Dock and Materials  
 Project Number: CF138

**Sample Data**

Source:  
 Sample No.: CF138-01  
 Elev. or Depth: Sample Length (in./cm.):  
 Location: Sample No. 1  
 Description: Mostly light colored sand  
 Date: 06/19/02 PL: IL: PI:  
 SCS Classification: AASHTO Classification:  
 Testing Remarks: ASTM Methods D-421 and D-422

**Mechanical Analysis Data**

	Initial	After wash
Dry sample and tare=	115.92	115.92
Tare	= 0.00	0.00
Dry sample weight =	115.92	115.92
Loss #200 from wash=	0.0 %	

Sieve	Weight retained	Sieve tare	Percent finer
12.5 mm	0.00	0.00	100.0
9.5 mm	0.00	0.00	100.0
4.75 mm	0.00	0.00	100.0
2.00 mm	0.21	0.00	99.8
850 µm	0.87	0.00	99.1
425 µm	9.90	0.00	90.5
200 µm	91.07	0.00	12.0
150 µm	9.97	0.00	3.4
75 µm	3.72	0.00	0.2
42.5 µm	0.08	0.00	0.1

**RECEIVED**

JUL 12 2002

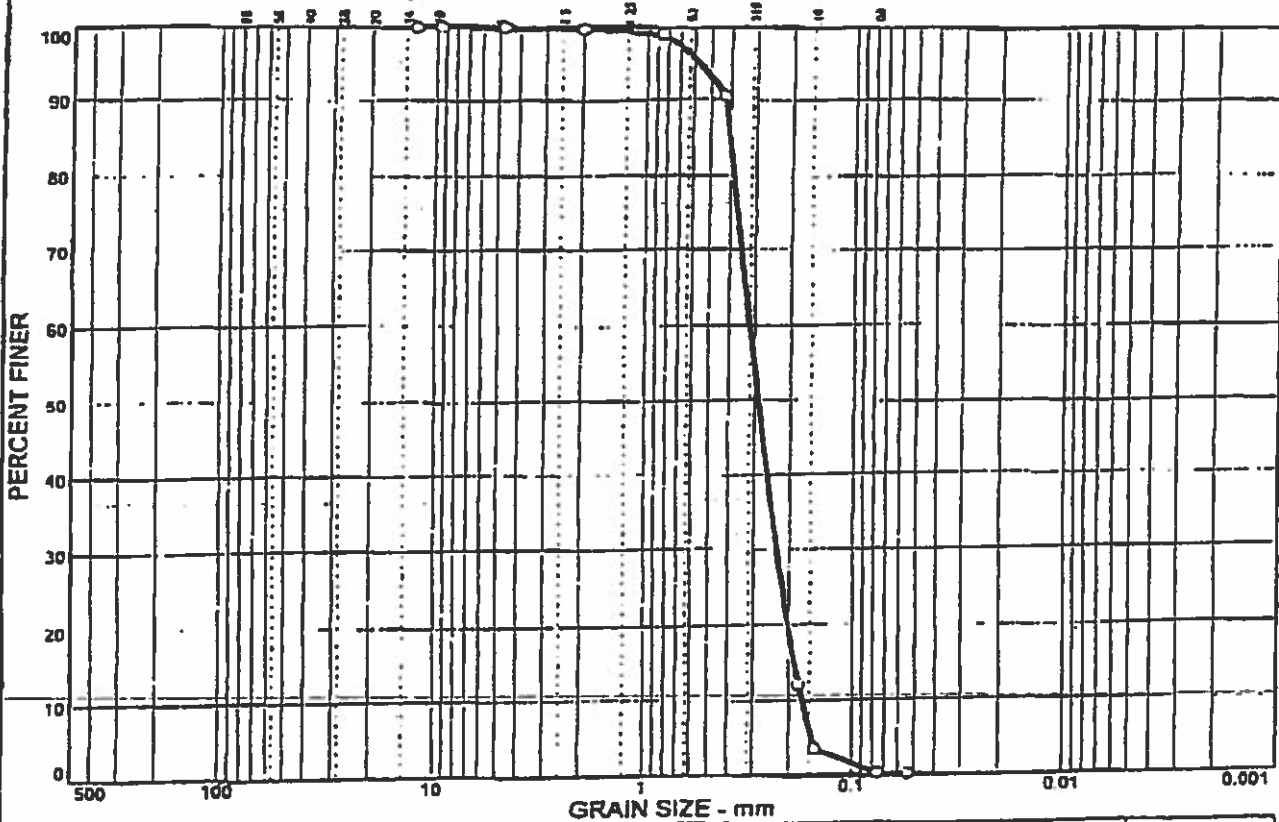
ENVIRONMENTAL QUALITY  
 LAND & WATER MGMT - PCU

**Fractional Components**

Gravel/Sand based on #4  
 Sand/Fines based on #200  
 COBBLES = % GRAVEL = % SAND = 99.8  
 FINES = 0.2

D<sub>15</sub> = 0.40 D<sub>60</sub> = 0.32 D<sub>50</sub> = 0.29  
 D<sub>10</sub> = 0.23 D<sub>15</sub> = 0.19 D<sub>10</sub> = 0.17  
 C<sub>u</sub> = 0.9666 C<sub>u</sub> = 1.8255

# Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	99.8	0.2	

SIEVE SIZE	PERCENT FINER	SPEC. PERCENT	PASS? (X=NO)
12.5 mm.	100.0		
9.5 mm.	100.0		
4.75 mm.	100.0		
2.00 mm.	99.8		
0.850 mm.	99.1		
0.425 mm.	90.5		
0.180 mm.	12.0		
0.150 mm.	3.4		
0.075 mm.	0.2		
0.053 mm.	0.1		

RECEIVED

JUL 12 2002

ENVIRONMENTAL QUALITY  
LAND & WATER MGMT - PCU

Soil Description

Mostly light colored sand

Atterberg Limits

PL=                      LL=                      PI=

Coefficients

D<sub>85</sub> = 0.403              D<sub>60</sub> = 0.317              D<sub>50</sub> = 0.287  
 D<sub>30</sub> = 0.231              D<sub>15</sub> = 0.189              D<sub>10</sub> = 0.174  
 C<sub>u</sub> = 1.83                      C<sub>c</sub> = 0.97

Classification

USCS=                      AASHTO=

Remarks

ASTM Methods D-421 and D-422

Sample No.: CF138-01                      Source of Sample:                      Date: 06/19/02  
 Location: Sample No. 1                      Elev./Depth:

<h2 style="margin: 0;">TRACE ANALYTICAL LABORATORIES</h2>	Client: Great Lakes Dock and Materials Project: Great lakes Dock and Materials Project No: CF138                      Plate
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**Client:** Missaukee Lake Association  
c/o Richard Morrow  
3716 Dale Road  
Saginaw, MI 48603-3131

**Date:** August 19, 2002

**Project Number:** 02-617-01

**Attn:** Mr. Richard Morrow

**Project Name:** Missaukee Lake Association

**Sample Date:** 11-Aug-02

**Date Received:** August 15, 2002

**Sample Description:** Lake Sediment - 3' below surface  
N44°19.482 , W85°15.784

**Test Date:** August 19, 2002

**Visual Description:** Highly Organic Lake Sediment "Muck"

**In-place Moisture:** Saturated

**PARTICLE SIZE ANALYSIS\***

**Weight of sample:** 38.5 grams

**Analyzed By:** AJJ

Sieve #	Size in mm.	Weight Retained	Percent Retained	Cum. % Retained	Cum. % Passing	Comments
3 in.	75	0.0	0.0	0.0	100.0	
3/4 in.	19	0.0	0.0	0.0	100.0	Coarse gravel retained on 3/4in.
No.4	4.75	0.0	0.0	0.0	100.0	Fine gravel retained on No. 4.
No.10	2	1.6	4.2	4.2	95.8	Coarse sand retained on No. 10.
No.16	1.18	0.0	0.0	4.2	95.8	
No. 30	0.6	0.0	0.0	4.2	95.8	Medium sand retained on No. 40.
No. 40	0.425	0.0	0.0	4.2	95.8	
No. 50	0.3	0.0	0.0	4.2	95.8	
No. 100	0.15	1.5	3.9	8.1	91.9	Fine sand retained on No. 200.
No. 200	0.075	0.0	0.0	8.1	91.9	
Pan		35.4				Fines passing No. 200

Recovered weight = 38.5 grams

Loss during sieve analysis = 0.0%

Breakdown by % weight: Gravel - 0.0 %, Sand - 3.9 %, Fines - 91.9 %, and Other (Fibrous Organics) - 4.2%.

**Atterberg Limits**

Plastic Limit = 0

Liquid Limit = 0

Plasticity Index = 0

Fine soils classify as Organic Silt (OL)

**The soil classifies as : OL - Organic SILT**

\* Method: ASTM D422-63 "Particle-size Analysis of Soils"

\* Method: ASTM D2487-93 "Classification of Soils for Engineering Purposes"

\* Method: ASTM D4318-93 "Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

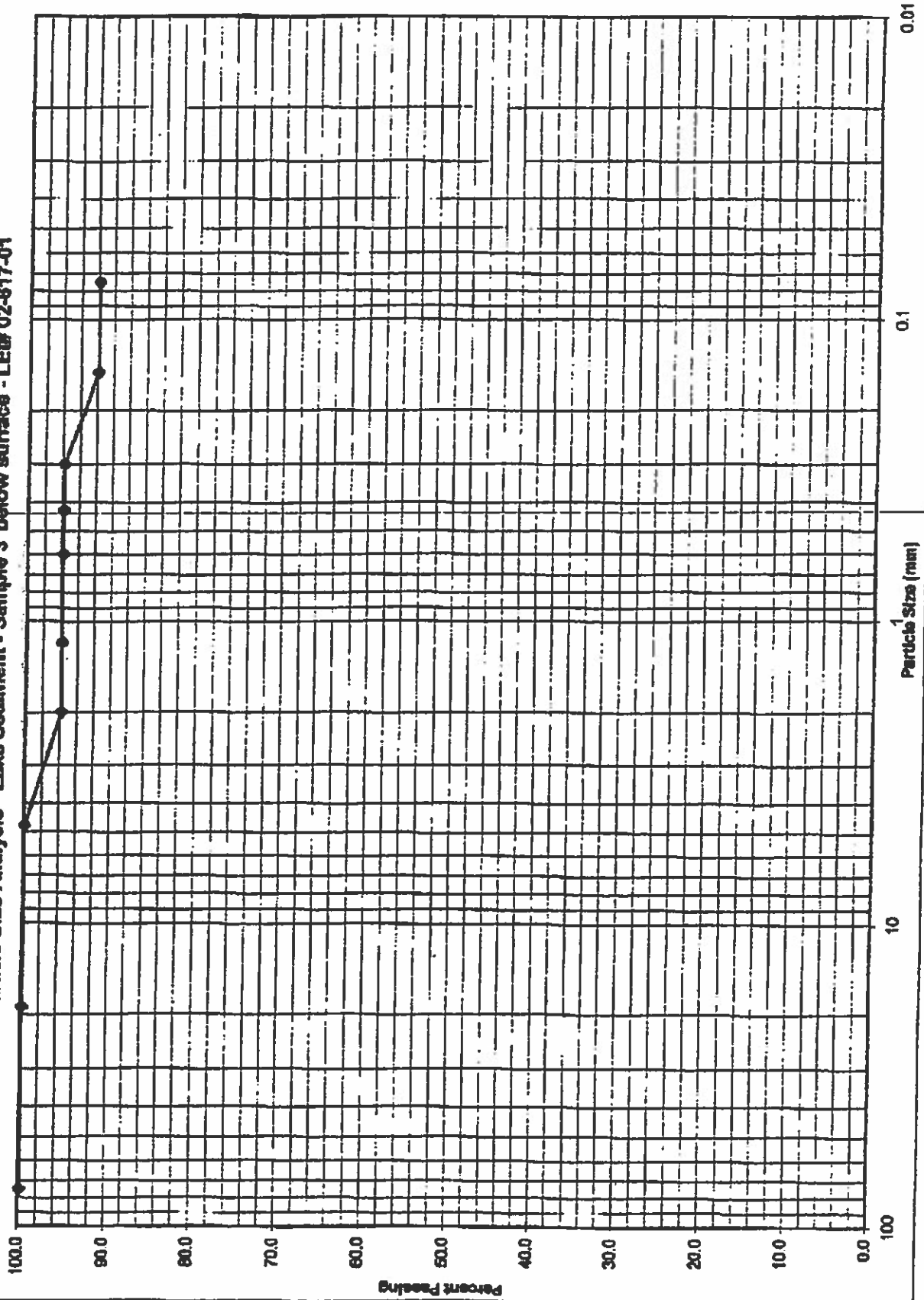
**Lakeshore  
Environmental, Inc.**

Consulting Hydrogeologists & Engineers | www.lakeshoreenv.com

803 Verbeke | Grand Haven, MI 49417 | 616-844-5050 | 800-844-5050 | 616-844-8053 fax

**APPENDIX D**

Particle Size Analysis - Lake Sediment - Sample 3' below surface - LE# 02-617-01





**Plate 1.** View of nearshore area, lakeward of Lot # 8, showing shallow water of Lake Missaukee, soft bottom sediments, White Water Lilies and Floating-Leaved Pondweeds.



**Plate 2.** View of the emergent marsh plants growing in the wetland zone directly lakeward of the shoreline near Lot # 8. Three Square and Arrowhead plants are visible.



**Plate 3.** View of the shrub community along the upland slopes of the Indian Lakes West area. In this area it appears that the shrubs (Speckled Alders) were recently removed.





**Plate 4.** View of the wetland shoreline of the western Lake Missaukee. These lacustrine wetlands are an integral part of the general ecology and food web of Lake Missaukee.