STATE OF MICHIGAN

STATE OFFICE OF ADMINISTRATIVE HEARINGS AND RULES

In the matter of:		File No.:	06-57-0002-P
Missaukee Lakes Master Homes, LLC _____/		Part:	301, Inland Lakes and Streams
		Agency:	Department of Environmental Quality
		Case Type:	Land and Water Management Division

HEARING - VOLUME NO. V

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE

525 West Allegan Street, Lansing, Michigan

Thursday, February 7, 2008, 9:00 a.m.

APPEARANCES:

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Lansing, Michigan

Thursday, February 7, 2008 - 9:10 a.m.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

DR. JAWORSKI: Yes, sir -- yes, ma'am.

EUGENE JAWORSKI, Ph.D.

having been called by the Intervenor and sworn:

DIRECT EXAMINATION

BY MR. PHELPS:

Q Dr. Jaworski, could you state and spell your name for the record?

A My name is Eugene Jaworski, E-u-g-e-n-e, and the last name is J-a-w-o-r-s-k-I.

Q And why don't we start with your educational background. What is that following high school?

A From high school where I graduated with honors I went on to the University of Wisconsin in Madison, majored in geography and geology and minored in rural sociology and then went on to graduate work at Louisiana State in Baton Rouge where I took 80 hours of studying instead of 60. I did that in lieu of a separate master's thesis, but I did several papers. Then I received my Ph.D. majoring in geography and geology at LSU where you have the Coastal Studies Institute and the Wetlands Institute, minored in marine science. As part of that I took geochemistry, also minored in soils studying

under Dr. Patrick and took a course in soil microbiology as well as an additional course in microbiology. And in marine science, the geochemistry course was taught by Dr. Clara Ho who's a well known geochemist. So I have a fairly strong background in the physical environment.

Q Do you have any professional certifications?

A I am certified as a wetland scientist as a result of the workshops held at Kalamazoo, the Kellogg Center by the U.S. Army Corps of Engineers Training Institute in 1978, '79 and 1980. I was one of the staff -- the scientists providing presentations. That was three day workshops and at the end of the workshops we held an examination. I took the examination the first time around and passed it. It was based on wetland plant identification, the identification of what we called back then transition zones and some material on wetland functions and values. I'm also certified as a hazardous waste site inspector as of 1993.

Q And have you also taught courses or workshop seminars to the DNR regarding the function and value of wetland?

A Yes, for the DNR, for the U.S. Army Corps of Engineers and for the U.S. EPA.

Q Do you have any particular knowledge or experience regarding trophic levels or food webs as they relate to wetland areas?

A I would say that my training in marine science in particular gave me some background. But my dissertation was on the

blue crab fishery of Louisiana, this (indicating) particular publication. It's focused on an estuary in Louisiana. The estuaries are surrounded by wetlands -- freshwater wetlands on the top then brackish then saline. The energy or food source is derived from the wetlands -- come from the wetlands into the water body, then are decomposed and translated into animal food material for the blue crab. The blue crab was particularly abundant in areas of current, of water flow, especially in beds of mollusks, not only oysters but also clams. And you just need to understand that in order to have good populations of crab and shrimp and other organisms in an estuary, they need food and they need lots of it. And so they're going to be located in those areas of high food production. And the initial input is to a large extent detritus, very similar to the wetlands of western Lake Missaukee.

I also did a study on Lake St. Clair in 1995 where we looked at the vegetation on the bottom of Lake St. Clair. That was in '95 and it was interesting in that in 1988 we had the introduction of zebra mussels. So zebra mussels were having a large effect on the clarity of the water as well as the nutrient loading of the bottom sediments through their feces. When they excrete their feces go to the bottom and it feeds the rooted aquatics on the lake and we could see that effect on the growth of aquatics in Lake St. Clair

due to the zebra mussels. So, again, it shows you the experience that I have ecosystemwise; not narrow which you might get if you took a degree in chemistry or some other field. I've got a much broader, much more integrated background through the training I've had and the work that I have done.

Q What's your current position?

A I'm a professor emeritus at Eastern Michigan University and I do teach courses. I taught one last semester in environmental assessment and planning. I'm also the principal of J & L Consulting Services. I've had that little consulting firm since 1983.

Q And what principally does the consulting firm do?

A It primarily does environmental consulting. I do a lot of wetland delineations for people buying property, both for private people as well as townships and municipalities. I'm the natural features consultant for -- currently for three public agencies, City of Southfield, Superior Township, Washtenaw County and Ann Arbor Township of Washtenaw County. Previously I did work for Meridian Township, Grosse Ile Township, Oakland Township and the City of Rochester Hills.

Q And the work you say you did for those townships, did that relate to identification of wetland, delineation of wetlands?

A Yeah, the delineation of wetlands, but also the preparation

of permits on behalf of those communities. If there's an expansion of a school or some other public facility, the township would be the permit applicant. For example, in Oakland Township, we established some sub fire stations and those had wetland impacts. Some had some fillings, some had discharge of storm water into wetlands so we needed permits. In addition to the delineation of wetlands and the preparation of permits, I developed mitigation plans. I do monitoring. I do a lot of site plan review, which is something I really enjoy, for the City of Southfield, the Townships of Ann Arbor and Superior. So all developments that have come through that have a natural features impact, I review that on behalf of those communities.

Q How many wetland delineations would you estimate you've done over your career or on an annual basis if that's easier?

A When I first started doing work back in 1983 -- actually the phone began to ring about 1980. People were calling and saying that, "Somebody says I have wetlands and I'm not even sure what a wetland is." And so I would do that pro bono. I just helped them out. Then I realized not only was it a lot of work, but sometimes I would be traveling, you know, to Sandusky or someplace, attend a meeting that would end at 11:00 at night and then I'd have to drive home at 12:00, 1:00 in the morning. And I said, you know, "I just can't do this for nothing." So I started my little consulting

business as a d/b/a in 1983. So today I do about two or three wetland delineations a week. Back in the early 1980's I probably did four or five, sometimes six in a week. So today I do fewer, but I do more permit applications, more mitigation plans, more site plan review, more investigation of violations.

Q You also indicated that you're currently a professor emeritus. When did you first become a professor?

A Well, my first assistant professorship was at Texas A & M in the fall of 1970. So I was there one year, taught meteorology, earth science and soils. Then I came to Eastern Michigan University where I was also assistant professor, promoted to full professor in 1985 and so I've got 18 years as a full professor. But in terms of professorship, I've been a professor for 34 years.

Q And what sorts of courses have you taught as a professor?

A Because of my minor in soils, I teach soils and soil science. I also teach biogeography which is more like natural resource management where I spend a good bit of time on wetlands and water fowl in the Great Lakes. I teach environmental site assessment for land use planners. I teach a good bit of aerial photography and remote sensing. I enjoy aerial photography and focus on getting students to identify features, measurement -- take measurements off photos. Remote sensing is a lot more automated where it's

computer assisted. I've taught earth science. I've taught quantitative methods, statistics primarily and typically manage at least one or two student theses as part of my work, as well as I used to be the internship and co-op contact person in the department. So I would contact industry and business and government who may have need for a co-op or an intern. So it allowed me to have that interface that I really enjoy very much.

Q You've touched on -- earlier in your testimony on some of the research work that you've done. Just elaborate if you would for the tribunal on any research or writing studies that you've done that are particularly relevant to the subject matter of this hearing.

A When I came to Eastern Michigan University in 1971, there was a lot of interest in wetlands. The state was interested in obtaining Section 404 authority from the Corps of Engineers and basically have their own state wetland act. Both the Corps of Engineers and the EPA were very interested in wetlands. So I set up a number of seminars and conferences on wetlands at Eastern Michigan University. I was hired by the U.S. Fish and Wildlife Service to do the function and value of the coastal wetlands. That's the text in front of you there, the one with the green cover. So I spent a good bit of time looking at the function and value of coastal wetlands in the Great Lakes. I also did a

publication, the smaller one there in front of you, in the Coastal Zone Management journal on the function and value of wetlands, particularly freshwater wetlands. I've done studies on the cause of historical wetland loss in the Great Lakes region. That is in the inland area largely due to agriculture. Along the coast we have more -- a number of factors including power plant development and so forth.

Q Okay. What about the subject matter of dredging? Have you had any experience with that?

A Yes. In 1974 we did a dredging analysis of the Great Lakes. That enabled me to become familiar with dredging. I was actually on the dredge the Markham that the Corps of Engineers used to dredge -- hydraulically dredge harbors. We used hydraulic dredging largely for maintenance dredging where the sediments are soft. Conversely, we use a drive line or a clam shell dredge where the sediments are hard or consolidated. So I was very interested in how a hydraulic dredge works, how the cutter head removes the sediments, pumps it to a scow and then is disposed in large contained areas. The work that we did in 1974 for the Corps of Engineers and the EPA was part of the confined dredge spoil disposal program in the Great Lakes where we have these large diked disposal areas, one at the mouth of the Huron River called the Big Banana which is two miles in length and half a mile in width and it contains contaminated or

polluted dredge spoil. There's probably 52 confined dredge spoil sites in the Great Lakes. There's one next to Cleveland; there's a couple next to Toledo; there's several in the Detroit River; there are those offshore of Chicago; there are those offshore of Green Bay, Wisconsin, all over the Great Lakes. The idea was if we were to confine these polluted spoils and give the water quality regulations a chance to work, that eventually our Great Lakes harbor would be free of contaminants.

Q And I take it you've testified before?

A Yes, as an expert witness as well as on behalf of the Michigan DNR/DEQ. Probably four or five times for the DNR/DEQ on various issues and as an expert witness probably 15 times.

Q And most or all of those relating to wetland issues?

A No, not necessarily. No, not necessarily. They could be a denial of a permit as in this case. It could be a violation where somebody -- some citizens group has taken somebody to court. I do do a fair amount of work for citizens groups. They tend to call me. Oftentimes it's pro bono work because the individuals are not well off and they're opposing a large developer. So much of the time I have to do the work with very little remuneration or kinds of studies that I might want to prepare.

MR. PHELPS: Your Honor, we ask that Mr. Jaworski

be recognized as an expert in the subjects of wetland and aquatic science and agronomy.

JUDGE PATTERSON: Voir dire?

MR. HOFFER: No objection. No objection, your Honor.

JUDGE PATTERSON: All right. No objection, he will be so qualified.

Q Mr. Jaworski, by whom are you retained and what were you hired to do in this case?

A I was retained by the Lake Association of Lake Missaukee, by Mr. Richard Morrow sitting right to your left there. And the goal or the reason I was hired was to -- two things: one, to investigate what appeared to be some wetland disturbance in the area of Indian Lakes West and secondly to understand the wetlands and the ecology of Lake Missaukee, particularly the western part of Lake Missaukee.

Q And on how many occasions have you personally visited Lake Missaukee?

A I've been at Lake Missaukee four times.

Q Would you by way of background just briefly explain to the court each of those visits and what you did during the course of each?

A The first visit was -- I want to check my notes to be accurate. First visit was on 9-6-98. Richard Morrow wanted me to look in particular at the Indian Lakes West area, sort

of the southwest corner of Lake Missaukee where a road was put in and more importantly, there was some disturbance of the wetlands in the 14 lots along the shoreline of Lake Missaukee. So we went out in a pontoon boat and we investigated the near shore area, the so-called littoral zone where there was wetland plants growing. We also looked at the upland side of the area landward of the shoreline to identify the vegetation -- the vegetation types. I collected some of the plants but most of them I knew. I had a soil probe with me. I probed the soil both in the near shore area and along the bank. I took color photographs. I took notes in terms of not only what plants I could see but -- plant species, but what birds and other wildlife I could see.

I was very concerned that there appeared to be a wetland violation, that the wetlands landward from the shoreline were either bulldozed or otherwise disturbed. You could see the sandy soil sticking out so I took pictures of that. Also at this time we went around all of the lake so that I could get an understanding of the water depths, the general ecology, the development. So with that pontoon boat, we circled the lake and I took notes and photographs. Then again on the 11th of June 1902 we went back out into the site because there was a --

Q Not 1902. What --

A 2002. Sorry.

Q 2002.

JUDGE PATTERSON: You didn't look that old.

THE WITNESS: Yeah, I apologize.

A The focus that time was on lot number 10 because there was a permit to dredge that particular lot. So we spent a good bit of time on the water depths, type of sediments and depth of the soft sediments waterward or lakeward of the shoreline. So we spent several hours collecting water depth, sediment depth and sediment type samples in that zone there. I also at this time looked at the remainder of that shoreline, again, from the pontoon boat. We collected vegetation samples, some samples of the invertebrates, some snails, some clams. As part of this visit -- or as a result of this visit, which I didn't realize at that time, there was a public hearing with regard to the permit to dredge lot number 10 -- not number 8, but lot number 10 at this time and I did attend that public hearing and gave a presentation as part of the citizens group.

Thirdly, I was on this site on 8-13-07. This time the focus was on lot number 8 because the permit had shifted to lot number 8. And, again, we were very interested in the type of sediments, depth of sediments, water depths lakeward of the shoreline. I spent a lot of time identifying the vegetation both up the bank onto the lot as could be seen

from the waterline. I have some idea where the OHM is, the ordinary high water mark. And as an individual, I am allowed to walk in the shoreline area up to the ordinary high water mark without trespass. So I investigated the vegetation in the near shore area and could see the vegetation up onto the bank in terms of the alders and the other -- the blue joint grass and other plants growing up onto the bank. I noticed at that time no wetland markers, no delineation, no wetland flags as I call it. It was as if the wetlands were not identified as part of the -- as part of the permit application. I had looked also at the permit application, saw no line that said OHM or ordinary high water mark. I saw no line that said 100 year floodplain. I saw no lines that said wetland boundary on the upland side, wetland boundary on the landward side. So this was of great concern to me. The last time I was out there was on the 15th of December in 1907. The focus this time was to look at alternatives. If --

JUDGE PATTERSON: I'm sorry. What was the date, Doctor?

THE WITNESS: The 15th of December 2007.

JUDGE PATTERSON: Thank you.

A The lake at this time was frozen over which was good because then we could do water depth and sediment sampling quite easily. So we focused this time on the lot number 1 area

because initially when I had looked at Lake Missaukee back on the 6th of September in 1998, we knew that the water depths were a little bit deeper there. So we took a traverse in that area in terms of water depth and sediment type. We found the water to be deeper at lot number 1, so it could possibly be an alternative, but the organic sediments were still on the bottom. We also did a transect out in front of lot number 8. We also went on further north walking on the ice and investigated those sandbar areas to see if that could be an alternative. So the idea -- and that trip was to see if there were alternatives to the lot 8 area. If that wouldn't work, what else could be done? One more thing that we noticed that was quite striking was the springs along the entire shoreline of Indian Lakes West and further north toward the sandbars. It was open water. Even though we had, I think, at that time 10 inches of ice, there were springs along the shoreline with open water. I even saw deer tracks where deer were drinking water out of one of these springs.

Q Okay. Dr. Jaworski, based on those visits to western Lake Missaukee, did you conclude that there are regulated wetlands on that western end of the lake?

A Yes, I did. And I also studied it, I want you to know, with aerial photography and satellite imagery.

Q And where are those regulated wetlands?

A The regulated wetlands occupy the shoreline area. They extend upland or landward of the shoreline perhaps anywhere from 25 to 50 feet. In that area we have alders -- speckled alder. In particular, we have blue joint grass, we have Carex sedges and other wetland plants. Lakeward of the shoreline the wetlands extend out to anywhere from 150 to 300 feet depending on the specific lot or area. That area along the shoreline you see the three square, the Scirpus olneyi; we have hard-stem bulrush; we have the arrowhead. A little further out we get into two water lilies, predominantly white water-lily but there's some yellow as well and the water shield. We also see some floating leaf plants in the Potamogeton and I identified Potamogeton natans. I also saw sago pondweed and Carex sedge -- I mean, muskgrass; the macroalgae Chara. The wetlands according to the literature, including Cowardin, et al, suggest that the wetlands in a lake extend out to a depth of six and a half feet. In this case, it appeared that the non-persistent wetland vegetation extended out to a depth of about three and a half feet. So I would think the lakeward limit would be the limit of the non-persistent vegetation, in this case the water lilies which would be out to a depth about three and a half feet.

Q So, first of all, just as a point of reference, you were examining specifically the area lakeward and landward of lot

8?
A Correct.
Q Okay. And so your testimony where you just described various plants, et cetera, that you found were either lakeward or landward of lot 8 on western Lake Missaukee?
A Correct.
Q And then just to clarify the record, do you have a distance of feet from the shore in front of lot 8 lakeward that you believe the wetlands extend?
A Yes. While I was out in the field on that day, we were in a pontoon boat and Mr. Dave Thompson who is one of the residents on the lake had a GPS system. So as I identified the outer edge of the wetland, he directed the boat along that outer edge and created a GPS line and map. And that map was reproduced and put in the reports that I generated to Mr. Arevalo.
Q And we have the report and the drawing, but do you recall an approximate number of feet that was from shore?
A I think in lot number 8 it's 185 feet. And I created a drawing in one of my reports, figure number 1, that indicates the limit -- I could refer to it to be precise, but I believe it's 185 feet in lot number 8. The water lilies and other non-persistent vegetation extend a little farther out in some of the other lots and I'm not sure in lot number 8 whether some of the water lilies were removed

by trampling or other means. But there is a little bit of an indentation on lot number 8. But elsewhere, the water lilies are out 200 to 300 feet. But if we use water depth or even the presence of organic soils, the wetland boundary could extend to as much as six, six and a half feet deep. So it would make a very wide wetland shoreline.

Q Thank you. You've testified that that's a regulated wetland. Could you elaborate as to exactly why you conclude that it's a regulated wetland?

A We have to go through the three criteria that the DEQ utilizes in Part 303 of Public Law 451. The three criteria are, one, the presence of wetland adapted vegetation. So when you see plants like alders, the speckled alder, blue joint grass, hard-stem bulrush, white and yellow water lily, those are wetland plants. Most of those are absolute or obligate wetland plants. And if we use this (indicating) little book put out on the status of wetland plants, what's interesting about this little book is this is the common and Latin name of all plants that are common in this part of the Midwest and indicates their wetland status. So when I do work, I refer to this to verify just how absolutely associated a particular plant is to wetlands. Some plants like the sugar maple are not a wetland plant. Other plants like the broad-leaf arrowhead is an absolute indicator of wetlands.

In addition to the plants, we have the soils. Soils in this case are organic. And all muck and peat soils thicker than six inches are considered wetland soils. We've got an organic rich layer here that is about a foot in thickness at the shoreline, at the waterline and extends out into the lake to a depth in excess of seven feet as measured by Mr. Morrow and myself and others to include the DEQ. So we've got the second criteria, the organic soil.

The third one is the hydrology. And a wetland has to either be saturated or inundated for certain periods of time. In this case, it's inundated under water anywhere from a few inches out to at least three, three and a half feet deep, if not more. At least the organic soil continues out into the lake. So we've got the three criteria; vegetation -- wetland adapted vegetation, wetland soils, in this case organic soils, and thirdly we've got the hydrology or water depths.

Q If you would turn to Exhibit 24 in the green -- yours is green and your Honor's is red -- binder.

JUDGE PATTERSON: I'm sorry. 24?

MR. PHELPS: Yeah, 24.

MR. HOFFER: Is that Intervenor's?

MR. PHELPS: Intervenor's exhibits.

Q There are three -- a series of three photographs. Let me know when you've got those.

A I've got the first one. They're stapled together. I've got the second one and then the third one.
Q What do these pictures depict?
A Well, the first one shows a -- somewhat of a close-up view from the water of the house on lot number 8. We can see in the foreground the floating leaved wetlands. We see in the foreground the white water lily Nymphaea odorata. It's in the foreground there. Further, closer to the shoreline we see what appears to be some cattails and some sedges. There looks like also some hard-stem bulrush.

MR. HOFFER: Your Honor, I'm going to object to this. He's testifying about documents not in evidence.

MR. PHELPS: He's identifying what's on the document. It doesn't even need to be in evidence for him to do that. But if you want, I'll move to have it admitted into evidence as Exhibit 24.

JUDGE PATTERSON: Okay. Why don't you do that since there's an objection.

MR. PHELPS: So it's admitted? Is that what --

JUDGE PATTERSON: Um --

MR. PHELPS: Well, let me ask the witness.

JUDGE PATTERSON: We need a foundation before we admit it.

Q When was this photograph taken?
A These photographs were taken from the pontoon boat when we

were out on site. That would be on -- let me go back to my notes to be specific. That was taken on August 13th, 2007.

Q And does the photograph fairly and accurately depict what you observed yourself in August 2007?

A Yes, and on previous occasions as well.

MR. PHELPS: Your Honor, we move that the photographs --

Q Well -- and is that true with respect to all three of the photographs in Exhibit 24? You can pull the staple apart.

MR. HOFFER: Your Honor, we do object. We received these in the mail, I think, last week. It seems every week something new shows up in the mail that they want to use and there was an opportunity for all of this to be disclosed beforehand. I don't know where he's going with this. And, you know, sooner or later it's got to stop.

MR. PHELPS: Well, I'll tell you where I'm going with it. The last time we were here I was surprised to see there was so much confusion about whether there were water lilies in front of lot 8 or not and I frankly couldn't believe that was a contested point. So now we've obtained the photographs that clearly show the water lilies in front of lot 8, undisputed, and there's obviously no prejudice from using -- having a photograph of lot 8 admitted into evidence.

JUDGE PATTERSON: Okay. I think there's been

sufficient evidence relevant to lot 8, both documentary and testimonial. I don't see any prejudice in the delay in disclosing them and I think a proper foundation's been laid. So I will admit Exhibit 24 --

MR. PHELPS: It's 24.

JUDGE PATTERSON: -- comprised of three photographs.

(Intervenor's Exhibit 24 marked and received)

Q Dr. Jaworski, you can continue explaining what you see with regard to the plants in the photographs in Exhibit 24.

A In the foreground where the water lilies are, the water depth was relatively shallow. We're looking at water depths of one to two feet, maybe two and a half feet on the outer edge to three feet; very soft sediments which we probed and looked at. The sediments are very organic, rich, clearly of a wetland nature. On the land -- I'm a little reluctant to bring this up, but when I was out there on the first visit in 1998, we had seen that the shoreline area had been graded and bulldozed, that there was a ice ridge berm there that was eliminated and leveled, some of the understory vegetation cleared so that would-be buyers of the property could see the lake from the road. You can see -- in this (indicating) particular diagram, you can see the white birches, you can see the other trees. The usual understory of alders and small red maples have been cleared away so it

provides better visibility.

Also, right in front of the house there's a sandfill. That sandfill extends into the wetland boundary. I looked at this both from the pontoon boat as well as from the uplands. I did not go on lot number 8, but in my report I generated a map that shows a wetland fill violation in my estimation on lot number 8. So the property, Indian Lakes West, is -- including lot number 8, is on the shoreline that has a nice wetland along the shore both extending onto the land as well as into the water. In my estimation, there's absolutely no evidence to the contrary. This is clearly a wetland and clearly regulated.

Q Are the wetlands and the plants that you observed in front of lot 8 on Lake Missaukee unique to that part of the lake?

A They are to some extent because much of Lake Missaukee, if you look at one of the aerial photos that we have -- I don't know, Mr. Phelps, what exhibit shows the entire lake, but if I could refer to that, please?

Q There's one on 14 and you can also use the aerial if that helps.

A So if we look at 14 -- I prefer that one. Do you have --

Q You can stand up.

A Okay.

JUDGE PATTERSON: As long as she can record it. Can you --

A Lake Missaukee is sort of kidney-bean shaped or figure eight shaped, however you might want to describe it, but it is elongated this (indicating) dimension. What is clear from the satellite image is that the shoreline is very much developed starting at this point here (indicating), which is not too far from where Richard Morrow lives. He lives down further here. But starting here, you can see the sand and the beach and there's a fair amount of development including lots of piers all the way around, even on this (indicating) end all the way up to about here. So this part of the shoreline is extremely developed. You look at the USGS quad you see a number of homes (indicating) all the way along there, even in the Tom's Bay area, numerous homes with piers and docks. So we have a very developed shoreline which is largely sandy; you can see it by the tones -- the light tones out along the shoreline. In this area here, in western Lake Missaukee, you don't see the sand with the exception of this area in the middle and along here (indicating). The rest of it is dark black indicating that we have wetlands -- wetlands in the Indian Lakes West area and wetlands extending to this area to include the Indian Lakes North area.

Q In the wetlands area, what other animal or insect life did you observe during your visits?

A Well, out in the field those three times, not in the

winter -- although in the winter I did see whitetail deer tracks in the wetlands -- but I observed redwing blackbirds as you'd expect; I observed black terns feeding on forage fish or minnows; I observed some fish, presumably northern pike, fairly large fish, feeding among the water lilies. I observed lots of minnows which I would think would be of the genus Notropis, in particular probably some spottail shiners. I observed marsh snails and I have some of those with me today. On the sandbars I observed the paper shell clam. I did find one crawfish cheliped or pincer. I observed snails on the stems and underside of the water lilies grazing on the water lilies. There were reported by Mr. Morrow eagles and loons on the western Lake Missaukee area, although I did not see them per se.

Q With regard to the animals, insects that you personally saw, did you see those in and around the proposed dredge site in front of lot 8?

A Yes, we observed -- and I forgot blue damsel flies.

Q Have you had an opportunity to look at the jar of sediment that Mr. Morrow testified about at one of our previous hearings?

A Yes, he collected that out in front of lot number 8 and, yes, I have looked at that. And I believe the consultant for the other party has looked at it as well.

Q When you looked at it, did you find any signs of life in the

jar?

A Yes, there is --

Q And what did you find?

A -- quite a bit of life. The most obvious are the family Gammarus -- or Gammarus (pronouncing), the amphipod, also called scuds. So there's quite a few scuds in the water there moving about. And when you shake the jar, they're very numerous. These scuds are -- the larger ones in particular are predacious so they predate on smaller creatures like water fleas.

Q Okay. Of what significance are those types of creatures to the ecosystem on the west end of the lake?

A The ecosystem on the west side of the lake is largely detritus based. So the plant material produced in the wetlands as well as being exported from the land including the wetlands next to the shoreline, that plant material is the basic input or is the detritus, the plant matter that feeds the system. And so these scuds and water fleas and Cladocerans are a little higher order level. They're the ones feeding on what is produced by the organic matter. So the organic matter is going to be broken down largely by bacteria and to some extent some marine fungi. They're going to break it down. There's also shredders at work breaking down and converting the organic material into animal life which then feeds the higher level things that we

can see in the jar. So the ecosystem there which has different food chains, or at least we might call them guilds, there are some grazing food chains or at least guilds you might call them. On the sandbars you've got the filter feeding clams and other organisms. But the main focus in this area is the algae and the detritavores. So that is the basis of the food chain all along that shoreline which starts from in that southwest corner that I pointed to all the way across that sandbar area to the other side maybe 10,000 linear feet of wetland shoreline lying largely on the detritus.

Q Have you read Dr. Lehman's report regarding his investigation into the existence or non-existence of life at the proposed dredge site?

A Yes, I did.

Q And did you agree or disagree with his findings?

A First of all, much of what he produced is very good, very accurate, very important, as a matter of fact, in this particular administrative hearing. His work on the organic matter in the lake, the percent water in the organic material, the percent ash in a dried sample, some of that is excellent. The amount of phosphorous that's in the organic material, he put that at an average of 260 milligrams per liter or parts per million; very valuable work that was done by him.

Q What about his work into the existence of life in the samples that he took with the dredge?

A What I have to understand -- and I think we have to understand here, he was hired to look at the effect of the impact of dredging on this 50 by 200 foot area. That's what he was expected to do. That's what was in his testimony. I read his testimony yesterday from end to end and that was what he was hired to do. So he was studying that 50 by 200 foot area, that rectangular area that would be dredged.

And in studying that, he took some Ponar dredge samples. He called it a petite Ponar dredge because it was a little bit smaller than the much heavier one that requires either a winch or some He-Man. And so he used a smaller version and collected a sample which I believe was 9 inches by 12 inches by 4 inches deep. That was his basis in part -- in large part for understanding what is growing on that floor of the littoral zone as he calls it. I call it a wetland area.

The problem with the dredge is that it is designed more for hard bottoms. So when it is put down, it often creates what we call a Ponar wave and hence you lose the top. And in his testimony, Dr. Lehman admitted that he might have lost some of the top material which he refers to as nepheloid or that organic -- that soft organic material on the bottom of the lake. That is very difficult to sample

with a Ponar dredge. But that's what he brought with him. That's what he had to work with. He was there only one time so he used what he had. And in my estimation or in my opinion, that was not the most appropriate tool to use to sample the macroinvertebrates of the bottom sediments of western Lake Missaukee, largely because as you collect the sample, you lose much of the top and it is the top where at least the living organisms would be. That's where you'd expect to find anything of a -- if there was any caddisflies working on the sediments, if there were any pill bugs, if there were any scuds, if there were any crawfish, if there were any fingernail clams, one would expect it to be in that top two, three, four, maybe six inches. And if he admittedly lost that in taking the sample, then he lost part of his sample area that would have had these critters.

Q You started talking about the nepheloid layer and the soil. What is the soil composition of the proposed dredge site?

A I wouldn't call the bottom sediment soil. I would call them sediments. The nepheloid material, according to Dr. Lehman, is the organic rich watery sediments that occur on the bottom of the lake starting from the shoreline going outward. I would disagree with that assessment a little bit in that at the shoreline you find a bit of sand because the sediments on the land are sandy. There's also some inorganic material there and it's a little bit stickier and

a little bit muckier in that first 50 feet or so. Beyond that, it becomes increasingly organic rich and the water content of the sediments increases so that there's kind of a continuum starting at the shoreline where you've got a mix of inorganic and organic and probably a water content maybe of 40 percent. But as you go farther out into deeper water, the sediments become more unconsolidated, more aqueous, more organic rich. But he did sample some of that and as I've indicated, I thought his work -- his data was very good insofar as what he collected it for.

Q Dr. Jaworski, what is the significance or importance of the wetland ecosystem on the west end of Lake Missaukee, to that area and to the rest of the lake?

A Before I answer that I want to check my notes because I think there's a very important point and I think we all need to hear it. If we're looking at the wetlands lakeward of the shoreline -- is that what you're referring to or are you referring to the other wetlands?

Q Well, let's start with the wetlands lakeward of the shoreline.

A If you start with the wetlands lakeward of the shoreline, we're talking about an emergent marsh that then grades into a floating leave and submersed wetland. So we've got a couple components there. In fact, in front of lot number 8 you even have kind of a mud flap where those springs are

coming up. So you've got that, the emergent marsh, the floating leaved and submersed aquatics going outward.

The primary value and function of those wetlands are in regard to fish nursery. Those shallow waters are where young fish, juvenile fish, can hatch and grow and not be subject to intense predation by larger fish. So we're talking about those forage fish, those minnows -- people call them minnows, but they're really forage fish. They're small fish, maybe a few inches in length but have soft fins and predator fish like northern pike and black bass and large-mouth bass, even large bluegills feed on them. But they need a place to grow that's relatively safe. It is -- the shallow water there of -- water from a foot to maybe three feet deep is where they are growing and feeding. And the predator fish are reluctant to move into that shallow water because they can be seen. And so if they come in there, they come in there quickly and leave, frequently at dawn and at dusk and they hide among the -- if you will, among the lily pads. So that is the cover. That is the area where there's both food and cover for the juvenile forage fish that are being reproduced in that area.

Q And what do those forage fish eat that's in that area?

A They're going to be feeding on those scuds that we see, those amphipods that are in that jar, as well as the water fleas. Some of them even eat algae, particularly when

they're smaller, and smaller zooplankton. So they're feeding among that organic rich sediment and also among the water lilies. They might be feeding on what we call the periphyton, the algae and other zooplankton that are feeding on the stems and leaves of the water lilies and bulrushes and so forth. So they have food there for them. So that's the main thing is that nursery.

The other thing that's really important about those wetlands -- oh, and I want to mention that -- you might say, "Well, there's plants on the bottom of the lake." It is said that much of the lake bottom has -- maybe 40, 50 percent is covered with vegetation. That's true. But the problem is, the predators are there. They can't hide. They're going to be, if you will, predated upon pretty seriously. But in those shallows areas, they have the cover and the protection.

The second thing those wetlands are important for is the primary production and the exporting of organic material for the lake. I like to think of western Lake Missaukee as the refrigerator for much of the lake. That's where the organic matter is being produced and being decomposed, broken down, translated into bacteria, into zooplankton, into insect larvae that feeds to a large extent the lake. Yes, there is some food production on the bottom of the lake, there's some in Tom's Bay, but a major part,

perhaps as much as 40 percent of the lake's food production, is probably on that western side of the lake. So that's really, really quite important. The third thing that I think is really important about those wetlands is that it has a impact set of components, both waterward and lakeward. And I prepared a diagram that I'd like for you to present at this time to help me explain that because I just don't want to be theoretical, I want to be very direct.

Q Is it -- the Exhibit 25 the one you're referring to? And it will be in the green -- your green book.

A 25? Yes, that's the one I'm referring to. And I really think it's really important for us to look at that and for the judge to see that because it shows both the lakeward side of the wetland as well as the landward side. And I put the functions above both of them. These wetlands are largely intact. If you go elsewhere in Lake Missaukee and in many lakes, like Walnut Lake, on the lakeward side there's a seawall or it's been dredged. In other words, it's been largely developed. There's no zonation there of plants and natural habitats. It's already developed. And on the landward side, frequently you've got agriculture there or you may even have a seawall or you may have a house.

But here we've got intact wetland systems with all the components landward and lakeward extending for about

10,000 linear feet along western Lake Missaukee. And in the middle there, I put a little ridge. That's called an ice-rafted ridge. That was the ridge that I believe they were taking out in 1997 and '98 in lots 1 through 14 so that people could see the lake. And I don't blame them. I like to see the lake myself. But that ice ridge there was probably removed and any of the vegetation on top of it so they could see. But the point is, we've got functions on the lakeward side, we've got functions on the landward side. On the landward side, I want to point out those springs because those springs I observed are very important in terms of nutrient transport to the wetlands. That's where we're going to get nitrate -- nitrogen being transported as the leaves and organic material break down and a certain amount of soluble phosphorous that can feed that detrital food chain. That's really important.

I made reference to a study that was ridiculed but I don't believe that should have been ridiculed because of the source of phosphorous coming in from the land. We really have to understand the energy dynamics and nutrient dynamics between the land and the water and we've got some very important things going on here that deserve further study by people more competent than me. But we still have to point it out. Also, I put in the functions on the very bottom of the landward wetlands the filtering of

contaminants.

We happen to have in Crooked Lake back in the 20's and 30's and 40's a lumber industry that was creosoting logs and doing other things, creating what we call tar pits. There was five to seven feet of tar and tar related material in Crooked Lake that was actually dredged out a few years ago. And in that dredging, there was a certain amount of soluble material coming through. And the wetlands in western Lake Missaukee and the uplands helped filter that out. So that may be a small point, but it's certainly important to the citizens of Missaukee Lake and to the Lake Association.

Q I wonder if you could -- and you might want to reference the drawings either at 26 or Exhibit 27 just to better explain what you mean by filtering the contaminants. How does that work?

A Are you referring to this (indicating) diagram?

Q Yeah, that one and the next one that's got the arrows on it.

A Let's start with that one, 26, then, if we will. Again, I prepared that because I just didn't want to talk in generalities and in regard to a lack of specifics. This map of Lake Missaukee is very important because it shows the shallowness on that western end. That western end of the lake is not like much of the rest of the lake and it cannot be developed that way.

So if a developer comes along and purchases large blocks of it -- in this case, Indian Lands (sic) West or whatever it's now called, that LLC, they own between Crooked Lake and Lake Missaukee 7,200 acres including Indian Lakes West which I have put on the map and Indian Lakes North. They're a big landowner. They have a great potential to affect this entire area of western Lake Missaukee. The wetlands I colored -- they're dark. So, again, you can see that they're largely on this (indicating) side. And if you look at the water level in Crooked Lake and you see that in meters at 378.5 and the water level in Lake Missaukee at 377.3, that data taken off of USGS quads, these quads here, you can see that the water flows from Crooked Lake through the wetlands and those uplands into Lake Missaukee. So those wetlands and uplands between them are the filter and the exporter of nutrients and phosphorous and nitrogen that help maintain the wetlands along the shoreline. This is a very important diagram to understand what's going on.

And so I would say that Dr. Lehman did a lot of work, but he was there once and his charge was to look at the impact of dredging a small area. He did not have the time, he did not have the mission to do a much larger, detailed study that I have attempted to do in part here.

And if you go to the next one, here I show how the contaminants from the tar pit, which is on the extreme left

side of your diagram there where the triangle is -- that's where that lumbering and creosote industry established back in the 20's, 30's and 40's created a very serious contamination area. But given the water flow from the northwest to the southwest and then into Lake Missaukee, those wetlands that are in between and uplands between Crooked Lake and Lake Missaukee are the important filtering area. Some of the contaminants that were located at the tar pits are some fairly detailed chemical analyses -- some of them I understand because they're related to heavy metals like copper. Some of them are the Aroclor species of PCB's. However, PCB's usually don't travel too far. But, anyway, they were there. And if the Indian Lakes people own that land in between, I think they bear a responsibility to the rest of the lake to manage and use that property consistent with the fragileness of the wetlands and the importance of the wetlands.

Q I wonder if you could explain the significance of the wetlands that you've identified in the process of filtering contaminants out of the lake?

A As the water through the wetlands and the water -- the groundwater in the higher land -- if we start with Indian Lakes West first, we've got higher land next to the lake and the house on lot number 8 is situated 10, 12 feet above the -- depending on where you are on the lot, above the

water level. Okay. The soils that are there are part of the Conover soil type which is kind of a loamy soil. It has a fairly high base saturation. In other words, it has a certain amount of calcium and magnesium. But as water flows through the soils, it's going to bring calcium, it's going to bring some of the other bases, it's going to bring nitrate, nitrogen, going to bring phosphorous into the lake and that's feeding that detrital system. We need a certain amount of nitrogen to break down organic matter.

In my soils courses, we always talked about carbon-nitrogen ratios. If there wasn't enough nitrogen, the organic matter doesn't get broken down. You add some nitrogen fertilizer and zippo, we can break down cornstalks in your field. Similarly here, as those nitrates come from those uplands into that organic area, it speeds up the process of decomposition which is part of the food chain of that area. So that's very important.

The other thing that I'd like to point out where I show the filtering contaminants, if we go back in time -- and there was some discussion by others here talking about the senescence of the lake and that the lake is slowly aging, but we should appreciate that Missaukee Lake is probably 14,000 years old. It has not filled in like some of the shallower ponds and wetlands have with organic matter. And part of the reason, if you go back in history

to about 9,000 years ago, Lake Michigan was 300 feet lower than present. If you lower Lake Michigan and Lake Huron and you dry up Lake St. Clair, which we know happened in the glacial history, we would have channels connecting Missaukee Lake and Crooked Lake into the Mosquito River which connects to the Muskegon River and out into Lake Michigan.

The point is that there's probably a channel that I haven't documented but I believe would be there because of these huge water level changes in the glacial history. There's a channel between Crooked Lake and Lake Missaukee exactly where I've got those flow channels. Lake Michigan has since risen back up because of the outlets through Canada that have been closed and the rebounding of the land; lake levels have risen again. But those shallow areas, those pathways, are still there. So I believe that water from Crooked Lake largely goes through those wetlands right between the lakes where I've got the arrows. I've talked to Bill Ardis about this. I've talked to Dave Thompson about this. My work is just not those four visits but includes talking, sending e-mails to these people who live on the lake because they're concerned about the lake.

Q I wonder if we've -- when we started this segment of your testimony, you said there were four important functions of the wetlands. Did we cover all four of those or was there still a --

A Let's review them quickly then. Fish spawning, export of nutrients into the lake, the wildlife habitats -- we've mentioned that there are black terns, that there are loons there, there is eagles there, there's redwing blackbirds, there's probably marsh wrens and I observed deer feeding there including drinking water from those springs. So we have quite a wildlife support system there. And then fourthly would be this groundwater and springs that not only bring some sediments but also filter some things as an important function.

Q You had mentioned fish spawning, but I don't think we elaborated on that in your testimony. Do some fish spawn in wetland areas?

A It depends on the fish. Two fishes that do lay eggs in vegetated area are northern pike -- I used to actually spear northern pike as a kid, illegally I should say, that came into the little creeks and farm ponds and northern pike would broadcast their eggs over the vegetation in the ponds and we'd go after them. There is very little area that's shallow like western Lake Missaukee. There are some areas in Tom's Bay where there is fish spawning on those beds of submersed aquatics. But that's where northern pike and yellow perch and some other fishes would lay their eggs, right over those beds of plants. The sandy areas would be used by the bluegills and bass. There would be nests in

those beds. And then the other fishes like the spottail shiners and blackmill shiners and other forage fish utilize a variety of things from rocks to sandbars to clumps of vegetation. So there is spawning going on there.

Q Dr. Jaworski, will the -- in your opinion, will the proposed dredging have a substantial negative impact on the wetland ecosystem of Lake Missaukee?

A Yes, clearly it will. And, again, I'd like to go through this carefully so that everybody understands. There's going to be impacts during the dredging; there's going to be a need for maintenance dredging after the dredging and then there's going to be what I call cumulative effects.

In terms of the impacts during the dredging, if we imagine a cutter head being lowered into, let's say, three, four feet of water, that cutter head is started up, churning the sediments. In order to remove hydraulically the sediments from this 20 by 50 area or whatever area we're dredging, we have to mix it with water, probably 85 percent water, maybe 90 percent water. So if the sediments are currently, let's say, 60 percent water, we've got to add more water to the sediments and then suck them out. Again, if we're dealing with water depths two, three, four feet deep and we start sucking it up, you're going to create a little vortex, a depression in the water surface if you will. This nepheloid that's been adequately described in

this area will float toward that depression, that suction, if you will.

As that happens, it will remove the sediments from around the water lilies and other plants. They will be dangling bare, if you will, in proximity to this dredging. The dredging site in my opinion will increase two to three times larger than the 20 by 50 area or whatever area they're trying to dredge because of the softness of the sediments. If you put down a silt screen, as the water flows toward the dredging site, it will float right under the silt screen and the sediments will continue to slough and wash and move toward the dredging hole. So you get a fairly large dredging area beyond the immediate area and it's largely because the sediments are so soft and unconsolidated and Dr. Lehman demonstrated that. It indicated that the water content was as high as 40, 50, 60 percent and that they were very soft. And he used the term "nepheloid." He didn't use the term "consolidated sediments" or "hard bottom," but nepheloid. And that's largely due to the ice rafting that takes place every spring as the ice moves back and forth over that area that's rich in organic matter and it keeps it stirred up.

So the other impact during dredging that's really important is if you start to remove the top layer of this organic material and expose the bottom layer, that bottom

layer of organic material is anaerobic. It's going to be black in color. We observed that black color when we did our sediment work. And Richard Morrow will attest to that and so will Dave Thompson, that the sediments below the surface, if you go down six, eight inches, become black and anaerobic which means without oxygen. So all the irons and sulfide or sulfates are reduced. If you expose that through the water, then the bacteria would immediately try to oxidize -- the oxygen in the water will try to oxidize those sediments. And that will reduce the dissolved oxygen level of the water in that area. And as that low oxygen water drifts out of the dredging site, it will affect the ecology that it runs into.

The other thing that will happen in part is these organic sediments will float out of the dredging site, maybe some distance, then by way of storms and ice shoving next spring, they'll be moved across the lake to include -- into the deep hole. And the ecology of that deep hole is very, very serious and very important to the lake. The lake is relatively shallow, only 10, 10-1/2 feet deep. The deep hole is down 25 to 30 feet and that's where the fish --

Q And where is that that you're referring to?

A That's on the other side of the lake closer to the eastern side. As this organic matter floats out into the main lake and is moved by storms and moved by ice and by boat traffic,

by some people who go quite fast over the surface, it will transport that nepheloid into the deep hole where it will become a very oxygen demanding material and will depress the dissolved oxygen. I xeroxed something for you from the testing being done annually by Professional Services Company. If you look at the one that I gave to you, you'll see that the dissolved oxygen in the deep hole is depressed, close to zero. The Lake Association is very concerned about that oxygen depression at depth. If the oxygen is removed, then the sediments are anaerobic. So you not only have anaerobic sediments and the problem of fish trying to survive down there, particularly in winter when you've got ice cover, but also as a associated process phosphorous will be released from those anaerobic sediments into the water column and the phosphorous level in the lake currently is kind of at a medium level and the Lake Association does not want it to increase substantially. That's the active effect of dredging.

Q Okay.

A And then there's the cumulative effects and the need for maintenance dredging. Let's talk about maintenance dredging. Those soft sediments, if you dredge an area, create a depression, if you will. Any storm that comes up will begin to move material right back into that hole. That hole becomes --

MR. HOFFER: Your Honor, I'm going to object to this on lack of foundation. I don't know how he's qualified to testify about soil movements, structural engineering.

MR. PHELPS: Well, he's got a minor in agronomy. He's been accepted as an expert in agronomy which is the study of soils and a wetlands expert.

JUDGE PATTERSON: I think, Counsel, you've established adequate credentials and experience. Credibility can obviously be an issue you can pursue on cross.

MR. HOFFER: Thank you, your Honor.

Q You can continue, Doctor.

A As I mentioned earlier, I was on the Markham, that dredge of the Corps of Engineers. I spent two semesters working for the Corps of Engineers as a exchange person. So it's not that I'm unfamiliar with dredging. And I did do that dredging study back in 1974. Anyway, I believe the sediments will wash back in there by various processes, particularly by ice shoving next spring. As the ice moves across that area and wraps up along the shoreline creating those raft berms that I showed you, you're going to fill that back in so there's going to be a constant maintenance dredging problem.

Q And why is that a problem?

A Well, if they want to use it not only for boating but for

wading and swimming, it'll fill back up again. And so they're going to need to have a long-term maintenance dredging requirement on there. The other third thing is cumulative effects. If you put in one pier, it sets a precedent. What about the people who live on the other side of the road? There's already been some discussion that we need a pier for those people. Also, my experience in Oakland County working on Walnut Lake and Long Lake -- if you have one pier that serves a group of people, everybody wants to be able to be picked up at their lot, at their shoreline. If they're carrying a can of gasoline, they don't want to carry it down the road or transport it down the road and carry it out to the end of the pier, they want the boat to come to them so they can put the gasoline aboard the boat or the picnic table or Grandma. So pretty soon we have boating at the riparian edge for almost everybody. And it's not that they want to do this on purpose, it's just the way it is. And I see that over and over. The only way you could prevent that is with a conservation easement and the DEQ had the good insight to suggest that. Okay. You want a pier. One of the ways we can prevent that cumulative effect of everybody using their shoreline as a docking area, whether there's a pier there or not, is have a conservation easement.

Q What's the impact on this wetland ecosystem on the west end

of the lake by the boating activity you just described?
A If we get increased boat activity, we will really stir up those sediments which will smother the vegetation in part, at least the submersed aquatics, the Chara and the sago pondweed. It will smother the spawning beds to include on those sandbars where the bluegills and bass spawn. The problem is, boats today are equipped with motors that are larger than they really need. People go faster. And right now in Lake Missaukee the Lake Association is trying hard to encourage people not to water-ski in that area. And I think Richard Morrow can testify to that. And on weekends in the summer when the kids are out of school, that lake really gets busy. And it's really important --

MR. HOFFER: I'm going to object to this as hearsay.

MR. PHELPS: And that's fine.

JUDGE PATTERSON: I'll sustain that objection without more of a foundation.

Q Yeah, let's move on to a related issue which is this -- you've studied the sediments on that west end of the lake?
A Yes.
Q Are those the type of -- is that sediment -- can that become, once it's stirred up, suspended in the water column and transported throughout the lake?
A Yes. But, again, we've got to understand that there is a

continuum from the shoreline. There's a little more clay in the sediment closer to the land and as we go farther out, it's more organic. So what will happen, depending on where the dredging is and where the boating activity takes place, we're either going to get some clay or organics, and much of it will, in fact, be organic. And that organic material is a little bit more dense than the water so it does tend to sink. While on the other hand, its density is close to water so that if we have people ripping and roaring with boats and water-skis, it will be moved into the water column, moved some distance. And then the next storm, the next ice shove will move it that much farther.

Q What about the dredging itself? Does that have the potential to stir up sediments that can be transported throughout the lake?

A Yes, because of the velocity created at the cutter head. In order to suck it out, cut the sediments and mix it with water, you have to have a cutter head. If you just had a pipe, the first time a chunk of organic would come in there and clog it up. So we do need -- if there was a stick or something else, it wouldn't function. So there's always a cutter head at that end cutting and mixing and then there's -- the velocity to draw that material out creates the vortex at the dredging point. It's worse here because the water depths are very shallow and within a few seconds

you've exhausted the water in the proximity to the pipe and more water has to come in, drawing the material to the cutter head.

Q Now, you testified that one of the things that happens both during the dredging and with increased boat activity is the stirring of sediment and I think you said smothering of plants or spawning areas. Can you elaborate on exactly what happens -- the potential for that to happen and how that would effect both the ecology of that part of the lake as well as the entire rest of the lake?

A We need to appreciate just how much removal they want to do. And I've heard talk that they want to take it down to the hard bottom. That particular scenario, taking it down to the hard bottom, concerns me because after you remove a foot to maybe five feet of soft material you get into the more clay material which has much more suspended -- higher potential for suspended sediments and turbidity, not unlike Redman Island back in the early 60's; you're going to get into that effect. So it depends on how much of that sediment column you want to take in terms of are you going to get just primarily organic material with a high BOD floating around or are you going to have inorganic sediments from deeper and/or closer to the shoreline? I don't see much evidence in the permit of detailed sediment analysis and its potential effect on the dredging process.

Q Does the potential -- well, would the turbidity of these sediments if the dredging goes forward have the potential to ruin spawning habitat for some of the fish that spawn in that area or to further impact the plant life that's in that end of the lake?

A Yeah. If we look at just the sandy areas where the bluegills and bass are spawning in their little nests that they create, if we were to happen to have dredging right during the spawning when the eggs are present, the eggs are somewhat sticky. So the organics and suspended sediment will cover over these eggs and actually prevent the eggs -- the little larvae from breathing. The egg literally has to breathe and take oxygen out of the water. If you smother those eggs with sediment or organics, you're going to have a die-off. So that's a direct effect. The other effect is to cover those spawning beds with either inorganic sediment or organic sediment to where they no longer are as functional. So, yes, it has an effect and I think Mr. O'Neal alluded to that in previous testimony.

Q Dr. Jaworski, based on your investigation, are there feasible, prudent alternatives available to the Petitioner that would have a less severe impact on the wetlands on the west end of Lake Missaukee?

A Yes, I believe so. Probably the most obvious alternative is to, instead of dredging that 50 by 200 area, leave those

sediments in place and simply extend the removable dock out into deeper water. If the magic depth is 3 feet as necessary draft, then we have to go out perhaps 200 feet or so into the lake and then put the dockage there. That would make it somewhat long, sure, but at least we wouldn't have to dredge not only initially but maintenance dredge and have those effects we've talked about. We could extend it in deeper water. We still may want to be concerned about cumulative effects and maybe even discuss as part of that a conservation easement so we don't have the destruction of the shoreline of the very properties that people are wanting to live next to, incidentally, if you will, but it will happen.

Another alternative is to locate the dock system in the lot number 1 area where we've got an additional foot or two of water depth as compared to lot 8 or lot 10. We had seen that -- back in 1998 Mr. Morrow and I saw that that area was deeper. There was even a little bit of sand at the shoreline suggesting a little bit of wave action there. So that represents an alternative. You'd have to work it out with Mr. Jack Bails who owns lot number 1, putting it either between 1 and 2 or you put it to the side.

MR. HOFFER: Your Honor, I'm going to have to object to this for foundation and speculation as far as what Mr. Bails would do.

MR. PHELPS: I don't think he said what Mr. Bails would do.

JUDGE PATTERSON: No, I think he said you'd have to work it out with him which is, I think, an obvious fact since he's the owner.

A There's a third alternative.

Q Well, before we go to the third alternative, I -- I don't think there should be any dispute about this, but you -- on your visit in December, did you examine the area in and around lot 1?

A We did.

Q Okay. And are you aware of whether or not the Petitioner or related persons or entities actually own land adjacent to lot 1?

A It appears that they do.

Q So when you suggest an alternative and you reference lot 1, it's not necessary that the dock be at lot 1, you're simply using that as a point of reference?

A Correct. In fact, it could be adjacent to lot 1 further to the southeast -- south -- southeast --

Q Southwest, I think.

A -- and -west, yes.

Q Okay. Southeast, I guess.

A Okay.

Q Whatever that is, whatever -- we can just -- there's already

been testimony in documents on the record about the ownership of the land adjacent to lot 1. But I just wanted to be clear that when you propose that alternative, is that based on your investigation of that area in and around lot 1?

A It is and we were there on the ice. We took water depth samples. We could see the limit of the lot 1 area and we could see where Mr. Bails had his dock. And so we felt that in that area there was greater water depth and hence less need for dredging and then hence less impact.

Q All right. And I think you said -- referenced a third alternative?

A A third alternative would be having a fairly long pier out to one of those sandbar areas. The sand would not have the same effect even if you did a little bit of dredging to have an approach channel than dredging organic rich sediments. It may not quite be as accessible to people in Indian Lakes West, however, so that's kind of a drawback, but you could do something there, you know, in proximity to that.

MR. PHELPS: And then, your Honor, I think we're largely done with the direct. I do, however, want to move for the admission of Exhibits 25, 26 and 27. These are the diagrams and the map with the arrows, et cetera, that Dr. Jaworski testified about. Obviously you can use them as demonstrative aids anyway, but I do think they're helpful

for the court to have them and the tribunal to have them in the record. And they're simply -- there's been numerous maps with his arrows on it. I can't imagine prejudice to the Petitioner by having these documents in as part of the record.

MR. HOFFER: We will object to the last set of diagrams, especially the ones that have the contaminants and the area -- or the arrows and the flow. This whole contaminants issue was a completely new issue that we never had any notice of. This wasn't listed in his testimony in his witness disclosure. It wasn't in his reports. This is something, you know -- these documents were actually e-mailed to me yesterday and we've had absolutely no, you know, opportunity to respond to this new contaminants issue that showed up this week. So as far as substantive evidence being admitted, I would object to that.

MR. PHELPS: So is the objection to all three or just the last one?

MR. HOFFER: Actually, just the last one if that's the one that has the arrows and the tar pit and all that.

MR. PHELPS: Okay. Well, then, that's 25 and 26. And my response on 27, your Honor, to which there is an objection is he's already testified for one thing about the issue. We're just having the diagram put in as part of the record so it will correspond with his testimony. And,

second, his testimony is largely about the function of the wetlands and the filtering process in general. Regardless of any identification of a specific contaminant, that's the function of those wetlands and that's one of the negative impacts if they're removed and disturbed. So I think there's adequate foundation and he's already testified, so there's no prejudice to simply having the exhibit put into evidence.

MR. HOFFER: No further response.

MR. REICHEL: Judge, just for the record, we have no objection.

JUDGE PATTERSON: All right. To any of them?

MR. REICHEL: Any of the three.

JUDGE PATTERSON: I'm going to admit -- obviously there's no objection on anybody's part to 25 and 26, so those will be admitted. Regarding 27, I'm going to admit that for the limited purpose of demonstrating general wetland functions. I don't think there's been a proper foundation for the existence of the tar pit or the constitution of that or, you know, whether that's actually flowing through.

(Intervenor's Exhibits 25, 26 and 27 marked and received)

MR. PHELPS: That's fine. And with that, we rest our direct.

JUDGE PATTERSON: And with that, I need a break. Let's take 10 minutes.

(Off the record)

JUDGE PATTERSON: Mr. Reichel, any direct of Dr. Jaworski?

MR. REICHEL: Perhaps just a couple of things.

CROSS-EXAMINATION

BY MR. REICHEL:

Q Dr. Jaworski, in your testimony you talked about -- you were asked about the different occasions when you visited the area of Indian Lakes West or the west end of Missaukee Lake. And I believe you testified that one of those occasions had to do with in -- I believe, in 2002 and you referenced something about a permit for lot 10; do you recall that?

A Yes.

Q Just so the record is clear, were you testifying that a permit was issued or that you were just asked to comment on a permit application?

A We were just doing some work in regard to that pending permit.

Q The application?

A It wasn't issued. At least that was my understanding that it was not issued.

Q Just to clarify a couple of other things, when you were testifying about the various functions with respect to the

wetlands, particularly the lakeward wetlands of the shoreline, you talked about various functions they provide with respect to fish. You were asked -- you testified, I think near the end of your direct examination, about fish spawning, but is it also your testimony -- or is it your opinion that the -- what functions, if any, do the wetlands in the littoral area, the lakeward area, provide with respect to forage fish; in other words, is it spawning? Is it nursery? Is it habitat? Is it nutrient source? Which of those -- what functions do those wetlands provide with respect to forage fish?

A Again, the forage fish are going to be located in shallow water in part because that's where they have cover and the predator fish tend not to want to go into shallow water after them. So it becomes a strategy, if you will, of survival to be located in shallow water. In the shallow water, they migrate to cover which is either the floating leaved plants or the submersed plants like the bulrushes and arrowhead and the submersed aquatics. So they're found in conjunction because of cover in regard to the plants. The plants also are providing the substrate for grazers like snails and other things that are feeding on the periphyton and algae. So they're not only hiding there and being protected there, but they're also finding food there, insect larvae, amphipods, other things that are there they're

feeding on. So the very habitat is providing cover, it's providing food resources, it is providing protection from predators.

Q And given your understanding of what project the Petitioners are seeking a permit for, what would be the impact of that project if a permit were issued as requested on these functions that I just asked you about?

A Yes. The impact would certainly -- that area that they would dredge, if it would just limit it to 200 feet by 50, which I don't see how it can be given the nature of the sediments -- so that's not my opinion, that's the sediments saying that because they are so light and unconsolidated and characterized by nepheloid, they will float into the dredging site. So the dredging will remove the plants which removes their cover, removes their food source and therefore diminishes the habitat for them. They'll have to move elsewhere. And because the dredging cannot be limited to just that small area because of the sloughing in of sediments and then the action by both storms and ice shoving, we have to constantly maintain it. Then we have, in addition, the effect of the reduced sediments on the dissolved oxygen. Those reduced black sediments are going to take up dissolved oxygen, lower the dissolved oxygen and directly affect the survival of fish and invertebrates and even the bacteria right in that area.

MR. REICHEL: May I have just a moment to review my notes?

JUDGE PATTERSON: Sure.

MR. REICHEL: I have no further questions at this time.

JUDGE PATTERSON: Okay. Cross-exam?

MR. HOFFER: Yes.

CROSS-EXAMINATION

BY MR. HOFFER:

Q Dr. Jaworski, could you turn in the big book to Exhibit 18 and then it's a rather long exhibit, but one, two, three, four -- it will be -- five pages from the back will be a plat map that reads, "View of dredge spoils sites" on it. Can you just let me know when you get there?

THE WITNESS: Mr. Phelps, is it this (indicating) one?

MR. PHELPS: Yes.

A What number?

Q Actually, let's use a different one. On the bottom left it should be number 3.

JUDGE PATTERSON: Exhibit Number 3?

MR. HOFFER: Exhibit 18.

JUDGE WARD: Okay.

MR. SHAFER: I believe it's the fifth page in -- sixth page in.

MR. PHELPS: I get a different page than you guys are on when I go in six, so that may be why he's --

MR. HOFFER: In the bottom left corner there's circled numbers and it should be number 3. It will read along the spine, "Item 1 map."

JUDGE PATTERSON: Okay. It's item 1 map?

MR. HOFFER: Yes, your Honor.

MR. REICHEL: Counsel, is this (indicating) the --

MR. HOFFER: Yes.

MR. REICHEL: Yes?

MR. HOFFER: Yes. Do you not have one?

JUDGE PATTERSON: Okay. That's what I've got.

MR. PHELPS: That's fine. I --

MR. HOFFER: There's about three or four of them in there.

MR. PHELPS: I'll go back to the one you're talking about.

Q Do you see where unit 1 is located on this map, Dr. Jaworski?

A I've got to find the same map you're looking at.

Q Oh, I'm sorry.

MR. HOFFER: Your Honor, may I approach?

JUDGE PATTERSON: Yeah, sure.

Q Okay. One of the alternative sites you proposed was the shaded area next to unit 1?

A Correct.
Q And there are wetlands lakeward of that area; correct?
A Correct, but they're not quite as extensive.
Q And you conducted an inventory of the wetland there in front of that area?
A Just a preliminary one in that they -- there is wetland vegetation, but then the water drops off fairly quickly, goes to two, three feet, and there was not the same number and extent of water lilies as in front of lots 7, 8, 9, 10.
Q So there are water lilies lakeward of that area; correct?
A But very limited.
Q And would dredging that area have an effect on the ecology of Lake Missaukee?
A It would, depending on what you dredged and what you didn't dredge.
Q How would the effects of the dredging of that shaded area be in relation to the proposed project?
A I'm not understanding what you're asking.
Q How would the effect on the ecology of Lake Missaukee -- how would that be affected by the dredging of that area -- that alternative area as opposed to the project area?
A First, there was no suggestion that we dredge all that shaded area. That would be board walked probably from the edge of the road or wherever the wetlands start out to the shoreline and the floating dock would be out in the water.

Q How would dredging lakeward of lot 1 or that shaded area next to lot 1 affect the ecology of Lake Missaukee?
A It would be minimum because the water depths are very close to the shore, like, maybe 50 feet, already three feet deep.
Q So dredging outside of that area would be minimal in relation to the ecology of Lake Missaukee; correct?
A If we put a removable dock in here that is largely lakeward of the edge of the wetlands, the amount of dredging and then the impact on the lake would be minor.
Q Minor. Can you quantify the difference between dredging this area as compared to the project area in terms of how it would affect Lake Missaukee?
A By the "project area" are we referring to lot number 8?
Q Correct.
A Yes.

MR. PHELPS: I'm going to make an objection to the form of the question. It's so vague and general we're comparing an apple and an orange. He hasn't defined what the dredging would be that he's talking about in his question adjacent to lot 1 and Mr. Jaworski didn't testify on direct that there would be any dredging on lot 1, nor did Mr. Morrow. It was an alternative site where the water was deep enough so there would be no dredging. So if it's a hypothetical, that's fine.

JUDGE PATTERSON: That was my understanding of his

testimony.

MR. PHELPS: But he needs to put some facts to the hypothetical.

Q Well, first let's talk about the dredging project. Where is your understanding of where the dredging will begin? What is the area to be dredged in relation to the shoreline?

MR. PHELPS: Are we talking about lot 8?

MR. HOFFER: Yes.

A I can look at the diagrams here in that -- well, to make it more quick, my understanding was that there was some clarification as to what would be dredged and what would not be dredged. And I think that I got out of it that the dredging would start maybe 25 feet from the shoreline as if that was the end of the wetlands and that it would start from that 25-foot distance lakeward of the shoreline out 200 feet.

Q Okay. And what is your understanding as to the width of the dredge area?

A 50 feet.

Q Okay. Now, back to Exhibit 18 here, is there anywhere lakeward of the shoreline depicted on this map that is not a wetland?

A I want to be sure I'm looking at the same drawing you are because I moved it. You're looking at the one that says "Item 1 map"? Is that the --

Q Correct.
A Okay. And your question was is any of that shaded area there not a wetland?
Q Is any of the lakeshore -- is any of the area lakeward of the lakeshore that you can see in that diagram -- is any of that not wetland?
A No, it's all wetland.
Q It's all wetland. So direct access from unit 1 would require going through a wetland; correct?
A Are you going by land or by water?
Q From land onto the water directly.
A I'm not understanding the question because --
Q If you wanted to walk from the area of land that was unit 1 directly into Lake Missaukee or onto a dock, you would be going through a wetland; correct?
A You're talking about coming along the shoreline?
A Just -- I mean, hypothetically if someone had a house on lot 1, which I believe there is, in order for him to access the lake, he has to go through a wetland -- correct? -- to directly access the lake?
A There's a pier on lot number 1 which goes over the -- it's a removable pier, so it goes over the wetland. It's boardwalk, so to speak. And he has access to the water.
Q So how about unit 2? There's no pier there. If someone wants to access the lake, they have to go through a wetland;

correct?

A If they're trying to move along the shoreline, that's part of the cumulative effect we've talked about.

Q And the same is true with unit 3? If you want to walk from unit 3 out into the water you have to go through a wetland; is that correct?

A Correct.

Q And the same is true with unit 4?

A Correct.

Q And the same is true for each and every unit, 1 through 14; correct?

A The wetland shoreline is all along there.

Q So if anyone wants to walk directly from the shoreline into the water they've got to go through a wetland; correct?

A Correct.

Q And in Intervenor's Exhibit -- I believe it was 23, it's your sketch that has the wetlands darkened.

MR. REICHEL: Excuse me, Counsel. Are you referring to 26?

MR. HOFFER: I don't have mine labeled. Is this (indicating) 26? 26.

Q Are you there?

A Yes.

Q Okay. And you testified that you darkened this map; correct?

A I did.
Q And the darkening is to indicate the presence of wetlands; correct?
A The general location, because this is a photo interpretation based on some field knowledge and the rest is the tones being exhibited by the image.
Q Okay. And do you see -- are the dark areas what you believe to be wetlands?
A Correct.
Q Okay. And do you see at the top of the map a area labeled "Tom's Bay"?
A Yes.
Q And are you familiar with the names of the smaller bays that are north of that? Have you ever heard of the phrase "North Bay Lagoon"?
A No, I haven't.
Q But you do see two smaller lagoon-like areas north of Tom's Bay?
A Correct.
Q And your wetlands -- your darkening for the wetlands begins in that area; correct?
A Correct.
Q And that is uninterrupted all the way to the Indian Lakes North area along the shoreline?
A No, that's not true. The area -- there's sort of a straight

line area where there's a large number of homes sort of in between Tom's Bay and Indian Lakes North. That has a fairly sandy shoreline. It shows on this image and that is not wetland.

Q Okay. You see that the two lagoons north of Tom's Bay are all darkened; correct?

A Correct.

Q And that indicates wetland; correct?

A Correct.

Q And Tom's Bay, the interior is entirely darkened; correct?

A Correct.

Q And as you exit Tom's Bay, the shoreline west of that, that is darkened as well; correct?

A Yeah, that's not correct.

Q That's not intended to be darkened there?

A No.

Q Okay. But basically between Tom's Bay -- Tom's Bay is a wetland; correct?

A Correct.

Q And you understand that dredging has occurred in Tom's Bay; correct?

A Absolutely.

Q And were you contacted to do a environmental assessment of Tom's Bay?

A Not really, but we did drive through that with a pontoon

boat on two occasions.
Q On two occasions, but nobody ever contacted you because they were concerned about the ecological effects of dredging Tom's Bay; correct?
A I think Mr. Morrow and I talked about it, but I was not asked to do something direct with regard to that permit application.
Q Okay. And did you ever survey the fish in Tom's Bay?
A I surveyed the vegetation primarily. We did notice some minnows, but that was kind of incidental and secondary.
Q By surveying the vegetation, do you mean that you documented the vegetation?
A We drove the entire perimeter starting on the west side and went all the way around and back out the entrance to see if it was largely colonized by vegetation, submersed aquatics.
Q Okay. And did you identify any spawning areas in Tom's Bay?
A Not as such, but I would assume that northern pike would probably spawn on the submersed aquatics in that area.
Q Okay. And you would agree that the dredging of Tom's Bay destroyed wetlands; is that correct?
A In the direct area of dredging it did and there was some secondary effect from the turbidity.
Q And what was your -- did you object to the -- did you personally object to the dredging of Tom's Bay?
A I can't really comment on that. I wasn't there.

Q You weren't there. So do you think it was detrimental to the lake to have Tom's Bay dredged?
A I wasn't there and I wasn't asked to comment on it. I have my own opinions -- professional opinions, but that's about all I can offer at this time.
Q Well, what was your professional opinion on that matter then? Should Tom's Bay have been dredged?
A Tom's Bay, the permit application should have included both 303 as well as 301, both Inland Lakes and Streams and Wetlands.
Q I understand that. But should Tom's Bay have been dredged in your opinion -- in your professional opinion?
A The bay is contained. The dredging was limited or restricted to an area. The dredger apparently, based on what I could see in a post situation, used silt screens. And it appears as though the impact area was relatively small and temporary. And given that not only dredging took place but some seawall construction, it was probably acceptable.
Q So the Tom's Bay dredging was acceptable in your professional judgment?
A Overall, given that it was a contained area, that they didn't dredge the entire thing, they dredged the area where the boats were being docked, they used silt screens and then they have since followed it up with some seawall

construction to prevent sloughing and the recurrence of the need for dredging, I think overall it appears to be at least somewhat acceptable, yes.

Q Okay. And you would describe the area of the dredging as small; correct? That was your testimony?

A It was restricted, yes.

Q You believe the dredging area was small -- small and temporary?

A I would have to literally scale it out, but it probably was. And, again, I didn't see the exact permit. I looked at the western side. My understanding was it was on the western side a little further to the north. We checked that area; it didn't seem badly damaged. So if it was a strip 100 -- or 200 feet long by 25 feet or so, it didn't appear to be grossly damaging.

Q Okay. And you also described the dredging as temporary; correct?

A The dredging as temporary?

Q The effects of the dredging as temporary?

A In the business of doing impact statements, we look at certain activities as temporary whether it be suspended sediments or the dredging of a site with regard to -- the turbidity would probably diminish in a few weeks, that over time the vegetation would re-colonize and the fish use will resume after a year or two. In that context, yes, we would

say the impacts of dredging that area is temporary.
Q Okay. And in relation to lot 8, the project site we're discussing today, that dredging and the effects of that dredging would be temporary as well; correct?
A No.
Q So if you dredged Tom's Bay and then you completely abandoned all activities, is it your testimony that that area wouldn't return exactly the way it was?
A Yes, it will not return because it's a enclosed system with a fairly narrow entrance channel. From what I can see, the homes surrounding particularly on the west side as well as those on the east side are stabilized with lawn, now with the retaining walls they put in. And I mentioned that it was not only dredged, but steps were taken to minimize the sloughing from the shoreline into the docking areas. That has taken place. So there may be in the future, 10, 15 years, some need to dredge some organics that accumulate because there certainly will be organic matter accumulation in there. But it's not the same as an open system where lot number 8 is.
Q Okay. But let's look specifically at lot 8. If the dredging project as you understand it was completed and then the area was just completely left undisturbed, it would return to its former state; correct?
A The sediments would come back into that, then it would take

some time for the floating leaved and submersed aquatic plants to re-colonize that area.

Q But your answer is, "yes," it would return eventually to its former state; correct?

MR. REICHEL: I'm going to object --

A Not completely.

JUDGE PATTERSON: There's an objection, Doctor.

MR. REICHEL: I'm going to object to lack of foundation or at least the form of the question. If counsel is asking -- is this intended to be a hypothetical or is this intended to be with respect to the proposed permit activity? Because I believe it's clear on the record now that the permit application at issue here proposes not only initial dredging but maintenance dredging. So the permit being sought in this proceeding would not entail a one-time dredging and then leaving it alone. So I guess with that respect, you know, if it's intended to -- if the question is intended to elicit a response to the proposal at issue in this case, I think there's a lack of foundation. If it's entirely hypothetical, I think that needs to be made clear.

MR. HOFFER: It is a hypothetical based on his opinions in Tom Bay -- Tom's Bay.

JUDGE PATTERSON: Okay. Go ahead.

Q So hypothetically, if the project as you understand it was undertaken -- a dredging was undertaken and then this area

was left alone, you agree that this would eventually return to its former state; correct?

A No, not completely. The problem is, as you dredge and as the area of impact widens and as some of the sediments have moved out into the -- out from the dredging site into deeper water where they can create BOD problems by way of nature of being anaerobic or by uptaking oxygen due to decomposition, you can't pull those sediments back into that place again. They're going to take some time to decompose and for the anaerobic nature to be neutralized or ameliorated by uptaking of dissolved oxygen. So there's a longer term effect there.

Q So you're saying that once this dredging occurs, sediments won't fill in the dredge area?

A Well, they will fill in with sediments from the surrounding area, but some of that have also been dispersed, covering spawning areas, going into that deep water area of site 1 where the anaerobic conditions tend to prevail in July and August, September. You can't bring those sediments back and you can't bring those conditions back.

Q Now, how deep does a -- well, first, the soil type here you describe as muck; correct?

A No, muck is more of a term used on the land for, you know -- sediments. I like Dr. Lehman's term, "nepheloid," at least for that portion somewhat lakeward of the shoreline area.

Q Well, what do you understand to be a nepheloid layer? Can you explain that for me?
A It's an organic rich layer that's largely unconsolidated and comprised, perhaps, of 70, 80 percent water.
Q 70 to 80 percent water?
A Very light and very easily disturbed.
Q And would you consider this part of the sediments or part of the water column?
A Oh, it's part of the sediments because it does sink to the bottom slowly.
Q Okay. Let's talk about that. It's your opinion that if dredging were to occur, what you understand to be the nepheloid layer would start filling in the void of the dredge area during the dredge; is that correct?
A During the dredge because of the vortex that's created in that shallow water at the dredging head, yes.
Q And it's your opinion that this nepheloid layer sinks to the bottom; correct?
A It's pulled downward by gravity and most of those sediments are somewhat heavier than water.
Q So what is your understanding of -- what is stopping this nepheloid layer from just rolling off into the center of the lake?
A It does. It is moved around by boat traffic, by ice, by storms. It's slowly moving from that area outward.

Fortunately, the area is shallow. But we need much more work on the circulation of Lake Missaukee to include those two bays where we would expect gyres to be set up during certain wind conditions. We don't really understand how that sediment moves, but we know that in a wind storm there will be gyres, there will be circulation patterns. If you put material in suspension or floating on the surface, it will migrate. There's no doubt about it. And the dredging of Redman Island clearly showed that. Now, that was more inorganic, but we have had an experience on that lake already. So it's not just clearly a hypothetical.

Q And, Dr. Jaworski, you don't have any firsthand knowledge of the Redman Island dredging, do you?

A No, sir, except by way of photos.

Q By way of photos. So you do have some -- at least some secondhand understanding of what this dredging entailed?

A Yeah, we could see the plumes -- the turbidity plumes.

Q And this was a clam shell dredge project; correct?

A I believe so but, again, I don't have all the details.

Q And it's your understanding that these spoils were deposited on shore?

A I think so to build up land to be useful then for development purposes.

Q And it's your understanding that these spoils were used to build up an island; is that correct?

A Yeah -- well, so to speak.
Q Fair enough. And you would agree that freshly deposited spoils on the shoreline would grow rapidly; correct?
A You have both the deposition and the potential for suspension at that time, plus wave action as the sediments are deposited or as they occur on the shoreline. So you got two matters in which to create suspended material, one by the actual dumping and the other by wave action subsequent to the disposal.
Q And is it correct that you've experienced both hydraulic dredging and clamshell dredging?
A Repeat that, please.
Q Have you witnessed both -- have you witnessed hydraulic dredging?
A Yes.
Q And have you witnessed clamshell dredging?
A Yes.
Q What was the name of the boat that the hydraulic dredging was on?
A Markham.
Q The Markham. Okay. Can you describe the dredging apparatus on the Markham in terms of size?
A The Markham is quite a large ship. It's for Great Lakes dredging; again, maintenance dredging. It has within it large hoppers, so you call it a hopper dredge. But it's a

hydraulic system and it has hydraulic pipes on both sides. So typically you dredge from one side or the other but they do dredge both. And so they drop the cutter head with pipe into the dredging area. They could suspend it at a certain depth if they wish or let it float to the bottom. But typically it's held at a certain elevation or water depth.

Q And what were the size of the pipes on this dredge; do you recall?

A Yeah, they're substantial. They're, I think, 18 to 24 inches.

Q And that's not the type of dredge you would use on Lake Missaukee, is it?

A I would hope not. For one, I don't think you could get the boat in the lake because its draft would be substantial. So you'd have to have a land-based system, I would think, given that shallow area.

Q Okay. And you did not witness the dredging of Tom's Bay; correct?

A Correct.

Q And have you ever witnessed the operation of a dredger with a pipe of around, say, eight inches?

A Yeah, we saw that in operation earlier this summer on Lake St. Clair near Benjamin canal. I had done a study on the canal that was going to be dredged but next door to the Benjamin Canal in St. Clair Shores. There was a dredging

operation going on, a permitted dredging operation, using a smaller dredge. But it was a floating rig and they had a scow with it and the scow was the disposal area. So they were dredging hydraulically and pumping to the scow.

Q Okay. Now, your first visit to Lake Missaukee was in what year?

A '98.

Q '98? And you said at that time you observed what you believed to be wetland violations?

A Let me check my notes. I think so. Let me check. Yes.

Q And did you report those violations to any authority?

A As a matter of fact, we did.

Q And what was the response you received?

A We had a meeting with the Michigan DNR. We met with Mr. Rick Powers, the head of the Enforcement Division, along with Jim Johnson, a representative. We showed them the pictures and explained what was going on and we were somewhat disappointed in the results. They had indicated that they could not tell from my photographs who was doing it and precisely where it was and that it's likely that some of the vegetation would come back. So they did not pursue it; at least that's my understanding. Perhaps Richard Morrow has more information, but I think my understanding was that they did not pursue it as a violation -- a wetland violation.

Q Okay. And you said you reviewed the permit that that was done pursuant to or that the activities there were conducted pursuant to?
A There was no permit issued. What was done there was back in '97 the cul-de-sac road was started. So there was no permission to do anything in the wetlands that I know of. The only thing that was going on was they constructed a cul-de-sac road for laying out a number of units, both on the lakeward side and on the landward side.
Q Okay. And did you also review the 2002 permit applications by Indian Lakes West?
A For which lot?
Q For the common area adjacent to lot 11, I believe.
A Yeah, what I call lot number 10. I have looked at that, yes.
Q And did you in your professional judgment object to that project?
A Well, it was not so much an objection although it was -- the point was that the water depths from the shoreline were extremely shallow. The sediments -- the soft, mucky, organic rich sediments were quite deep and it seemed incongruous to try to dredge that out for a docking system. So from that point of view, I was hired to go out there and check water depths, sediment type and sediment thickness. And that we did and we furnished that data to the Lake

Association. And it was quite obvious to us that this is not an appropriate area to dredge a boating dock or a wading area or beach area.

Q And you objected to the project in 2002 then; correct? It was your professional judgment?

A Again, it's not so much an objection because I wasn't asked to give an opinion on the permit. I was asked to look at that shoreline to see if that was an appropriate place to put a pier or whatever. And based on what we found, we found it unacceptable. But I did not write a report objecting to the permit. I wasn't asked to. I didn't send anything in to the DEQ or whatever.

Q Okay. Now, based on your examinations of the western side of Lake Missaukee, you would agree that the shoreline is entirely muck except for that sandbar point area?

A There are some areas in -- particularly in the middle that are somewhat sandy and have sandbars out front. I wouldn't call it so much a -- mucky, although it has a lot of organic sediments. But, see, much of that shoreline is wetland in nature, yes.

Q Okay. Now, you say that the west side of Lake Missaukee is used as a forage area and a nursery area due to its shallowness?

A And its vegetation that is growing there and the organic matter being exported, both dissolved and particulate, into

that area.

Q And have you ever measured the amount of organic matter that's being introduced through that area?

A In situ or what we call allochthonous transport, you know, the leaves and stuff that blow in, drift in. Because you've got in situ, in place production by the water lilies and the bulrushes and then you've got proximity to these trees and to the wetlands and there's an export of that. So we --

Q Did you ever measure either of those?

A We did measure the depth of the sediments in several places, but not the quantity of material coming from the land except to observe leaf litter on the ground and to some extent the thickness of the sediments in the wetlands.

Q So in your opinion it's a good thing when leaves fall into the lake and decompose; correct?

A It can be a good thing. It's a part of the natural process and it creates a wetland and organic rich shoreline which can produce some food. It also can create a biological oxygen demand. So it's part of the natural system. Too much would probably be not good. If you have a small pond and we put lots of leaves in it, it would probably destroy the pond in terms of the dissolved oxygen. In this area we have a small portion of the lake -- or not a small, but perhaps 20 percent of the lakeshore, 25 percent has an organic shoreline and the rest of the lake, probably

two-thirds of it, is more deep. It functions very well and it's probably necessary for the game fish of the lake to have this production there in terms of the forage fish.

Q You're aware that there are weeds elsewhere in Lake Missaukee; correct?

A I am aware of that.

Q And have you toured around Lake Missaukee in a boat?

A Yes, I have.

Q And have you attempted to, you know, see how much vegetation is in other parts of Lake Missaukee other than the west side?

A Yeah, we've done that. It wasn't real successful. But I understand that as part of the herbicide control program in Lake Missaukee that there is one company that maps the submerged aquatics using aerial photography as well as boat transects and another firm that takes that information and does the herbicide application.

Q Can you turn to the Intervenor's tab 13?

A The big book?

Q Nope. That's --

MR. HOFFER: Which color is yours?

MR. PHELPS: Green.

Q Green.

JUDGE PATTERSON: Green.

A 13?

Q Yes. And do you see the legend on the right side of this map?
A Yes.
Q And this is a map of Lake Missaukee. And the various hashes refer to the different types of vegetation; is that correct?
A Yes.
Q Excuse me. Was that a "yes"?
A Yes. Sorry.
Q Okay. And do you have any reason to dispute the indications of vegetation on this map?
MR. PHELPS: As they exist today?
Q As they exist today.
A Yeah. Compared to today, it's not a very accurate map. For one, back in '69-'70, the lake level was changed by an order of two feet or so; that's my understanding. So the lake level was dropped in part to assist in the function of septic tanks because everybody at that time was still on private septic. So, again, we're talking '67, '68, '69, at that time period. So it was dropped a couple of feet to assist in the function because apparently we had some high water. The point is that the lake is somewhat dynamic and this (indicating) is not a good map. The distribution of sand is way off.
Q Well, let's just -- let's concentrate on the vegetation. Would you say that there is more or less vegetation now than

you see depicted on this map?
A You know, I never colored it in. I viewed it as old, somewhat out-of-date data. And based on the sand distributions, the dark tones, I didn't agree with it. And, therefore, to a large extent, I dismissed this map as being just an older document of limited value.
Q But you would agree that 40 to 50 percent of the bottom of the lake is covered with plants; correct?
A That's what the map indicates.
Q Is that your testimony, that 45 to 50 percent of the lake is covered with plants?
A No, I don't really have that knowledge, but I am concerned that the recent herbicide control program -- and my understanding is that they use 2-4-D. That's a pretty strong herbicide. It kills a variety of plants. I know they're targeting the water-milfoil and that's a very serious, invasive plant worthy of control.
Q What would be your best estimate as to the amount of plant cover on Lake Missaukee?
A Probably somewhere between 30 and 40 percent.
Q And what percentage of the 30 to 35 percent total coverage would the proposed dredge area be?
MR. PHELPS: I'm just going to object to the -- I'm not sure what's meant by "plant coverage," if we're talking about plants that cover the surface. I don't think

anybody thinks there's 30 to 40 percent of the lake covered by plants. Are we talking about covering the bottom or -- I just think we need more clarification on that.

Q Dr. Jaworski, what do you understand "plant coverage" to mean?

A You have plants growing on the bottom or floating leaved plants, so either submerged or floating leaved or emergent plants growing in the water.

Q And is that what your -- is that understanding what your estimate was based on?

A Yes.

Q Okay. And of all the plant cover that exists in Lake Missaukee, what percent would be removed by the proposed dredging project?

A A small quantity would be removed, but a much larger area would be impacted, particularly the ecology of the lake in terms of dissolved oxygen and BOD as well as phosphorous transport.

Q Okay.

A In other words, you can't take it in isolation, just that little area, because the impact is greater than just dredging that little area. And I know you would like to do that, but it's just not limited to that area.

Q Can you turn to the big binder, the Petitioner's binder, to tab number 2?

A Number 2?
Q Correct. Okay. At what depth do these soils become depleted in oxygen?
A First of all, you'd need a fact-finding report --
Q Excuse me. In lot 8, in the proposed dredging area --
A Is that where we're starting, Dr. Lehman's report?
Q Yes.
A Yes. Okay. All right. Repeat the question, please.
Q In lot 8, how deep does one need to go into the sediment to find anaerobic conditions?
A It will be a transition area, but the oxygen depletion would start probably about six inches below the surface.
Q But you've never measured that, have you?
A We've looked at that with my little coring device and we looked at it when we did the probes and we certainly were very aware of the black sediments that we would see on our probe as we put it into the water and pulled it back out. You could see the black, anaerobic nature. That anaerobic nature could be determined by the redox potential. And I looked carefully in Dr. Lehman's work. I didn't see him do any redox work either.
Q And do you mean six inches from the top of the sediment or from the top of the nepheloid layer?
A Well, those two would be the same, the sediment and the nepheloid layer. So into the nepheloid layer you have not

only organic material detritus but we have algae. And between the two, the oxygen depletion would start probably, as best as I can remember from the two times we looked at that, about six inches below the surface.

Q Okay. And you're basing that estimate on color alone; correct?

A Yeah, we didn't do any redox, nor did Dr. Lehman.

Q Okay. And there are ways to measure dissolved oxygen content -- correct? -- redox being one of them?

A Redox gives you a measure of anaerobic conditions but, you know, dissolved oxygen is measured differently. You could use the Winkler method. You can use, you know, more immediate measures.

Q So your testimony is, "yes," there are means available to test the oxygen content of the soil; correct?

A And the redox potential, yes.

Q Okay. But you didn't perform any of those; correct?

A No; no.

Q Okay. And you testified -- am I correct? -- that you believe Dr. Lehman's petite dredge missed the nepheloid layer or did not -- did not capture the nepheloid layer?

A No, I didn't say that. The Ponar dredge, even that smaller version, is a relatively heavy device that drops down and then it closes based on its response to the sediment bottom. As a result, it tends to lose the top in a process that we

call a Ponar wave where as it goes down it creates a vector and you tend to lose the top. And I believe by reviewing Dr. Lehman's testimony, he admitted that he lost some of the top, which would be really important to determine whether or not there were macroinvertebrates in that top layer.

Q Okay. So you don't believe that the petite Ponar dredge captured the nepheloid layer; is that correct?

A It didn't capture the top, the more loose portion where the living edge -- the live benthic community would be located.

Q Okay. And do you believe that top loose layer, the nepheloid layer, would trigger a petite Ponar dredge?

A No, it wouldn't.

Q And you testified that the nepheloid layer was likely 70 percent water; correct?

A It appeared to us when we sampled it, both by walking in it where it was a little bit shallower as well as by probing it, that it was probably 50 to 70 percent water. Dr. Lehman did an actual measurement which I indicated to you or to the group earlier was an excellent measurement, important data and certainly reliable data.

Q Okay. Can you turn to page 6 of Dr. Lehman's report? And the top of page 6, do you see a table labeled "table 4"?

A Correct. But if I might --

Q And in table 4, do you see a column labeled "percent water"?

A I do.

Q And you understand that these samples were all taken with a Ponar dredge; is that correct?
A No, I think this was a sediment core which was collected by Dr. Evans using an acrylic tube.
Q You are looking at the top of the page; correct?
A Oh, no. I'm looking at the bottom. I'm sorry.
Q Okay. It says "table 4" in the writing just above it to the left?
A Let me study this for a moment, please.
(Witness reviews exhibit)
A Okay.
Q Okay. And it's your understanding that table 4 was created using samples from a petite Ponar dredge; correct?
A That's what's in the report, yes.
Q And do you see a column in table 4 that says "percent water"?
A I do.
Q And you see that the sample A was 93 percent water?
A Correct.
Q And you see that the second repetition of sample A was 94 percent water?
A Correct.
Q And you see that the first repetition of sample B was 95 percent water?
A Yes.

Q And do you have a basis to dispute any of the findings you see in that chart?
A I would like to say that Dr. Lehman has a great reputation, is well known nationally and internationally and I would not like to question his work, question his methods. We're looking at a table. I don't know how the samples were actually collected -- from where or how.
Q The question is, do you have any reason to dispute the findings in that table?
A The percent water looks a little bit high and so --
Q And do you have anything -- any measurements to dispute that with?
A No, but I remember reading somewhere where he talked about the sediments having a water content of somewhere between 60 and 80 percent. So these are 90 and 88, so they looked a little high.
Q And you would agree that 93 percent is more than 70 percent?
A Correct.
Q And you agree that this Ponar dredge, according to Dr. Lehman's measurements, captured sediment which was between 80 and 95 percent water?
A That's apparent only by this table. And, again, I don't wish to question Dr. Lehman's work.
Q Okay. And if you go down to the next section labeled "sediment core," do you see table 5?

A I do.
Q And you see a column labeled "sections"?
A Yes.
Q And the paragraph just above that indicates that each of these sections was 2-1/2 centimeters thick; is that correct?
A Yes.
Q And you would agree that the percent water doesn't drop down to anywhere below 85 percent until you reach section 13; is that correct?
A Correct.
Q And, Dr. Lehman, can you tell me what would cause --
MR. SHAFER: Dr. Jaworski.
Q -- or, excuse me -- Dr. Jaworski, can you tell me why a sediment which is 86 percent water would not have the same oxygen content as the overlying water?
A First of all, this is the sediment core that I alluded to earlier taken with an acrylic tube. And it was taken by -- my understanding, by a Dr. Evans and given to Dr. Lehman. So there's a quality control issue there or --
Q That's not the question. The question, Dr. Jaworski, is when the sediment contains 85 percent of water, why wouldn't that water contain the same dissolved oxygen content as the overlying water?
A Well, because of bacterial decomposition of the algae as well as of the detritus. I mean, you have a vertical column

of --

Q You're familiar with diffusion; correct?

MR. PHELPS: Excuse me. He asked him why. He's in the middle of his answer and he's cutting him off.

JUDGE PATTERSON: Yeah, let him finish his answer.

MR. PHELPS: You can finish your answer.

A If you have a vertical column of aqueous sediment that's largely organic in nature, not only do you have detritus, but you have algae and algae is easily decomposed. And unless you have a lot of stirring of the water column -- or the sediment column, I mean, you're going to get oxygen depletion.

Q So it's your testimony that unless the sediment is stirred, you wouldn't -- or the oxygen from the overlying water wouldn't be able to penetrate the sediment that's 86 percent water; is that correct?

A Yeah, I just don't see any way in which we can get water flowing through those sediments unless there's some gradient or current. And if we have quiet water conditions, it won't take very long for an oxygen depletion gradient to set up, where we would expect the bottom of sediments of this core to be anaerobic and coming upward fairly straight until you get to the top six, eight inches, then it would bend and become increasingly aerobic.

Q And that's a generalization; correct?

A Yes.
Q Okay. You indicated that you observed shiner minnows in the lot 8 area; is that correct?
A I did observe minnows, yes.
Q And shiner minnows can occur anywhere in Lake Missaukee; correct?
A Yes, because fisherman probably release unused bait into the water when they fish. I've done it many times. You dump the rest in the water.
Q But you're saying that shiners will only occur in wetlands unless people discard unused bait?
A No, they are probably distributed widespread but they will reproduce and survive in those areas where they have cover and protection from predators. And those are likely to be in those shallow water areas and among the submersed aquatics and water lilies.
Q You would agree that there is an abundance of shallow water areas in Lake Missaukee; correct?
A Right, but not all of it is vegetated with water lilies or submersed aquatics or emergent vegetation.
Q And if a bass or a pike ventured into that uncovered, shallow area, they would exposing themselves to predators?
A Bass and pike?
Q Yes.
A They are the predators.

Q Nothing preys on bass or pike?
A Larger fish -- well, you certainly have your wading birds, your blue herons and egrets, but they feed in shallow water in a walking position. The only other predator of fish would be eagles and they would take largely fish that were not healthy or, you know, spending time at the surface and then they would grab them. But eagles typically wouldn't take a northern pike or a bass. They would probably take maybe a wounded sucker or something like that.
Q Okay. And you stated you observed a crawfish in western Lake Missaukee; is that correct?
A Just a claw.
Q Oh, just a claw? And crawfish will pretty much occur everywhere in Lake Missaukee, won't they?
A There's different species of crawfish. There is one that's more bank and there's one called a rusty crawfish. I didn't have enough of the claw and enough of the organism to key it out. I suspect it's the more favorable one, but I don't know.
Q But crawfish in general will occur in sandy areas; correct?
A Crawfish -- there are some that are more deep water, some of them are shallow water. Many of them are more creek and rocky stream creatures because I used to catch those and still do for bait and for eating purposes.
Q But crawfish will occur in sandy, shallow areas, will they

not?
A There will be some, yes.
Q Some. Okay. And you observed snails attached to the vegetation; is that correct?
A Yes.
Q And snails will attach on other types of vegetation other than the ones you observed; correct?
A Other submersed aquatics?
Q Yes.
A Sure.
Q Okay. And scuds -- scuds will occur anywhere that organic sediments is present; correct?
A Yeah, the family of scuds, the Gammarus, are pretty widespread. Some are more numerous than others. I've seen scuds in streams, in organic accumulations. They're a fairly common amphipod. They're a very common organism in lakes and streams, yes.
Q And you would expect to see them anywhere you find this either peaty or organic sediment; correct?
A Yeah, many species are found in conjunction with organic rich sediments, yes.
Q Yup. So you would expect to find scuds where there is organic and peaty sediments present?
A Some species, yes; yes.
Q Okay. And you stated that bluegill tend to prefer to spawn

on sand; is that correct?

A They will spawn in sand, gravel, rocky areas, generally not mud or organic unless there's no alternative.

Q And there's no shortage of sandy areas on Lake Missaukee, is there?

A Yeah, to a large extent there are sandy areas around probably two-thirds of the lake and then there is those spotty areas on the western side.

Q Okay. And you wouldn't be worried that a proposed project would deprive the lake of adequate sandy spawning areas, would you?

A The dredging itself may not, but the dispersion of dredge spoil, unless properly contained and limited, could have a major effect on spawning.

Q Now, did you find any spawning beds in the proposed project area?

A Not per se, no.

Q No. Did you find any spawning beds anywhere in Lake Missaukee?

A No.

Q So based on observation of spawning beds, you couldn't say where in Lake Missaukee spawning occurs or doesn't occur; correct?

A No, we certainly could use the literature, we could use deduction and we have to because we can't sample and be on

site all the time.
Q But a person can, during spawning season, traverse the near shore areas and look for spawning beds; correct?
A Correct, but I was looking primarily for wetlands and at that time I didn't know there would be a court case like this. Just like Dr. Lehman, he was asked to do certain things, he did that and I was asked to do certain things and I did that. It might have been good for me to do more, but that wasn't part of it and little did I know this would be a court case down the line.
Q And did you survey the remainder of the lake other than the west side to determine what nursery areas were present?
A We did traverse the lake and I did take some field notes as to what the bottoms were like. The shoreline area is pretty active with boating. On the other hand, much of the spawning occurs in May -- early in the season, April, May, June depending on the species. Some of that spawning activity precedes the heavy boat use when the kids are out of school which is mid June or early June -- June, July, August.
Q So you weren't able to observe where spawning does and doesn't occur on Lake Missaukee; is that correct?
A Correct. I could only use theory.
Q Okay. And you weren't able to observe which areas are and aren't used as nursery areas; is that correct?

A No, I did observe western Lake Missaukee and was very cognizant of the forage minnows. I even seen the black terns feeding on them. That was one thing I did observe and did document.

Q And did you take those -- undertake those same efforts elsewhere in Lake Missaukee?

A No.

Q No. So you have nothing to compare what you observed in the western side of Lake Missaukee to; is that correct?

A Not completely because I did observe Tom's Bay. I was very cognizant of the fact that dredging had occurred and was there still vegetation in much of it, was there still some fish? And so, yes, from that point of view, I could see that parts of Tom's Bay were not largely impacted by heavy siltation, that there was still some submersed aquatics that were not -- leaves were not weighted down by fine grain sediment and that here and there I could see some fish.

Q Okay. Now, in your testimony you said that the owner of this wetlands area bear the responsibility to the lake; do you recall that?

A Yes.

Q And does that mean he has a responsibility not to develop this area? Is that what you're saying?

A Oh, no; no, nor -- I nor the Lake Association is opposed to development.

Q Okay. And you state that in relation to sedimentation that Lake Missaukee hasn't filled in like some other lakes have; is that correct?

A Each lake is somewhat different if you study them geomorphically. For instance, some lakes have very rapid marl or chalk deposits because of leaching of high-base saturation soils into the lake. There is some marl, as a matter of fact, in Lake Missaukee at depth. Sometimes the marl -- the process ceases and we get organic on top of the marl. Some lakes and streams are impacted by land drainage, especially related to agriculture and so you get rapid filling of lakes from that. Some lakes are shallow enough to where it's organic accumulations, kind of like Lake Missaukee, but Lake Missaukee has water depths sufficient to allow water to stand and ice formation.

So if you watch the way ice breaks up in the spring, the ice freezes down to 10 to 14 inches or so and then as the wind in spring kicks up, that ice will actually pull the vegetation out and move some of this organic around by just movement as well as ice shoving. So the lake -- the organics are being spread out and not allowed to just accumulate like they might in some small, marshy wetlands where it goes from open water to 100 percent organic and then we get the vegetation growing right over the surface. That's not happening in Missaukee Lake. It's happening in

the area between Crooked Lake and Missaukee Lake.

So to understand lakes and lake process, you've got to have a little broader background than just chemistry or biology or geology. And I've been fortunate to have a variety of experiences and research projects where I believe I have a pretty good handle on what's happening in that lake.

Q Okay. So you're saying that a large amount of sedimentation hasn't occurred on the west side of Lake Missaukee; is that correct?

A Not inorganic sedimentation, no.

Q But as far as organic sedimentation?

A There was quite a bit of it, but it is not causing the shoreline to recede and hence the lake getting smaller. So the traditional lake senescence that you see in a textbook where we go from a kettle lake to a marsh with solid, emergent vegetation like cattails is not happening in this case.

Q How much filling in would you expect to see over a period of, say, 50 years?

A Well, we like to think that lakes have one to five millimeters of sediment per year. But, again, each lake is different and sediment can not only accumulate, but it can decompose if it's organic. If it's inorganic, then we've got to talk about marl processes, we've got to talk about

river sedimentation. You know, to say each lake is similar and hence little descriptive models apply to them all equally is not right. What we know on this lake, it's 14,000 years old and it has not filled in as one might expect, particularly in that shallow area. And the reason for that is the movement of ice and movement of sediments back and forth over that area including into the somewhat deeper areas. And the Lake Association has a responsibility for the overall quality of that lake because the Lake Association is comprised of members who own property on that lake. So the quality of that lake is a direct effect on their property and the equity that they've got built up in that property. So that's why they hired me. That's why they're concerned.

Q Well, based on your familiarity with the processes on the lake -- the west side of Lake Missaukee, how much -- in your professional judgment, how much sedimentation would you expect to occur over, say, a 50-year period?

A Organic sedimentation?

Q Correct.

A Over 50 years?

Q Correct.

A We could get a half a foot.

Q Okay. You would agree -- you stated that this organic material is moved by ice; correct?

A In part.
Q And you would also agree that this organic material can be stirred up by the wind; correct?
A Oh, yes, in storms, absolutely.
Q Okay. And you would agree that this organic matter can be stirred up by boats; correct?
A Correct.
Q Okay. Let's turn to Intervenor's Exhibit 11, which I believe is your first report. Paging in from the back is a picture labeled "plate 1," and there's a number 11 on top of it.
A Yes, I have it. Sorry.
Q Okay. And did you take this picture?
A Yes.
Q Okay. Can you see the sediment in this picture?
A Yes, I can. I can see it in the foreground and in the middle area there's sediment with algae growing on it. And also in the middle there's a little dust cloud where we observed a large fish taking off.
Q Okay. This cloud you're saying is from a single fish?
A Yeah.
Q So all the disturbance we see on this photo was from a single fish?
A Yeah, it just flipped its tail and took off. So I snapped it to get some effect of that and some of the turbidity had

disappeared, but you can still see some of it there.
Q Okay. And were you on a pontoon boat at this time?
A Yes.
Q And behind that pontoon boat -- it was motorized, I assume; correct?
A Yes.
Q And when you were driving this pontoon around, did it create a -- did it disturb the sediment, first of all?
A Somewhat, yes, --
Q And did it create --
A -- depending on the shallow water, yeah.
Q Okay. And did it create a similar disturbance as what you see here?
A No, this is largely undisturbed except for that little fish. In fact -- what are you driving at?
Q When you drive the pontoon, there's sediment disturbed behind it -- correct? -- as you're driving?
A Yeah.
Q Okay. And the sediment that would be disturbed by your pontoon would be more sediment than would be disturbed by a single fish; correct?
A Correct.
Q And so as you're driving along the shoreline of west Lake Missaukee, you would expect that the boat would be turning up sediment?

A Turning up some sediment. But, remember, this was Dave Thompson and Dave is very careful. He's one of the Lake Association members and he lives on the lake. Dave is not going to drive a boat rapidly and whatever.
Q So most boat drivers aren't as careful as Dave Thompson; is that correct?
A Probably.
Q And would you agree that a boat such as a pontoon boat could leave at least a five foot wide area of disturbance behind it?
A It's all dependent on water depth and speed of the boat. But clearly pontoons are less impacting than other boats, other than skiffs or canoes.
Q Do you think that a five foot wide disturbance would be relatively accurate, somewhere in the ballpark? Would you agree with that or would you say more or would you say less?
A It could be less if you were going slower.
Q And could be more if you were maybe -- if you were in a speedboat or if you were going faster?
A Yeah.
Q Okay. And you understand that there is 10,000 feet of shoreline along the west side of Lake Missaukee; correct?
A Correct.
Q And so if you were to drive along the shore with a speedboat or a pontoon boat, you would disturb the sediment as you go;

correct?
A Much more for the speedboat, but much less -- particularly if you were a slow, deliberate person, much less with the pontoon boat.
Q Okay. And if that 10,000 foot trip along the shore disturbed an area that was one foot wide, that would be precisely the same size as our dredge area; correct?
A I have to calculate that out. One foot wide from --
Q You said that -- you stated that the dredge area is 10,000 --
A 10,000. Oh, yes. I see, yeah -- okay -- your math.
Q Okay. So --
A The area that you're talking about, 1 foot -- one times 10,000 is the same as 250 times 50. Is that what you're saying?
Q Exactly.
A Yeah.
Q And if a boat creates a 5 foot wide disturbance, then that trip along the shore is going to disturb five times the size of the dredge area; correct?
A It will be -- the area is five times, but the impact is not the same.
Q But the area at least is five times?
A Yeah. You're talking area and I would agree with that, but impact I will not agree with you.

Q And you would agree that during the summer boat traffic on Lake Missaukee is quite heavy?
A Correct, especially on weekends.
Q And you personally observed people water-skiing on the west side of Lake Missaukee?
A Yes. West side? No; no. There's kind of a unwritten policy that water-skiers don't water-ski throughout these shallow areas that we're looking at, particularly in -- along here. There's really no police action, but the policy is not to water-ski there. They do come out to the sandy areas to party. They do party on those sandbars. But water-skiing, I'm not exactly sure how they police that. I think it's kind of by word of mouth and good neighborliness.

Q Okay. But what type of boating activities have you personally observed in the west side of Lake Missaukee?
A Other than Jack Bails with his pontoon boat and the pontoon boats we had, the only other activity we saw is some larger craft, kind of like Boston whalers but smaller, on the sandbars; otherwise, not much activity there at all.
Q Okay. What do you believe to be the phosphorous content of the sediments in west Lake Missaukee?
A We have water samples expressed in milligrams per liter by the Lake Association, who they hired, and we have Dr. Lehman's work showing 260 parts per million or milligrams

per liter of phosphorous in the sediments. I have not personally done that and I appreciate the fact that he did.

Q Okay. And you would agree that Dr. Lehman's measures indicate there is very little phosphorous in those sediments?

A No; no. No, that's not the case. There is phosphorous in the sediments. His work suggests that they don't leach out easily, that they remain in the sediments and they're not coming out of the detritus into the water column in a soluble form.

Q And have you ever measured the nitrogen content of the sediments?

A I have not measured the nitrogen content of the sediment.

Q Okay. Did you conduct a environmental assessment of Lake Missaukee on the 6th of March of 1999?

A Yes.

Q Okay. Can you turn to -- do you recognize this document?

A Yes; yes, I do.

Q And you produced this document?

A Yes, sir.

Q Okay. And can you turn to page 5 of this document?

A Okay.

Q And on the bottom, the last paragraph, would you agree that the last -- or the first sentence of the last paragraph says,

"In addition, during the tour of the lake on 9-6-98, the undersigned observed boaters and water-skiers boating on the west side of Lake Missaukee in areas where emergent marsh and shallow, unconsolidated sediments were present"?

A I did not notice them in the shallow water areas like two feet --

Q Is that what it says, what I read?

A -- like two, three feet. But if you look at the map of Lake Missaukee, a good third of Lake Missaukee is shallow. And according to our work and the work of Robyn Schmidt, the bottom sediments are largely inorganic in nature. And we were concerned with water-skiing in depths of 5 to 10 feet or boating in that area. But landward of, let's say, three, four, five feet we did not see them.

Q But you would agree that I read that correctly; right?

A That's correct.

Q And so were you mistaken when you wrote this report or are you mistaken now?

A No, I'm not mistaken now. I should have clarified it. Again, Lake Missaukee, according to the one map I produced where it shows the 5 foot contour and 10 foot contour and the organic sediments that we found and others found, including Robyn Schmidt -- there were boaters in the western side of the lake. You know, west is half the lake. In that

area with shallow water, probably 4, 5, 6 feet deep, yes, we saw them and, yes, at least Mr. Morrow said that, "We encouraged them not to go there." They weren't in the shallowest of the water but they were in that area of 5 to 10 feet which has organic sediments on the bottom.

Q And you testified earlier that the floating leaved vegetation was present in areas where the depth was three and a half feet; is that correct?

A Yeah, I did notice Potamogeton natans in about two and a half, three feet of water.

Q And am I correct that you also testified that although wetlands can extend to as deep as six feet, you didn't see any floating or emergent vegetation in water that deep?

A I didn't see it in that deep.

Q So if these boaters were skiing in an area where there was emergent vegetation, it was probably in about three and a half, four foot of water?

A No, there were probably more in, like -- like I say, somewhere between 5 and 10.

Q Have you visited the area known as Indian Lakes North?

A Not directly, no, only from the water.

Q So you've never conducted a assessment of Indian Lakes North?

A No, sir.

Q Okay. Can you turn to Intervenor's Exhibit 12?

A Is that just where we were before?
Q It's actually the November 22nd report.
A Oh, okay. The one from Mr. Arevalo?
Q Yes, Mr. Arevalo.
A Arevalo. Yup.
Q Okay. Can you turn to page 6 of that report?
A Okay.
Q And do you see on the bottom of page 6, the very bottom, the last sentence that starts with the words, "That is"?
A Yes.
Q And does this sentence read,

"That is why it is important that we initiate the study of western Lake Missaukee so that we may limit the environmental impacts of Indian Lakes West and perhaps eventually prevent Indian Lakes North from having any lake access"?

A Yeah, I read that statement.
Q That's correct? The way I read it was correct?
A Yes, sir.
Q Okay. So you want -- you propose a study to prevent Indian Lakes North from having lake access; correct?
A No; no. I may have put that there, but I don't agree with that.
Q And on page 1, under "A, introduction," the second sentence starts with, "The basic concern"?

A Yes.
Q Would you agree that that sentence reads,
"The basic concern of the Lake Association members who own property along the shoreline of Lake Missaukee is that the proposed residential developments along the west margin of Lake Missaukee by Missaukee Lakes Master Homes will adversely affect water transparency, nutrient loading, general ecology of the lake due to the existing wetlands, fish and wildlife habitats and fragile, natural environments in western Lake Missaukee"?
Did I read that correct?
A Yes, they are very concerned about development of those wetlands. That's an accurate statement.
Q And that sentence doesn't refer at all to dredging, does it? Dredging is never mentioned in that sentence?
A No. Not directly, no.
Q Okay. And the last sentence of "A, introduction" says that -- or starts out, "Even though." And that sentence reads,
"Even though the quality of the lake was enhanced by the recent extension of sanitary sewer service several years ago, continued shoreline development, especially on the western side, represents a serious threat to the water quality of this important shallow

inland lake."

I read that correctly; right?

A Correct.

Q And that refers to development specifically; correct?

A That does refer to development, yes.

Q Okay. And that does not talk about dredging at all, does it? That sentence does not refer to dredging at all?

A No, but it doesn't exclude it as a cumulative effect, either.

Q Okay. And the sentence refers to "continued shoreline development"; correct?

A Correct.

Q And outside of Tom's Bay and North Bay Lagoon, has there been any other dredging on Lake Missaukee that you find detrimental?

A Detrimental to what?

Q To the general lake ecology based on your experience and opinion.

A Right. But we don't get detriments just by dredging. We can have continued development into some marginal areas. People are always trying to get lakefront property and so they buy land that perhaps isn't the best suited, but they're going to gain access to the lake. And that's important to them because then they have riparian rights.

Q Okay. And if you could, turn back to the first page of

Exhibit 11. That's your October 19th report.

A Exhibit 11. Yes.

Q Okay. Section A, this was created using your personal visit to the western Lake Missaukee; correct?

A Correct.

Q Specifically you visited lot 8?

A Correct.

Q And the area near lot 8?

A Yes.

Q And these observations are based on what you saw on lot 8 and near lot 8; correct?

A We were in the water and we were on the road.

Q Okay. And the title is -- the title of section A is "Wetlands in the Near Shore and Near Lot 8"; is that correct?

A Yes; correct.

Q And you don't indicate which of these species of plants were present actually in the proposed project area; correct?

A The floating leaved and submerged aquatics and emergents that -- were based on precise observation in front of lot 8.

Q Your report in section A does not indicate which of these plants was observed in lot 8 or not in lot 8; correct?

A These observations also follow my plates. And the plates show lot 8. So if you look at plate 1, 2, 3 -- they go along with this report -- it definitely shows my

observations are on lot 8.

Q I'm going to keep asking. In section A here, you don't indicate which plants are present in the proposed project area and which are just near the proposed project area; correct?

A We start with sentence number one, no. "We observe white water lilies in the near shore area going out to a distance 180 to 185 feet from the shoreline. See plate 1." If there was no other reference, I would agree with you. But we've got plate 1, plate 2, plate 3 indicating where these came from.

Q Okay. Let's go to page 11, plate 1. Now, looking at this plate, you can't tell precisely where the proposed dredge area is, can you?

A No, I can't.

Q And if you turn the page to plate 2, looking at that plate, you can't tell where precisely the proposed dredge area is, can you?

A No, but all the shoreline looks similar to this and you don't have to be a professional to understand that the shorelines are wetland in nature, soft and muddy.

Q And if you turn the page to plate 3, you can't tell where the proposed dredge area is on plate 3, can you?

A Oh, I certainly can.

Q Okay.

A I can see the disturbed soil on lot number 8 out in front of Mr. Mohney's house.
Q And how do you see that?
A It's that white patch in the right central area. That's where he filled some wetlands.
Q Okay. So this is in -- and so plate 3 is your observation of the upland plant community; correct?
A No, it's got both uplands and shoreline. It's got the whole continuum.
Q And plat 3 is labeled "View of shrub community"; correct?
A Correct. But it's much more than that. But the shrub community is largely gone because of removal.
Q Did you see these shrubs removed?
A No.
Q Did you see the shrubs there before they were removed?
A I did not see them. Those that were removed in '97 and '98, no.
Q Okay. Now, back to the -- the first page of your -- oh, excuse me -- plate 4, which will be the next one, you can't tell where the proposed project area is on this plate, can you?
A Not precisely, no.
Q Okay. Now, back to the first page of the report, now, in the second to last paragraph of this page, the last sentence -- or the second to last sentence beginning with

"hence," you would agree that that reads, "Hence, based on the floating level and submersed aquatic plants present in this near shore zone, this area should be classified as a wetland"?

A Correct.

Q And when you were out at lot 8 for the purposes of this report, you documented the plants that you saw?

A Correct.

Q And you were careful to document all the different plants you saw?

A Correct.

Q And of all the plants that are listed above that sentence, is there a single one that is a submerged aquatic plant?

A Yea, Chara is.

Q Chara is? Muskgrass?

A Muskgrass, yes.

Q Okay. And as far as the written description of your observations, you never did a grid or any other way of indicating where these plants were located; is that correct?

A No, we did not do a grid.

Q Okay. Let's go to page 4. Now, on the second paragraph, you see a calculation of the dredge area; is that correct?

A Correct.

Q And you state that a 200 by 50 by 2-1/2 foot area equals 555.55 cubic yards?

A Correct.
Q And that's incorrect as far as math; correct?
A Yeah.
Q Yeah. And it should be closer to 928 cubic yards; correct?
A If we understand how the cutter head works and if we introduce water --
Q Well, just based on the measurements alone, first of all, the 555 cubic yards is an incorrect statement; correct? Your math is just wrong?
A I have to crank that out.
(Witness reviews document)
A I think what I had done is considered that to be half water; therefore, the solid volume would be around 500.
Q Okay.
A I think -- I can't remember exactly what was going on in my mind when I calculated that. But you're right, if we consider just the area times 2-1/2 divided by 27, it's closer to 900 than 500.
Q Okay. And if that 555 number was solids, then your next calculation would be wrong as well; correct?
A Correct.
Q Okay. And you note that a hydraulic dredge takes a mixture that's about 75 to 85 percent water; correct?
A Yeah, at least.
Q And you're aware that according to Dr. Lehman's

calculations, the sediment already has a higher water content than that?

A Yes. According to his data, yes.

Q Do you have any reason to doubt his data?

A Dr. Lehman is a very respected scientist.

Q Okay. Let's see. On page 6 of the same report under section D, the last sentence of the first paragraph under "D" indicates that, "Lake Missaukee has a nine-year flushing rate"?

A Correct.

Q And that is your understanding of the flushing rate?

A That is the calculation according to Dr. Wally Fusilier.

Q And you hired someone else to do that calculation; right?

A Correct.

Q And what was his name again?

A Fusilier.

Q Fusilier? Okay. And he calculated that flushing rate based on the Vogel City gauge; correct?

A Correct.

Q And the Vogel City gauge is located 18 miles away from the outlet of Lake Missaukee; is that correct?

A I guess -- wait a minute. I would have to go back to -- I think I have an exhibit or an appendix that indicates his actual calculations.

Q Actually, in the 1999 report that I just handed you, I

believe it's the first exhibit.
A I guess what I'm saying, I don't want to make a misstatement as to what he did.
Q Excuse me?
A I don't want to make a misstatement as to what he did.
Q Oh. Yes, it's Appendix A to your '99 report. And I believe it's about two-thirds of the way down beginning with the word "discharge."
A Okay.
Q And so his flushing rate was based solely on the discharge passing through the Vogel City gate; correct?
A It appears that way, yes.
Q And it doesn't take into account any of the other possible ways that water could leave Lake Missaukee; correct?
A Correct.
Q Okay. Now, on page 7 in the second paragraph, you indicate that Lake Missaukee is a productive sport fishery; correct?
A Correct.
Q And there are lakes that are -- there are other lakes that are productive sport fisheries; correct?
A Correct.
Q And not all of those have the extent of wetlands as Lake Missaukee?
A They have some way in which to produce the necessary food because if we look at lakes that have fish and fish growth

rates, Lake Missaukee's growth rates are good. There are some lakes that have, you know, fish and we catch fish, but the growth rates, like in Walnut Lake of Oakland County, are relatively slow. And part of the reason is that a shoreline is very, very much developed.

Q And you would agree that in Lake Missaukee the littoral zone is very important in producing fish?

A Correct.

Q And the weed beds found in the littoral zone are very important to producing fish?

A Correct.

Q Okay. On page 8, there's a section F, "Summary and Recommendation"?

A Okay.

JUDGE PATTERSON: Are we in the same document?

MR. HOFFER: Yeah, same document.

JUDGE PATTERSON: Okay.

Q And you -- in the last sentence of the first paragraph, you state that, "The developer appears unwilling to cooperate with state officials"; is that correct?

A Yeah, I guess it was my understanding that they turned down the idea of a conservation easement.

Q And you weren't present at any of the meetings between Missaukee Lakes Master Homes and the DEQ; is that correct?

A That's correct.

Q And you had no knowledge of the alternative proposals that had been proposed to the DEQ; is that correct?
A There was some general discussion between Richard Morrow and I, some e-mails.
Q And you don't -- you were unaware that the Missaukee Lakes Master Homes offered mitigation?
A I did not see any mitigation in the permit application, no.
Q But yet you saw it fit to say that the developer appears unwilling to cooperate; correct?
A Well, that was an indirect comment in regard to the conservation easement.
Q And that was -- the extent of your knowledge was just the conservation easement?
A As well as any other mitigation. I didn't even see a good -- no feasible and prudent alternative section in the permit.
Q Okay. Can you turn now to Appendix A, same document? Would you agree that the following page is a enlarged version of the page that is labeled "Appendix A"?
A Yes.
Q And in both these pages, the green circles represent where you observed vegetation?
A Correct.
Q And in the second blown-up page, there's no green circles in the proposed dredging area; is that correct? Is that

correct?

A There happens to be no symbol in the dredging area, but that doesn't mean there's no vegetation there.

Q Okay. Let's move to Exhibit 12, your November 22nd report. Under your introduction, towards the middle of the paragraph there's a sentence I previously read. You state that the natural environment of western Lake Missaukee is fragile; is that correct?

A That's correct.

Q And how did you mean "fragile"? Did you mean fragile as in on the brink of destruction?

A Fragile in terms of the sediments being unconsolidated and it's easily affected by ice rafting; that, you know, the substrate is not stable, it's mobile and unconsolidated; that it can be easily disrupted by dredging, by boat traffic.

Q Do you have any measurements or other data that would suggest that western Lake Missaukee -- that the ecosystem there is on the brink of being upset?

A Nobody said that. Those are words that you're throwing out. It certainly is an important ecosystem to the lake. It is fragile in terms of its nature of its sediments. It has wetland vegetation which in itself is often easily impacted.

Q So when you say "fragile," you mean that the sediments are easily moved?

A Yes, in part, as opposed to a stable shoreline where the sediments do not move as much.
Q Okay. So then by "fragile" you don't mean that the ecosystem is on the brink of destruction; correct?
A No; no.
Q By "no" you --
A I mean it's not on the brink of destruction.
Q Okay. Thank you. Now, on page 2 of the report, in the first paragraph at the bottom you indicate that the shorelines are low energy; correct? Very end of the paragraph.
A Yeah, I see it.
Q Okay. And that's why sediments collect in this area; correct? It's a low energy area?
A Sediments collect there and they also tend not to create the core screen materials you associate with a higher energy shoreline.
Q Okay. And on the eastern side of Lake Missaukee, the beaches are sandy and there tends not to be an accumulation of sediment; correct?
A Not to have an accumulation -- sand is a sediment.
Q Or, excuse me -- of organic sediment?
A That's correct, except in the nooks and crannies.
Q Okay. And you would agree that boats have been disturbing the organic sediment in the western Lake Missaukee for

decades?

A Again, boat traffic is not really generally allowed there by way of mouth. People tend to avoid that. Water-skiers don't like to come off -- to water-ski into that muck, so they tend to avoid that area. So we can't say that it's being heavily impacted.

Q Well, you would agree that over the last 30 years sediment hasn't -- or organic sediment hasn't built up on the eastern side of Lake Missaukee due to boat traffic; correct?

A They haven't built up on the eastern side due to boat --

Q Boats haven't disturbed sediment on the western Lake Missaukee that has subsequently deposited itself on eastern Lake Missaukee; correct?

A The boat -- what little boat traffic is taking place on the western side has probably not created any organic sediment on the eastern side.

Q Okay. And storms over the last 1400 years that have disturbed this sediment, that hasn't caused the organic sediment to deposit itself on eastern Lake Missaukee; correct?

A I can't suggest that there never was a straight line wind or a tornado that went through that lake. And I don't know where you're coming from, that 1400 years.

Q Didn't you indicate that this lake hadn't filled up in 1400 years or do I have my figure wrong?

A 14,000.
Q Okay. So the last 14,000 years the disturbance of sediments due to storm hasn't caused a buildup of organic sediments on eastern Lake Missaukee; correct?
A No; no. We can't say that.
JUDGE PATTERSON: Counsel, how much more do you have? Do you have any idea?
MR. HOFFER: I've got at least a half hour more. If you want to take a break, I assume --
JUDGE PATTERSON: Yeah, I think if it's going to be that long --
MR. HOFFER: I'd like to take lunch.
JUDGE PATTERSON: Yeah. Come back at 2:00 o'clock.
(Off the record)
Q Dr. Jaworski, we discussed this earlier, but you were familiar with Dr. Lehman's measurement of the amount of phosphorous in the sediments?
A Yes.
Q And that's a relatively low level of phosphorous in the sediments, is it not?
A Perhaps medium to low, yeah, but it's not -- 260 milligrams per liter is not real low. It's not like sawdust.
Q Okay. And when you said that dredging at this project would cause a 40 percent reduction in food production or -- 40

percent reduction in food production, were you referring to the dredging of lot 8 specifically or were you looking at all of the -- you know, Indian Lakes West development?

A No, that's a misstatement. What I said, that those wetlands on the west side probably provide 40 percent of the food production of the lake in terms of that detritus food chain.

Q Okay. And this project as proposed, how much of a reduction will this project cause in that 40 percent?

A The impact will be relatively small. It might be less than 5 percent, maybe 2 percent. But it's those other impacts that are significant.

Q And this 40 percent number, that's not based on any calculations, is it?

A No, that's just a guess.

Q Just a guess? Okay. Now, if this project goes forward as proposed, can you give me one scientific measure that we could look at after the project to see if this project has caused a negative impact on any aspect of Lake Missaukee?

A The one measure you could use is the distribution of floating leave plants in and around that dredging site.

Q But as far as water quality measurements, transparency measurements, is there any predictions that you would like to make that this project would cause?

A Water transparency or dissolved oxygen would be temporary. So those would last depending on the nature of dredging and

how careful they were with silt screens and so forth -- and spills.

Q Now, in regard to dissolved oxygen, the freshwater springs that you referred to, those are bringing oxygen into the sediment, aren't they?

A Not really.

Q Have you measured the oxygen content of those springs?

A No, I didn't. But, no, I don't believe that that's going to be a contributor of oxygen.

Q And why is that?

A Oftentimes groundwater is not fully oxidized and a lot of water towers you see rust. In fact, many communities that have well water don't keep a lot of water up in the towers more than a few days -- like two or three days -- because it creates a rust problem. And we use a lot of potassium permanganate to treat the iron in the water.

Q So you say often cases -- what about this case? Is there anything you can tell us about the qualities of that spring water?

A That water, depending on where it comes from and how long it stays underground, will have dissolved substances in it. And I was saying that the groundwater, particularly in Indian Lakes West, is going to bring with it some soluble carbon, there's going to be some nitrate nitrogen, some soluble phosphorous and cations like calcium. And that's

part of the ecology of those near shore wetlands. That's where the water is being discharged. And I believe that had Dr. Lehman seen that in the winter -- because that's the only time you would pick that up unless you happened to note the coolness of the water and hence say, "Oh, this must be groundwater." You wouldn't know it off the top of your head unless you saw some water boiling up or whatever. It would take a good, sharp eye to see that. But it is part of the ecology and the nutrients that comes from this groundwater -- and the springs are all along that shoreline, so it's not just one little place -- it's helping the detritus food chain by bringing in sufficient nutrients, the nitrate nitrogen for the carbon nitrogen ratio and the phosphorous with regard to algae growth.

Q What measurements do you have that would indicate this food chain is detritus based?

A You can see the detritus food chain right in that jar over there (indicating). It's nothing but organic matter, particulate organic matter and some soluble organic matter, and yet we have quite a nice -- both variety and abundance of invertebrates in there including the scuds.

Q And do you have any measurements that document the magnitude of the nitrate or phosphate income from the springs that we've been talking about?

A I have no quantitative data, but I wanted to indicate that

when Dr. Lehman suggested that my citation of the -- I believe it was Gainsworth (sic) was all wet, I wanted to show that there was in this particular case, sources of both nitrate and soluble phosphorous for these organic deposits and detritus food chain. And, therefore, to say that my idea was ridiculous I thought was probably a bit of an overstatement.

Q Let's talk about Gainswin.

MR. HOFFER: May I approach?

JUDGE PATTERSON: Sure.

Q Now, on page 5 of your November 22nd report you cite to a Gainswin article; correct?

A Correct.

Q And you actually refer to that as a "Gainsworth"; is that correct?

A Where are you on the --

Q Page 5 of Exhibit 12, Intervenor's, second paragraph down?

A I guess I misspelled the man's last name.

Q Okay. And you have two studies in front of you. I'm going to refer to Gainswin 1, the one that you cited, the "Kinetics of Phosphorous Release."

A Okay.

Q And I'm going to refer to as "Gainswin 2" the companion study that begins, "The Effects of Sediment Size Fraction" --

A Okay.
Q And these studies were conducted on the River Thames; correct?
A Correct.
Q And that's a notoriously polluted river; correct?
A It has some very serious discharges of both storm water and sewage, yes.
Q Okay. And in the field, the phosphorous was actually going from the water into the sediment; correct?
A I would have to read the article.
Q Let's see if I can narrow it down for you. All right. First, on Gainswin 1 on page 136, the author indicates that the level of flux from the sediment into the water -- it was directly related to the amounts of phosphorous that was originally present in the water; correct? Because that's where it got the phosphorous from?
A Yes; yes.
Q Okay. And that's different than the situation you're talking about here; correct?
A Yes, we're trying to get, in this case, the phosphorous out of the sediments or out of the particulate matter, yes.
Q Okay. And on page 138, the article -- excuse me, at 137, the left-hand column, second paragraph it indicates that stones dominated the flux; is that correct?
A It says "where stones," yeah.

Q And the purpose of the study was -- the main subject of the study was a type of algae; correct?
A Correct. Or the presence of algae and biofilms.
Q And those algae films, in the study, were present on rocks and gravel; correct?
A Right. But they could be present on particulate organic matter as well.
Q What type of algae did you document as being present on the particulate organic matter in this case?
A It was just a green, non-filamentous.
Q Okay. And the type of algae it referred to in this study was actually a filamentous algae, was it not?
A I see it, yes.
Q And what is your understanding of how the authors got the sediment to actually release phosphorous experimentally? Do you recall that?
A Yes. But let me just say that what I wanted to demonstrate by citing that is that there are other sources of phosphorous. And I don't think that Dr. Lehman would disagree that there wouldn't be phosphorous transport from the soil under the trees near the road of Indian Lakes West into the groundwater and into the near shore area adding both nitrogen and phosphorous and thereby aiding the detritus food chain. This is all I wanted to suggest in those articles. If you want to get into the details, you

should probably talk to Dr. Lehman because that's his expertise. I could talk to Bob Neely of our department or VanderVelt of Ohio -- or Iowa, but I don't have those people at my disposal. So I just wanted to suggest that -- to suggest that there's no way to get the phosphorous out of the inorganic sediment into the water column, into a soluble state, there are some mechanisms to do that.

Q So your citation of Gainswin was just a suggestion then? You didn't really mean it?

A Well, I meant it and I still mean it and it certainly needs a lot more work, that whole transport system both coming out of the wetlands into the lake as well as the effect of groundwater transporting nutrients into that near shore area. That area -- those wetlands are fairly productive and it belies the, you know -- or it requires some additional work much beyond what I've done.

Q Okay. Let's turn to your 1999 report on page 8.

MR. HOFFER: Before we get there, your Honor, I'd like to move for the admission of Dr. Jaworski's 6 March 1999 Environmental Assessment of Lake Missaukee.

JUDGE PATTERSON: Has it been marked?

MR. HOFFER: It has not. It would be 61, I believe, of Petitioner's.

MR. PHELPS: I don't have any objection.

MR. REICHEL: No objection, Judge.

JUDGE PATTERSON: Okay. No objection, proposed Exhibit 61 -- Intervenor's 61 will be admitted.

MR. HOFFER: Thank you, your Honor.

MR. REICHEL: Excuse me, Judge. I believe --

MR. SHAFER: That's, let me point our --

MR. REICHEL: -- Petitioner's.

MR. SHAFER: Petitioner's 61.

JUDGE PATTERSON: I'm sorry. I misspoke myself.

(Petitioner's Exhibit 61 marked and received)

Q Okay. On page 8, the third paragraph, in there you indicate that a Mr. Jeff Silagy of the DEQ visited the site?

A Silagee (pronouncing), yes.

Q Silagee (pronouncing)?

MR. WILKINS: Silagy (pronouncing).

Q So Mr. Silagy is from the DEQ's Mio office and he visited the site approximately a year before February of '99 and he did not notice any wetlands violations; is that correct?

A That's what he said.

Q Okay. And on page 9, in section 2, the first paragraph towards the middle of the paragraph you state that, "The wetland vegetation in places extends 300 feet or more"; is that correct?

A In places, yes, out 300 feet or more. That was documented by Dave Thompson.

Q Okay. And then in the next paragraph you state that if

owners on Indian Lakes West want to have private boat piers that they're going to have to extend them over 200 feet; is that correct?

A Yeah, to get out to a water depth of 3, 3-1/2 feet, yes.

Q Okay. And you state that, "Adverse wetland impacts will occur during the installation and removal of these docks"; is that correct?

A It depends on how they're done. Some people drag them out there and knock over vegetation. It's hard to do that in a very muddy, soft shoreline like that, especially if you don't have a whole lot of equipment or tools. You can create some localized damage, yes.

Q Okay. And I'm going to move ahead to page 12, paragraph 9. Towards the bottom you propose that a common pier access be given for the -- as a preferable method of access for the owners; is that correct?

A That's correct. That reduces impact, yes.

Q And that was your understanding of the 2002 proposal -- correct? -- was a floating dock for neighborhood access?

A You're talking lot number 10?

Q Yes, the lot number 10 area.

A In that easement area?

Q Yup.

A No. I understood that it was going to involve dredging; that they were going to dredge that out, kind of similar to

what's being proposed now. So it wasn't just a pier out to deep water.

Q Would that be --

A That was not my understanding, that it was a pier out to deep water.

Q Would that be your preference, though, would be to have a common access for all of the owners; is that correct?

A Yes, with a conservation easement to protect that cumulative effect, that would be the preferred thing.

Q Okay. And you're aware that that the permit for the common dock and dredging was denied; correct?

A Correct.

Q Okay. Back to Exhibit 12 again. Okay. Page 3 at the bottom of the page?

A Okay.

Q You recognize that a thunderstorm had disturbed the sediment?

A Correct.

Q Do you recall which sampling site this was?

A Are you referring to sample site one, two or three?

Q Exactly.

A I do have all the sampling data with me. I could look it up. But off the top of my head I don't know which -- one, two or three. I suspect it was one because sites two and three are relatively shallow and to me aren't a real good

representation of the lake as is site number one.
Q Okay. And you recognize that typically water transparencies of eight to ten foot were common?
A Correct.
Q And that means that the sampling site must be at least ten feet deep; correct?
A Yes. That's why it's not likely to be two and three because they're only about that deep.
Q Uh-huh (affirmative). And I can check but if that is sampling site one, then that is approximately how far from shore; do you recall? I know it's going to be a little tough, but your best guess?
A Maybe a mile and a half, two miles, something like that.
Q From shore?
A I think.
Q Oh, from the west?
A Yeah.
Q Oh, how about from the closest shore from the east side of the lake?
A Probably about a half mile or less.
Q Okay. If it helps you, behind Intervenor's Exhibit 5, the very last page is the sampling sites.
A Yeah.
Q So that would probably still be a couple hundred feet from shore; would that be fair?

A Yeah, maybe -- yeah, maybe a quarter mile or something like that, yeah.
Q Okay. And so you'd expect more disturbance in shallow waters and less disturbance in deep waters when a thunderstorm occurs; is that correct?
A Yeah, generally, but it all depends on the wind and the circulation. Those gyres are going to get set up in western Lake Missaukee because of the shape and so forth.
Q And you would agree that most likely the area between this sampling station and shore was probably stirred up during the thunderstorm?
A At sample station number three?
Q Correct.
A Yup. I would suspect they all would. A thunderstorm would probably -- given the nature of wave and the way waves radiate outward from the wind source, I would expect the whole lake to be worked up.
Q The whole lake extending hundreds of feet from shore?
A Oh, yeah, because the wave action -- you know, waves always outrun the storm. So, yes, I would expect a pretty turbulent circumstance during that rain event.
Q And that would extend out into the lake to at least depths of ten feet; correct?
A Oh, the wave action and disturbance?
Q The disturbance of the bottom sediments.

A Yeah, let's see. If you disturb the shoreline -- like if you fly out of Detroit Metro toward New York and you fly over Lake Erie, you can see that turbid zone right along the lakeshore. And it sometimes goes out several hundred feet just because the wave action is on the shoreline but the sediments -- the plume that you see when you observe that extends out maybe 3-, 4- or 500 feet. And one would expect that if there was a thunderstorm over Lake Missaukee, it would probably result in the entire surface being somewhat turbid, but particularly on the western end.

Q Okay. All right. On to page 4, section C, you refer to the -- in the first sentence you refer to the total levels of phosphorous in Lake Missaukee?

A Right.

Q And those measurements are wrong; correct?

A Are wrong?

Q They should be milligrams rather than micrograms? And that's a factor of 1,000; correct?

A Yeah, you're right.

Q Okay.

A Just change the micro symbol to a little "m." No; no. 7 to 59 micrograms. Sorry.

Q No problem. And you suggest that calcium cations are co-reciprocating in Lake Missaukee; is that correct?

A Calcium cations?

Q Cations. Sorry.
A Okay.
Q "Yes"?
A Well, according to theory, calcium can -- complex phosphorous and the higher the calcium concentration -- soluble calcium concentration, the more we would have a more complex calcium phosphate. So we go from a di- to a tri-calcium phosphate with increasing levels of soluble calcium.
Q Have you studied or calculated the thermodynamics and solubility of calcium carbonate in Lake Missaukee?
A I have not.
Q Okay. So you don't know whether it's supersaturated, saturated, under-saturated?
A In terms of the calcium?
Q Correct.
A The calcium content is relatively low. I get that partly from -- well, there's a measure of alkalinity that's been regularly taken. But the shells of the papershell clam -- or it's sometimes called a "floater" -- are relatively thin. They should be a little bit thicker suggesting that there's not a lot of calcium. But, again, if you do have calcium, it will tie up phosphorous. And the easiest lakes to manage are high marl or high calcium lakes because phosphorous is largely tied up in a calcium phosphate and, hence, not

available for plant growth including algae.
Q And how much calcium is in the sediments of Lake Missaukee, organic or otherwise?
A I don't know off the top of my head, but I know it's relatively low.
Q Okay. And one can measure if calcium is binding with the phosphate; correct?
A Yes.
Q And you can -- that can be examined microscopically by looking at the sediments; is that correct?
A If you're well trained, a good geochemist.
Q Okay. And is there a marl in Lake Missaukee?
A There's some buried marls, I understand.
Q And where are those?
A Boy, I read that somewhere. I would suspect they're on the western side probably being precipitated out. Well, it's hard to say. It could even be on the southern side. They would be -- I would think be located where the soils are highest in base saturation and relatively high elevations where the groundwater over time was solubilizing some of the calcium in the soils and carrying it into the groundwater and then precipitating it out.
Q Okay. But you haven't observed or measured any of these marls?
A No.

Q All right. Bottom of page 5, you suggest that a study of the function and value of the wetlands, near shore environments and lacustrine vegetation of western Lake Missaukee should be studied in relation to the entire lake?
A Yes, sir.
Q And no such full study has been completed to date, has it?
A Not that I know of, no.
MR. HOFFER: Thank you, Dr. Jaworski.
THE WITNESS: Thank you.
MR. HOFFER: Your Honor, I rest.
MR. PHELPS: Just a few questions -- follow-up.
JUDGE PATTERSON: Okay.

REDIRECT EXAMINATION

BY MR. PHELPS:
Q Dr. Jaworski, you were asked a series of questions about Dr. Lehman's Ponar samples; do you recall that?
A Yes, sir.
Q Well, regardless of whether Dr. Lehman found any non-plant life in the proposed dredge zone, you have examined the sample taken by Dick Morrow; correct?
A Correct. Yeah, I've looked at that several times, even quite recently after he collected it.
Q Okay. And based on this sample, what -- do you agree or disagree with Dr. Lehman's analysis in his report regarding non-plant life in the proposed dredge site?

A Yeah. I have to disagree with him in terms of -- he suggests that the animal life is impoverished, that there is no macroinvertebrates in those sediments. Based on that and our observations, that's just not true. Again, on the other hand, I strongly respect the man, he's got a lot of credentials and I'm not here to disparage him in any way. That's not my purpose. But based on what he reported, the impoverishment, the absence of macroinvertebrates -- I realize those aren't quite macro, they're on the smaller side, but we would have certainly seen in the sediments carapaces and other things. And to say that there's none in there, it's devoid, seems to be a contradiction to what we see here.

Q Okay. Just to set the record straight, on Exhibit 11 of the green book -- your green book, is this plate 1 photograph?

A Yes.

Q Is there any question in your mind what -- that photograph reflects the area directly lakeward of lot 8?

A Well, it's been pointed out that I don't have any reference point of that. It was taken in front of lot 8, but unfortunately I don't have a stake or something there to identify it.

Q But did you take the picture?

A Yes.

Q And at the time you took the picture, did you know that lot

8 was the disputed area?
A Correct.
Q And then I take it this is your note in your report that says "lakeward of lot number 8"?
A Is that plate 1?
Q Yes.
A Yes; correct.
Q And did you personally then observe both emergent vegetation and submergent vegetation in the proposed dredge site?
A Correct.
Q You did?
A Correct; yes.
Q In your testimony, you made a couple references to BOD problems.
A Yes.
Q Can you just explain what that is?
A Well, certain organic materials have a -- exhibit a biological oxygen demand which means that if you're going to decompose them, they will take up oxygen in order to do that. So that we can actually burn organic matter and otherwise test it to understand how much oxygen it would take to decompose it. Even inorganic sediments can take up oxygen as there's an interaction between the substance and the water.
Q You were also asked a series of questions about the

sediments in the west end of the lake and some questions about Dr. Lehman's report. In his report, he's got a section about sediment sinking rate. Do you recall reading that?

A Yes; yes.

Q Are you critical of the work he's done --

MR. HOFFER: Objection; that's beyond the scope of direct.

MR. PHELPS: Not beyond the scope. It relates directly to the sediments that are at issue and the series of questions he was asked about them.

MR. HOFFER: There isn't --

JUDGE PATTERSON: Okay. I'm sorry?

MR. HOFFER: I say there was never any discussion of sediment sinking rates on the cross-exam that I was aware of.

MR. PHELPS: There were questions regarding the sediment and turbidity which are directly related to the sinking rate.

JUDGE PATTERSON: Okay. I'll overrule.

Q You can continue.

A Again, it's not my purpose to be critical of Dr. Lehman. But what we have is a tube and a settling in a tube and relating that to an open system. And it may well be that that's what he had and that's what he used in good faith,

but settling rates in a tube don't reflect the open system that's out there. It just doesn't in terms of currents, wind action, boat traffic, et cetera. It may be useful in some ways, but it doesn't directly apply to this open system there at Lake Missaukee. Also, I would add that to say that most of it sunk in two minutes sounds very optimistic to me.

Q Meaning what?

A That I just don't believe that those nepheloid sediments would sink in two minutes or a short period of time like that. I may have the exact time wrong. And, again, my -- I want in no way to be critical of Dr. Lehman. That's not my purpose.

Q But, I mean, would the idea that sediments might sink in two minutes -- was that inconsistent with your personal observations of the sediments?

A Correct.

Q And what were your observations in that regard?

A Well, we stirred up some sediments when we took the cores. We watched even fish action. We did not see it sink in a matter of minutes. It just didn't do that. And the density of the nepheloid is very close to the density of water, just a little bit more dense. And so it doesn't sink like a rock or sink like sand. It didn't even sink like silt might. It's just more of a -- and if there's any turbulence in the water, any wave action due to wind or whatever, it's not

going to go straight down. And so, again, it was a good experiment, perhaps not as appropriate as it could have been.

MR. PHELPS: That's all we've got.

JUDGE PATTERSON: Mr. Reichel, any questions?

MR. REICHEL: I think either one or two.

RECROSS-EXAMINATION

BY MR. REICHEL:

Q Just following up on a question that counsel asked you on cross-examination having to do with -- I forget exactly how it was phrased, but it had to do with installing a -- you were testifying about installing a dock -- a seasonal dock and whether or not that would stir up sediments. Do you recall testifying about that?

A Yes.

Q And I believe you indicated that it could disturb some sediments; is that correct?

A Yeah, some sediment and probably knocking down some plants as you drag this thing out there and then when you take it out, the same thing. But it would be pretty localized, right in the vicinity of the pier itself.

Q And how would you compare the magnitude of the impact or disturbance of sediment from that kind of an activity; that is, installing and removing a seasonal dock; with what's being sought in this petition which is a dredging and re-

dredging on a maintenance basis a channel?

A Yeah. Those are really quite different. The installing and removing of seasonal docks is regarded as relatively minor. In fact, the DEQ doesn't even permit those things. You can do that without a permit, that's my understanding. And, therefore, the impact is minor. And generally I think the DEQ relies on the landowner to do a kind of sensitive job because that's his or her property that they're putting the dock on and taking it off, you know. On the other hand, a dredging is going to have a major impact, not only on the area being removed, but in this particular case, given the soft sediments, additional material is going to slough in. And a silt screen, unless it's anchored to the bottom, is not going to stop material coming in. And even with that, it's going to be difficult to hold those silt screens in place. And if you move some of this outward a bit, then storms and ice shoving will move it out farther. We've talked about the effect of those high BOD sediments getting into the water column and perhaps getting distributed all the way into the deep hole of the lake. It's just something that I think the citizens of the lake don't really want.

Q On following up on this, in terms of dock installation, are you aware of whether or not sometimes docks are permanently installed as opposed to being seasonal docks?

A Correct. Yes, I am.

Q And, again, following up with the same line of inquiry, if -- just hypothetically let's suppose that a permanent dock were installed off of lot 8 in approximately the same location as the proposed seasonal dock, how would you compare any impact resulting from the installation process of that dock, impact in terms of disturbing sediment -- wetlands to the project that's being sought by the Petitioner here?

A Okay. If one were to propose a permanent dock, you'd have to be prepared to deal with ice shoving. And so in the springtime, as that ice begins to move and float out into the lake, it'll take the dock with it unless it's a very, very substantial dock. If I were going to do it, I'd probably use riprap, large poles -- kind of like a breakwater. But to put just a wooden pier or even a aluminum pier like so many of them have, the ice will destroy that -- damage it badly. And so you'd have to have a very, very substantial pier, large poles, you know, substantial -- not just 2-by-6's or something like that. You'd have to have a very, very substantial -- that would withstand that ice shoving.

Q I understand what you're saying. But in terms of the -- if one were to do that, to install such a structure, would you have to dredge out a channel 50 feet wide by 200 feet long to the hardpan?

A Not necessarily. You could put these large piers down like we do on the Great Lakes, you know, using jackhammers or pile drivers to pile them in and build out a platform. That would be very substantial. And you'd have to take that out into deep water which is about 200, 250 feet from shore in order to have that deep water area. And from time to time you may have to repair it due to ice damage. So you could do it. If you started from the land and put the poles -- you could build it out. I've seen that done with minimum impact, building the pier from the land, build as you go with very little bottom impact. But it takes special equipment and people who know what they're doing to do that.

MR. REICHEL: I've nothing further. Thank you.

RECROSS-EXAMINATION

BY MR. HOFFER:

Q Dr. Jaworski, the sediment jar that Mr. Morrow has -- that sample?

A Yes.

Q You haven't compared that to any other sediment samples from any other place in Lake Missaukee; correct?

A Of that kind, no; no.

Q And you personally haven't calculated the sinking rate of the sediments on the west side of Lake Missaukee; correct?

A I have not done any experimental work on that, no, just field observations.

Q And on what basis do you say -- or testify that a sinking rate can be extrapolated into the conditions of a turbid lake? Why can't a sinking rate be extrapolated out to predict the sinking rate in turbid conditions?
A Because you don't have any of the dynamics of an open system. You don't have the turbidity. You don't have the wind. You don't have any minor -- may be occurring due to passage of cold fronts or whatever.
Q Are you familiar with --
A It's like being in here. It's a very controlled environment. You drop something in it and all you've got is the effect of gravity. All the other parameters that are factors are held constant because everything's in a tube, if you will.
Q And are you familiar with a term called a "turbidity factor"?
A Yes.
Q And that's the point of a turbidity factor, isn't it, to extrapolate a sinking rate into a environment?
A In a controlled environment, yes, but not in an open system. So the applicability of that data is applicable to a controlled, contained environment. That's all.
Q So are you saying that the turbidity factor for Lake Missaukee can't be calculated?
A No, it could be calculated but you'd probably have to have

some brackets around your estimates -- sinking rates. You have to understand that the sediments are not, as I've tried to describe, completely homogenous from the shoreline out 200 feet, 300 feet, 400 feet. There is a difference in the nature of the nepheloid as you go from the shoreline outward to deep water. And I don't believe we've got that factored in either.

Q Okay. And for a permanent dock installation, you discussed using riprap. Would that be a continuous border along the bottom of the entire permanent dock? Is that what you were referring to?

A Yeah, it's kind of like a breakwater, but that's very damaging not only of the area we're setting it on, but it interferes with circulation. You see that in many areas. I just saw one in Lake City -- of the Mississippi River. They have a riprap, but it resulted in some stagnation and some sedimentation they hadn't counted on. So I don't recommend that. I'm not suggesting that. I said the only thing is given ice damage, you have to do something fairly substantial like that. But I wouldn't recommend that. If I were going to go with something permanent, I would go with pretty heavy poles or posts put in with a jackhammer or a crane or something and build it from the land outward so I had minimum sediment disturbance.

MR. HOFFER: Thank you, Dr. Jaworski. Nothing

further.

MR. PHELPS: Your Honor, we rest.

JUDGE PATTERSON: Thank you very much.

THE WITNESS: Thank you.

JUDGE PATTERSON: Rebuttal?

MR. SHAFER: Yes, your Honor. We call Dr. Lehman first -- recall Dr. Lehman.

JUDGE PATTERSON: How long do you anticipate rebuttal taking?

MR. SHAFER: I don't know. I'm calling Dr. Lehman first because he's the one that has a scheduling problem so I want to make sure I get him on and off today.

JUDGE PATTERSON: Okay.

MR. SHAFER: Mr. Boughner will probably be 5 minutes and Dr. Evans might be 20 minutes.

JUDGE PATTERSON: Okay. Let's see how far we can get with it. Welcome back.

THE WITNESS: Okay. Hi.

JUDGE PATTERSON: Dr. Lehman, you were sworn when you testified --

THE WITNESS: Sure, yes, I was.

JUDGE PATTERSON: Just reaffirming that you're still under oath.

THE WITNESS: Thank you.

JOHN LEHMAN, Ph.D.

having been called as a rebuttal witness by the Petitioner and previously sworn:

DIRECT EXAMINATION

BY MR. SHAFER:

Q Dr. Lehman, you've sat through the entirety of Dr. Jaworski's testimony today; correct?

A That's correct.

Q And you also sat through the entirety of Ms. Schmidt's testimony; correct?

A That's correct.

Q And Mr. Arevalo's testimony; correct?

A That's correct.

Q And Mr. Morrow testified over two different days. The first day you were here; correct?

A I don't know if it was -- I think that was the first time he was on the stand, yes.

Q Correct. The first time he was on the stand you were here and you listened to his testimony; correct?

A That's correct.

Q And then we provided you a copy of the transcript of the second time that Mr. Morrow testified; is that correct?

A If you did, I didn't get it.

Q Okay. All right. That's fine. In regard to the testimony that you did hear from Ms. Schmidt and Mr. Arevalo, Mr.

Jaworski and the limited testimony of Mr. Morrow, did you hear any of them discuss intermediate disturbance theory?

A I mean, in terms of it being an ecological theory?

Q Correct.

A No, I didn't hear any discussion of that.

Q Okay. Could you explain to the judge what that is?

A Oh, there's a pretty --

MR. REICHEL: Excuse me. Objection. If this purports to be rebuttal and the premise of the question is that other witnesses didn't bring this up, how is this rebuttal?

MR. SHAFER: Your Honor, it's very simple because Dr. Lehman has testified that there would not -- that there would not be an adverse impact in regard to this dredging project. Everyone else testified there would, in fact, be a significant impact. There's actually a theory that he's going to talk about that no one's talked about, about the fact that disturbances like this are beneficial to the ecosystem and none of them ever considered that. It's absolutely rebuttal. It's in direct rebuttal to their testimony that says that this is going to have a negative impact. He's going to testify it can have a beneficial impact.

JUDGE PATTERSON: Okay. I'll allow him to -- what was the term?

THE WITNESS: It was -- intermediate disturbance hypothesis is usually how it's been reported in the literature.

A Okay. Well, let me say this: I mean, first of all, I do want to thank Dr. Jaworski for the kind things that he said about my work. Although, I have to tell you, at some points there I felt it was like I was in a -- Shakespeare's "Julius Caesar" and I was hearing Mark Antony's speech. And I also want to say, Mr. Morrow, that I really did appreciate the depth of concern that you have for the lake. I mean, that came through very clearly. There were words that I wrote down when you talked about things like passion and being passionate, a beautiful sight to behold and so forth.

So let me now turn to this business of intermediate disturbance hypothesis. I would assert and I'd assert with great confidence that there is not one single thing -- property that can be measured by science; that is, something that can be objectively weighed and measured, counted; at the ecosystem level that would be significantly altered in any measurable way as a result of this dredging and dock project going forward. Now, that's at the whole lake ecosystem project level. And I say that with tremendous confidence. At the local level, at the regional level, what is most likely to happen is an increase in biological diversity.

Q And when you mean local level, you're talking about right around lot 8 at the dredging site?

A That's correct. I'm talking about perhaps in a 1,000 square feet or a couple thousand square feet area. Because what happens -- and this is the essence of this body of theory -- it's -- I shouldn't say just one thing. There's lots of experimental evidence to back it up -- is that if you let a system sit long enough that it comes to some homogenous state, you tend to have a deterioration of the total amount of biological diversity in the system.

Similarly, if you disturb the system egregiously on large scales, then you similarly have an erosion of its biological diversity and community integrity. But on the other hand, there's intermediate levels that actually enhance the overall species richness and diversity of the system and it's because you introduce some heterogeneity of habitat types. In this particular case, you allow some variation in water depth, you allow some foragers to extend a little bit deeper into an area, you allow organisms that frequent different types of bottom types or maybe favor spawning on different types of bottom types to exploit that environment. And I would state as a testable hypothesis that you could see an increase -- you could actually measure an increase in biological diversity on that regional scale if this was regarded as an experiment and it went forward.

Q Now let's talk about some of that biodiversity because you heard Dr. Jaworski's testimony talking about minnows and the fact that you may be losing some cover because you may be losing some plant material as a result of the dredging. Do you recall his testimony in that regard?

A Yes, I do.

Q Do you have any opinions in regard to those statements as expressed by Dr. Jaworski?

A Well, I don't dispute that minnows can exploit cover in shallow areas, but minnows will frequent shallow areas irregardless of whether there's a substantial amount of cover there or not. They use a behavioral mechanism called "schooling" to avoid predation and they are in that area to avoid big fish. They're not going to come into shallow water. But you'll find schools of minnows in all sorts of places that don't have extensive amounts of cover. And they may not even be foraging when they're in those shallows. And in many cases, what happens is they wait until the sun sets and at dusk they migrate horizontally out into the more center regions of the lake where they forage and then come back again at dawn. I mean, it's just an observation.

Q So, like, for example, when you're at the lake and you see the minnows right next to shore, there's no cover there but they're swimming in a school, that's an example of what you're talking about?

A Oh, sure. I would bet everybody's seen that.
Q And does that hold true not just minnows but big fish in general?
A Big fish in general certainly use schooling as a behavioral mechanism.
Q Now, you heard Dr. Jaworski testify actually about your testimony concerning the nepheloid layer. Do you recall that testimony?
A Yes.
Q And do you have any opinions in regard to his testimony in regard to the nepheloid layer, and more importantly, whether you believe that he really understood what you meant by that term?
A Thanks for giving me the chance to amplify. I was very concerned about the way the term "nepheloid layer" was being used and I was concerned that it may be misunderstood. And maybe that's because I didn't explain it as thoroughly as I might have at the outset. There's a nepheloid layer in Lake Michigan that I've measured 20 miles from shore in 100 meters of water and it extends 10 meters thick. It's a suspension of particulate matter, but it's not really rich in particulate matter. If we were to talk about its water content, it's far more than 99 percent water compared to particulates. And there might be some organic matter in it, there might be some inorganic matter. In Lake Michigan it's

certainly inorganic. And in Lake Michigan, its cause is near bottom currents and a certain amount of resuspension of the currents. But these nepheloid layers can be put into suspension by things like biogenic activities, biological activity like a fish swimming through the water flicking its tail. The key is they're not terribly particle rich and they are certainly not part of the sediment. You don't sample them by any kind of a sediment sampler. You use a water column sampler to do it. So, for example, I heard about the --

Q And could you explain to the judge what that would be? I don't mean to interrupt you, but --

A You might use a -- I might use a horizontal cylinder that goes down with sort of plungers at both ends. And I lower it to the place where I want to sample and then I trip it from the surface and it closes the water inside the sampler. So imagine going down with a cylinder that's open and then just clamping it closed and catch the -- you catch the water that way. But you do it right above the sediment surface. I want to -- can I say something about Ponars and --

Q I'll get to that.

A Okay.

Q But why don't we -- why don't we just finish about the discussion about the nepheloid layer and Dr. Jaworski's use of that term.

A Sure; sure. yeah. Well, characterizing it as something which is as much as 10 percent particulate matter as opposed to water, I'm not comfortable about that at all. That doesn't correspond to the nepheloid layers that I see or the ones that I saw in Missaukee Lake.

Q Okay. And some of the testimony about the nepheloid layer was obviously directed towards your experimentation or your sampling with the Ponar sampler; correct?

A That's correct.

Q And you heard the testimony about the Ponar wave and all that?

A Right.

Q Do you have some -- do you have any opinions in regard to Dr. Jaworski's testimony in regard to your Ponar sampling method and the Ponar wave as he testified to it?

A Yeah. A Ponar wave is a fine phenomenon -- a recognized phenomenon. When it occurs, is when you have one of these 100 pound plus Ponar dredges on board a ship and you have a winch operator lowering it and the winch operator decides to ease up on the brake and let the thing free fall into the mud. And -- okay -- it's true and you can imagine what happens. This is not the situation that I was doing -- that I was dealing with with my little petite apparatus. Remember, I was leaning over the side of the boat. I was watching it as it went down, moving it very gently because

my Ponar has a hair trigger on it. And the trick is to not let it trip before it actually hits the surface of the sediment. So I watched it as it -- because it -- I mean, you could see the surface of the sediment, shallow enough water, plenty transparent.

Q And when you're saying "surface of the sediment," I take it what you're referring to is not the nepheloid layer, but the sediments below that; correct?

A Right. I could see there was a little, tiny -- a little bit of a flock on the top. And as my sampler went down, I could see that it was submerging into that and then into the stuff that was beneath it. I don't think that I missed everything that was above it, but I could have missed some of it. It's just a matter that it set in and then I let it -- I let it trip. And when it came up, the fact is it was -- the sediment was pretty --

Q Now, Dr. Jaworski characterized your testimony -- I don't remember the exact words -- but basically believing that it was your opinion that this area was devoid of macroinvertebrate life. Do you remember that testimony?

A Yeah, I do.

Q Is that your testimony, Doctor?

A No, it isn't. The word I used was "depauperate." I didn't -- and depauperate doesn't mean devoid. It is -- it is -- I never doubt for a minute that there is something

alive down there. That is not a sterile lake. But I will tell you that if you go out and you make some surveys around that lake, I am quite confident that you will find plenty of other places that have higher densities of aquatic invertebrates than I found, which was I didn't find any. But when you don't find any, all you know is they're rare, you don't know that they're not there. We can never say that they are absent, devoid, but we can say they're depauperate in comparison to other lakes that I've studied and that's it.

Q And would the core sample have been another factor that led you to that conclusion?

A Well, I don't believe that -- the core sample doesn't necessarily sample a big enough area of the bottom. If I wasn't going to catch something in a Ponar Grab which had a bigger footprint, I wouldn't be surprised at all that I didn't see a -- you know, something on the top of a core sample.

Q But did the core sample at least confirm your general observations from the sample that you received from the Ponar Grab?

A Oh, certainly. There were no burrowing organisms or worm tubes inside it.

Q Now, Doctor, you heard Dr. Jaworski's testimony in regard to the fact that it was his opinion that 40 percent of the lake

food production was from the wetlands area on the west side of the lake. Do you recall that testimony?

A Certainly.

Q And do you have any opinions in regard to Dr. Jaworski's testimony in that regard?

A Well, I can't imagine where that number could come from. If you look at the area of the lake and you look at the fact that even Dr. Jaworski is saying something like 30 or 40 percent cover of the bottom by aquatic macrophytes -- by plants, and think about the total contribution of primary production that could be accounted for on that aerial basis, I don't see how the 40 percent comes -- I mean, I don't get a number anywhere close to 40 percent. I mean, I -- look, here's the thing: When I -- when I sometimes teach science to non-scientists -- and there's a statement that I always lead off with. And the statement is, in science the ultimate arbiter is the testimony of evidence, not the fervor of belief. And what we get is so far, I see lots of speculation, lots of things that could be tested but never have been tested. And I -- it troubles me even -- when a quantitative number like that comes out and I -- as a scientist, everything inside me, you know, lurches and says, "Where does that number come from and why isn't it 4 percent? Why is it 40 percent? Why isn't it 80 percent?" You know, I mean, that's -- those kinds of things bother me,

but that's part of my makeup.

Q Doctor, you heard Dr. Jaworski's testimony in regard to the phosphorous levels and the impact that this dredging could have upon that. Do you recall that testimony?

A Yes, I do.

Q Do you have any opinions in that regard?

A Talking about phosphorous content of the sediments?

Q Yes, sir.

A Okay. The phosphorous content of those sediments are they're -- they're very low.

Q And what do you mean by that? Are you comparing that to something?

A Yeah. I'm putting it in the context of other lake sediments that I've studied. And it's maybe six times lower than any other lake sediment that I've measured in terms of its phosphorous content per unit dry mass. Let me put it into another context. Based on the organic matter of that sediment which I measured and it's in the report and the phosphorous content which is measured and I reported about, the ratio of carbon to phosphorous in those sediments is 3,000 atoms of carbon for every 1 atom of phosphorous. That is enormously phosphorous deficient. Now, when Dr. Jaworski testified that he thought that was nothing like sawdust, I actually scratched my head a little bit and I said, "I'm not sure." You know, I've never measured the phosphorous

content of sawdust, but I know that it's not zero. And so it may very well be that those sediments have phosphorous contents as low or lower than sawdust.

Q And so does -- is there anything that Dr. Jaworski testified to give you pause or change any of your opinions in regard to the fact that this dredging project would not create any type of problem for the lake ecology of Missaukee Lake in regard to release of phosphorous from the sediments?

A No. I don't recant any of the testimony or conclusions. And I may -- and I say that understanding that the lakeshore residents feel very strongly and very passionate about the ecosystem and don't want to see anything bad done to it. But I've got to go back to this distinction between belief and observation.

Q Now, Doctor, you also heard Dr. Jaworski testify in regard to the -- if I'm paraphrasing this correctly -- the lack of oxygen content in the sediment.

A Yes.

Q Do you recall that testimony?

A Yes.

Q And you also recall his testimony in regard to an answer that he gave to a question posed by Mr. Hoffer about the fact that he did not believe that the springs that he testified to in regard to the wetlands area of the shoreline on the west side of the lake would contribute in any regard

to the oxygen content. Do you recall that testimony?

A Yes, I do.

Q Do you have any opinions in regard to that testimony of Dr. Jaworski?

A Yeah. One, I was actually pleased to hear the suggestion raised or the observation put forward that there were springs. Because when I first read that report about the suspected residence time -- turnover time of the lake water, I was in somewhat --

Q Is that the flushing rate?

A Flushing rate, yeah. I was in disbelief because I felt there must be subterranean drainage into that lake that changed its plumbing situation. And its flushing rate is actually shorter -- or, you know, faster than the number that was cited. The springs are clearly -- because of where they're supposed to be entering the lake, they're surficial. They're close to the surface. They're not analogous to wells. And the fact that there's nitrate in them rather than ammonium indicates there's oxidizing conditions and you know there's oxygen in there. What's actually happening is that that water is probably aerating the near shore sediments and those peaty sediments are -- they're not anaerobic. I say that not having put an oxygen probe into it; not having tried to measure its redox potential, certainly having smelled them as I took them out of the core

and they were not anaerobic.

Q Okay. And the fact that it's not anaerobic, what does that tell you in regard to the general opinions that you've previously expressed here? Why is that important?

A Well, in truth, the -- I guess just in terms of putting the ecosystem together is how it works because given the low phosphorous content of those sediments, even if they went anaerobic, there's not that much phosphorous for them to release -- I mean, even if you could artificially get them to be anaerobic.

Q Okay. And what was -- you testified about the smell of the sediments. What is significant about that?

A Well, some of my colleagues like to taste lake mud when they take the sediment cores. I don't go that far. But it's just -- you know, it's one of these things that happens over long periods of time and you're used to dealing with mud and sediments and you're used to understanding the way they feel in terms of some things and how they smell in terms of others. And I'm not going to put my nose up as an analytical instrument. Okay? But I'm just saying that I feel confident that those sediments were not anaerobic. But it's okay if people don't believe me. I don't have the measurements to -- you know, to prove it.

Q Now, you also testified a couple minutes ago about the flushing rate and I believe you said something to the effect

that it was not the rate that had been cited. What did you mean by that and where did you get that information?

A Well, I saw a flushing time to be on the order of, I don't know, seven years or something like that -- or maybe it was even longer than that. And I started looking at sort of water export per -- you know, per square meter of land in Michigan and it just sort of -- the calculations in terms of expectations of what you get about watersheds. And I said based on my expectations of water export, it ought to be on the order of three years which is still a long time.

Q And what does the flushing rate of the lake provide to you in regard to your ultimate opinions?

A Well, the reason it was raised in the first place, I believe -- I didn't raise it, but it was in one of the documents -- is the suggestion that anything that is done to this lake will stay there for, you know, decades and not be washed out. And, of course, the residence time of the lake is something that one considers. If you did get a pollutant into a lake that only flushes once in a hundred years, that's a different matter than if a pollutant is added to a lake that flushes every week.

Q And so the fact that it had a much faster flushing rate, does that give you confidence that this dredging project will not have a significant ecological negative impact?

A Well, I guess my interest was more intellectual because I

don't think that this has a significant detrimental effect on that ecosystem regardless of what the residence time is. I mean, that's how I did the --

Q All right. Now, did you also hear Dr. Jaworski's testimony about the algae buildup and his concerns in that regard?

A Yes.

Q And I don't know if you fully answered this really by some of your previous answers, but I just want to ask you, do you have any other comments or opinions that you'd like to express in that regard -- in regard to the algae issue that Dr. Jaworski raised?

A Yeah, I think -- I think the -- I think the connection -- I think the way this goes is that the suggestion is that there is this subterranean drainage and that it's bringing nitrate and phosphate into the lake and that somehow, perhaps, it gets trapped by the algae and then they release it into the water. Of course this is a big whole series of inductive reasoning and speculative steps that aren't connected by any kind of measurement or deduction.

But there's a couple of things that caused me to question it. One is the suggestion that these are basic soils in the area that the water is percolating through and the suggestion that there were carbonates in there. Under those conditions, phosphate is trapped very well by the sediments. Nitrate is going to move through, but the

phosphate is going to be absorbed differentially. So the way you test that -- and if I knew about it and it would be an easy thing to do -- it was the first time I heard about it today -- you just take a sample of that water and measure it -- easily measure the amount of nitrate and the phosphate that's in it. It's one of these things when you raise a theory like that, you've got to know that 99.9 percent of the time you're wrong. That's true of me, that's true of everybody. But the only way you can keep yourself on the straight and narrow is to make your measurements and correct those -- you know, those ideas as you go along.

Q You also heard Dr. Jaworski testify about the fact that he did not believe that your sinking rate experiment could be extrapolated to the real world in regard to Lake Missaukee.

A Yes, I remember that.

Q And do you have any opinions in regard to his testimony on that?

A Yes, I do. And I think that it was counsel for the Intervenor who was skeptical about the results of that experiment the last time. And here's the thing: Those sinking rates are spot on. There's nothing wrong with those sinking rates. What people are concerned about is they're trying to figure out how that translates into what we might call a "clearing rate" of particles out of the water column. See, the particles have that sinking rate, whether they're

in turbulent water or not.

So let's then address the question of what is the clearing rate of particles that have that sinking rate? Because you have to figure that there's turbulence which is resuspending -- and they're suspending. And it's actually a simple mathematical problem to solve and I did solve it. Because the one key point that you have to bear in mind is once the particle hits the bottom, you've got to consider that it's back on the bottom because if you don't, then what you're saying is you expect that the sediments that are already on the bottom will be continually resuspended and that's out of the game. And they're basically -- they're not suggesting that those sediments are constantly being resuspended all the time or else they wouldn't care about putting a dock in. So the question is, what's the clearing rate? And I solved the problem to say at that sinking rate, full-blown turbulence, as turbulent as you can get, how long does it take before 90 percent of the particles hit the bottom for a lake which is mean depth three meters -- Missaukee Lake? At least that's what I used.

MR. PHELPS: Excuse me. Your Honor, I do want to make an objection here because it sounds like we're going to get a calculation. And the reality is that Dr. Lehman did a report, he put together what he thought was and the Petitioner thought was the relevant important calculations

and issues in the case. And based on that, we've responded to his both his testimony and his report. Now it sounds like we're going to get a new calculation -- a calculation that's never been disclosed before, wasn't disclosed -- we weren't even given any notice of it before the hearing today.

So now we're supposedly getting rebuttal testimony that's going to involve a new calculation that we're not -- we don't know about this. It's not in the report and that we're not going to be in a position to dispute. So it's essentially -- I mean, it's clever. It's a "Don't put it in your real report. Wait 'til rebuttal, throw it out there at the last day and then give the other side no opportunity for full and fair cross-examination."

MR. REICHEL: I join in the objection, Judge.

MR. SHAFER: Your Honor, to say that those objections are hypocritical is probably the grossest understatement of anything that has occurred in this trial so far because, you know, we came in here asking for discovery that we never got. We come in here and we have all new theories that are thrown in front of us. We have documents that show that the DEQ says there's no additional wetlands after 20 feet and I spend the entire day working my case with absolutely new theories. They brought in tar pit leaching issues today that was e-mailed to us for the first

time yesterday. When Mr. Phelps was cross-examining Dr. Lehman the first time, Dr. Lehman said he could do it right then and there and they were the ones that said it can't be extrapolated. That was their testimony. You cannot extrapolate a sinking rate analysis in order to -- what occurred in the lake. He's saying, "Yes, you can." He's done it and now he's going to testify exactly what he found. It's exactly rebuttal of exactly the testimony they put on.

MR. PHELPS: It's not rebuttal. He had the sinking rate in his report. That's what they submitted. If they wanted to put a clearing rate or some other rate -- settling rate, they could have done that. This is -- Dr. Lehman's report addressed sediment sinking rate. We responded to that. And now he says, "Okay. Well, forget about that. Here's what's really important, clearing rate. And by the way, you don't get to examine my calculations before trial."

JUDGE PATTERSON: I think Dr. Jaworski opened the door when he testified that the --

MR. SHAFER: Thank you, your Honor.

JUDGE PATTERSON: -- the tube sediment rate wasn't relevant given incidents --

MR. SHAFER: Correct.

JUDGE PATTERSON: -- and circumstances of the real world, if I can put it that way.

MR. SHAFER: Correct.

JUDGE PATTERSON: So I'll allow you to pursue that.

MR. SHAFER: Thank you, your Honor.

A Look, it's very simple. If everyone wants full disclosure, put up a poster, I'll write the equation on there so anybody can check my calculus. But the solution is very simple. You use that sinking rate because that sinking rate is correct and then you take into account the fact that the lake is mixing like this and there's a certain mean depth of the lake. And you figure out how long it takes, in this case I said 'til 90 percent of the particles actually hit the bottom. And the answer is less than one day.

Q And if Mr. Phelps wants you to write that out, you can do that for him when he cross-examines you?

A Sure; sure.

Q Okay. So would it be a fair statement then that you would agree with Dr. Jaworski that the transparency issue in regard to the dredging project would be a -- I forget the exact word he used, but it would be a temporary problem?

A Certainly, if it exists at all. I don't know enough about the engineering aspects of, you know, these hydraulic dredges. But, yeah, I know that if something got up in the water column, it would be -- it would be -- it would basically not be noticeable in a day.

Q So in using the testimony in regard to some of the documents that we've seen and some of the testimony that we've heard over these numerous days of trial, I take it then that what you're saying is that based upon your experiments in regard to the sinking rate and now your new calculation regarding the clearing rate, that you would believe that there is not going to be a problem of -- I think the exact phrase was "persistent plumes of turbidity in the lake"?

A That's right. I make that prediction and, you know, make it quantitative.

Q And is the analysis that you did hear, the additional analysis, is that something that is generally accepted by limnologists in the field when they're trying to determine these type of issues?

A It's the common, classic way to make that calculation.

Q Would you describe, Doctor, the opinions as expressed by Dr. Jaworski as being supported in science or as being speculation?

A I didn't -- I honestly didn't hear any evidence. I mean, it's in the range of -- see, science has two elements to it. One is deduction, which is the rigidly logical aspect of science. And that's where, you know, you get the reputation to be that cold, calculating type. The other thing is induction. And induction is this creative part of science where you make up theories and that you make them up out of

the inside of your head. And you can never know that you're on the right track until you actually start to make some measurements to self-correct. And the danger that students face oftentimes is they start to move into the realm of novelist rather than scientist before they've actually checked their first steps and their first assumptions by calibrating themselves against data. I see lots of ways in which the suggestions that have been put forward that are speculative -- they're inductive, could have been tested. But instead, I see a whole chain of these inductive events unchecked by data.

Q Is there anything you heard in any of the testimony over the various days that you've sat here that change any of your opinions?

A No.

Q Doctor, I guess I'll just give you a -- you know, an open-ended question. I think I've gone through all of Dr. Jaworski's testimony with you that I wanted to cover. But are there any other statements or opinions expressed by Dr. Jaworski that you wanted to respond to?

A Not that occurred to me off the top of my head. Let me think.

MR. SHAFER: Your Honor, if I could just have a minute?

JUDGE PATTERSON: Okay.

Q Doctor, do you recall Dr. Jaworski's testimony describing your work as being hired to consider this particular dredging project?
A Yes.
Q Were you hired to take a look at just the impact upon this dredging area or to take a look at the impact upon the entire lake ecosystem?
A The question that was posed to me was would a project of prescribed dimension and scope have an effect on the Lake Missaukee ecosystem at any scaled -- you know, at any reasonable scale that I thought I could measure or could be measured? And, so, yeah, it was to see whether it would have a bad effect on Lake Missaukee, I guess, is what I characterized. I wrote out specifically what I was told in the report so I could read it.
Q Okay. No, that's fine. It's a document. It's in there. The judge will have that. In addition, you've heard some testimony from Dr. Jaworski -- I'm not sure if you were here during Mr. Morrow's testimony in this regard or not -- but Mr. Morrow's opinion is that this area, if it was dredged, because of the consistency of the sediment it would fill back in very rapidly basically then making the dredging project -- I guess superfluous is probably the wrong word, but --
A Feckless perhaps?

Q Correct. Good Wolverine word; right? Do you have any opinions in regard to -- based upon everything you've heard through this testimony and the studies that you've done with regard to whether you believe that this area, if dredged, as the Petitioners want would fill in rapidly?

A It's the word "rapidly." I mean, there's no question as I've testified before that any project like this is completely reversible. The long-term study -- state is probably basically what the system is right now. But then comes the question of what is rapid? And I don't know what the time scale is. But I know it can be -- I know it can be tested. It can be tested by doing an experiment. And I would imagine that if somebody did that experiment, it would answer the question -- a lot of the concerns of the property owners. It would answer the concerns of the Petitioner because I would imagine that if it filled right back in, it -- decide that wasn't a good idea.

Q Doctor -- and Dr. Jaworski testified to this a little bit, but in limnology, is there a rule of thumb for the rate of accumulation of sediments in the inland lakes of Michigan?

A A rule of thumb? If you're forced to cite something, yeah, it's going to be in the range he was talking about, less than a half a centimeter to maybe a half a centimeter or more. It's more than that in lakes that are impoundments -- that are reservoirs where you have substantial amounts of

silt coming in from rivers.

Q Okay. Now, you've heard a lot of testimony in regard to -- particularly Dr. Jaworski in regard to the fact that he perceives there were wetlands in the area beyond -- that there were wetlands in the area lakeward from lot 8; correct?

A I heard that.

Q Okay. And you've also heard earlier in the trial that my clients agreed to change the dredging project so that they would not dredge the first 20 feet out; correct?

A That's what I heard.

Q All right. Now, in regard to your specific observations, beyond the exclusions zone lakeward -- and I mean that 20 foot area -- beyond the 20 feet lakeward of lot 8, did you see when you were there areas in the lake that would be in the dredging area that you would describe as a limnologist as wetlands?

A Well, I -- first of all, in my teaching, I don't use the word "wetlands" because I regard that as a -- it's sort of like legal interpretation because it's cultural. It's dependent on statutes and things. And I didn't have -- I wasn't aware of this 20 foot thing when I visited the site, so I wouldn't be able to say for certain that I measured this 20 feet. But I know that lakeward of the emergent vegetation which was present in the pictures that were

included in my report, there was a little bit of submerged vegetation. And then moving out beyond that I didn't -- within that zone, I didn't see much, if any, vegetation right within that area that was identified as the putative dredging zone. But I certainly saw vegetation to the north and the south.

Q Outside of lot 8 you mean?

A Yeah; yeah.

Q Okay. Doctor, just for general terms, was there anything you saw when you were out there beyond the 20 foot exclusion zone that you would describe as a limnologist as a bog, swamp or marsh, lakeward beyond the 20 feet?

A No; no; no; no; no. But the soils -- I mean, the sediments are kind of peaty, yeah.

Q Okay. Did you see any floating vegetation lakeward of lot 8 that you believed would be around 200 feet in from the shoreline -- out from the shoreline?

A I mean, out of the shore -- well, certainly I was at that distance and took samples and, no, I didn't see any there. But there was some to the north.

Q Now, Doctor, you heard the testimony of Robyn Schmidt in regard to what she saw standing from the shore; correct?

A Yes; yes.

Q And do you recall before lunch she testified that she could see the bottom of the lake, after lunch she said -- what she

said was she could see floating vegetation on the top of the lake? Do you recall her testimony?

A Yeah, I noticed that.

MR. REICHEL: Objection.

A I noticed the difference.

MR. REICHEL: Objection, I don't think that fairly characterized the testimony.

MR. SHAFER: Your Honor, this is not a jury trial. You can look at the testimony and you can separate the wheat from the chaff. So what I'm going to ask the doctor is --

Q Doctor, during that lunch break before she testified again and differently, did you express an opinion to me as to whether or not Ms. Schmidt could have seen the bottom of the lake at that distance from where she was standing?

A Yeah, well, during her testimony if somebody read my lips they could have seen what I said. It's impossible.

Q And why is it impossible?

A Because there's a phenomenon of -- the difference in the refractive index of water and air leads to a phenomenon called "total internal reflection at particular angles from the vertical." And that's why, I think, Mr. Hoffer asked her how tall she was because I was just curious --

Q At your request; right?

A At my request. Yeah, I was just curious how far out she could have been able to see the bottom. And I think the

answer is something like 31 feet.

Q Doctor, will you agree or disagree with Ms. Schmidt's testimony that this dredging project would destroy a natural resource?

A I'm not aware of any natural resource that it would destroy.

Q Doctor, would you agree or disagree with Ms. Schmidt's testimony that this dredging project would impair the surrounding wetlands?

A I don't believe it would. And I think that's a testable hypothesis.

Q Doctor, do you agree or disagree with Ms. Schmidt's testimony that the dredging project would cause more than just a minimal effect on the natural resources of Lake Missaukee?

A I think it would -- not only negligible, basically impossible to detect, would be the magnitude.

MR. SHAFER: Your Honor, that's all I've got.

JUDGE PATTERSON: You want a few minutes before you do your cross?

MR. PHELPS: It doesn't matter.

MR. REICHEL: I'm ready to go but if someone wants a break, that's fine with me.

JUDGE PATTERSON: I don't need one. I'm just asking if you --

MR. REICHEL: Okay. Thank you for asking.

CROSS-EXAMINATION

BY MR. REICHEL:

Q Dr. Lehman, you were asked about what your charge was in this project.

A Yes.

Q And I believe it was indicated you did testify to that. In fact, your initial report summarized what you understood your work assignment to be. Direct your attention to Petitioner's Exhibit 2 in the reddish -- no -- Petitioner's. I'm sorry. This --

MR. SHAFER: The thick one, the burgundy one.

Q The thickest, yes. Just take a moment to --

A Exhibit Number 2?

Q 2, and then specifically page 2 of that document.

A Okay.

Q And directing your attention to the second paragraph there, does that summarize what you understood your task to be?

A Yeah, I put "public trust" in quote (sic) because I saw that that was something I was asked -- and the "inland lake." And I take it that this language was drawn from some other document.

Q Right. And, again, I don't -- we touched on some of this on your cross-exam in your initial testimony. But in substance, is it fair to say that you were asked to opine about the environmental impacts of the proposed dredging

project? Is that a --

A I think that people might call that an environmental impact.

Q I don't mean to say like an environmental impact assessment, but generally speaking you were asked to offer your opinions as to what environmental effects may or may not result from the activity that the Petitioners are seeking to engage in; right?

A I think that's generally correct.

Q Okay. And on your direct examination today, you were asked about something called the "intermediate" -- I'm sorry -- bear with me.

A Oh, "intermediate disturbance hypothesis."

Q Yes. Okay. Now, you would agree that nowhere in your -- either this Exhibit 2, your initial report or the follow-on report that you prepared -- you can look at that if you want -- did you use or introduce the phrase of "intermediate disturbance effect" -- or "hypothesis"?

A That's correct.

Q That's true?

A That's correct. I can explain why it came into my head, but I don't know if you want me to.

Q Well, let me -- I just want to establish --

A Yeah, okay.

Q First of all, when you were asked to opine on the environmental effects at the time when you first did this,

when you wrote up your report -- and, indeed, would you agree that you didn't testify about this when you testified before, the first time on direct examination?

A I agree.

Q Okay. So -- but today you have -- or sometime between today -- when you last testified and today, you have seen fit to presumably suggest to counsel that he ask you about this intermediate disturbance hypothesis; is that right?

A I mentioned it. I didn't say he asked me about it. I just mentioned it in a way of explaining something that I had observed about some of the testimony from the DEQ people.

Q Well, I want to make sure I understand what this concept is. If I understand your testimony earlier today, this hypothesis -- and you admit it is a hypothesis; correct?

A Yes. It's theory.

Q Yeah, it's a theory.

A I mean, hypothesis, theory, it's all the same.

Q Okay. It's a theory, hypothesis. You're suggesting that the possibility exists that engaging in the permitted activity would actually have some environmental benefit by promoting greater biological diversity, is that -- I want to understand it. Is that the gist of this theory?

A Well, I usually -- I really try to avoid use of, I mean, value terms like "beneficial" or "detrimental" unless it's in the context of a particular frame of reference.

Beneficial -- if you are interested in increasing the amount of biological diversity -- by diversity at a particular region, beneficial in the absence of having a context is meaningless. So I will agree with you in the use of the word "beneficial" if it is considered to be a positive thing to increase the amount of species richness or species diversity. If that's not the case, then the human value judgment would be that that's not a good thing to do.

Q Okay. Well, I just want to put this -- is it your -- are you testifying that in your opinion, implementation of this project as proposed by the Petitioner would, A, cause increased biological diversity in some area?

A At some regional scale. But, yeah, at some regional scale that includes that site and some of the surrounding sites.

Q And are you offering -- just following up on your response to my previous question, are you offering any sort of value judgment about whether that's a good thing, a bad thing or not? You're just making the observation that hypothetically engaging in this project may result in some greater diversity on some, quote, "regional scale"?

A That's right. I'm not making a value judgment. That's not my job at all.

Q Okay. Recognizing as you've testified that part of this case involves legal or statutory terms or standards which you described as cultural rather than scientific --

A Certainly.
Q But in terms of the -- again, looking back -- I'm not trying to confuse you.
A Certainly. That's fine.
Q Looking back at page 2, the second paragraph I asked you to look at earlier where you quote some of those standards, is it -- are you testifying that this project as proposed would advance any of the values or standards stated in paragraph two?
A Explain what you mean by "advance."
Q Okay. Public trust, it's a term you quoted. We talked about this. I'm not -- you -- you testified candidly on your previous examination that this is a term that you didn't typically deal with but you were asked to -- you were given some copies of statutes and regulations to look at. Do you recall that?
A Yes; yes.
Q I guess to the extent, if any, that you understood those terms or understand them today, is it your testimony that -- or are you asking the tribunal -- strike that. Is it your testimony that you have formed the opinion that implementing this project would enhance or protect the public trust?
A I believe that this project is probably pretty neutral with respect to my understanding of what the public trust is.
Q And with respect to the remainder of this quoted language,

are you testifying that this project would have a positive as opposed to adverse effect on the lake, the stream, the waters and the uses of the waters just following through that quoted language?

A Possible effects? See, it doesn't say "beneficial," it doesn't say "detrimental." And so if I look at something and think about the word "aesthetics," that's such an incredible human value judgment that I would imagine some people will say, "This is a good thing," and some people will say, "It's not a good thing," and that's why it's probably neutral.

Q Okay. So the bottom line is you're not, in your testimony today, offering an opinion that this proposed activity would have a positive effect with respect to these criteria?

A I don't -- again, you've got to put that into a context. "Positive"?

Q Okay. Well -- go ahead.

A What I have testified to, because I believe it's correct, is that there's no measurable effect on the lake that is an outcome from this project. And so, therefore, whatever it's impact is on the lake is not measurable. The decision is going to be made by non-scientific criteria.

Q Okay. You were asked by counsel on direct examination today -- I think actually we talked about this when you testified previously about observations of wetlands. And my

recollection of your testimony both today and the previous occasion was that you, again, candidly said that "wetland," quote, unquote, is not a term that you typically use in an academic context; correct?

A That's correct.

Q And I believe you understand -- or you testified that you understand that in the context of this proceeding, "wetland" is essentially a legal term of art?

A I understand.

Q Okay. And indeed you are not offering an opinion today -- I just want to be clear -- as to where wetlands as defined in a legal sense under the statute, this Part 303 that is part of what's at issue -- you're not offering an opinion as to where wetlands do or do not exist in that legal or regulatory sense?

A That's correct.

MR. REICHEL: I have nothing further. Thank you.

MR. PHELPS: Dr. Lehman, a few questions for you.

CROSS-EXAMINATION

BY MR. PHELPS:

Q I want to make sure I get this phrase right. I think somewhere in your testimony you said that in science, one of the most important -- or the most important thing is the testimony of evidence, not the fervor of belief. Did I get that right?

A That's correct.
Q And I take that to mean that what you believe is important is what the evidence says, what the documented facts are, not how much someone believes in something?
A That's correct.
Q And you expect this tribunal to make its decision in this case based on the evidence of the facts; is that right?
A No, I don't. I don't have a prejudice about that. I don't know what's going to be used. No, I was speaking about science. I don't know what gets used in making decisions at this level. I honestly don't.
Q But you believe that scientific assessments or conclusions should be reached based on facts in evidence?
A Evidence in the context of science is tied to observation. These are reproducible things that can be weighed, counted, measured in a reproducible manner. It is not -- I do understand that as an expert witness I am somehow qualified to offer opinion in the eyes of the court. But I spend a lot of time talking to students to try to explain what the words "fact" and "theory" mean in science and that they are not necessarily the way that other people use them in the vernacular or in a courtroom. So, I mean, I want to make clear that when I say evidence in the context of science, I am talking about the testimony of observation.
Q Observation as evidence?

A Observation as evidence.
Q And so when you made the statement that you saw no evidence from Dr. Jaworski, that's not correct?
A What was the -- what is the quantitative numbers that I'm missing?
Q His observations that you say consider evidence.
A What are the observations?
Q You heard his testimony, he observed wetland plants, he documented all the life -- the organisms and other life that he found in the proposed dredge site. Those are his observations. You heard those; correct?
A Okay. I don't dispute that.
Q Yeah. And you don't dispute that that's evidence?
A I don't dispute that that's observation.
Q That that's evidence?
A Did I really say there was no evidence? Really?
Q That is what I wrote in my notes and the record will reflect what evidence --
A Okay. Let me change this. No quantitative evidence.
Q So observations are evidence but a different type of evidence than what you're referring to now?
A They're pretty hard to test. They're pretty hard to test. They're pretty hard -- see, you've got strong theory, you've got weak theory. Strong theories are progressively more restrictive and it's possible to prove them wrong if, in

fact, they are incorrect. There's a lot of theory that goes around that is so weak, that it is impossible to prove it wrong. And so it's not theory that advances our understanding of the system very much.

Q In speaking of what I would describe as weak theory, you've offered the intermediate disturbance hypothesis or theory; correct?

MR. SHAFER: Objection; argumentative.

THE WITNESS: That's okay.

A The person who proposed it is in the National Academy of Sciences.

Q And you've advanced it to this -- you've advanced it to this tribunal; correct?

A Yes; yes.

Q And that is just that. You have not offered any testable evidence that there would be increased biodiversity if this proposed dredging went forward, have you?

A No, but I've made that as a quantitative prediction and it can be disproved if, in fact, it's wrong.

Q It can be disproved by seeing what happens?

A By performing an experiment, that's right.

Q You can't tell the tribunal, though, today based on evidence that that will, in fact -- what will happen?

A I can tell the tribunal by evidence that in other systems in which intermediate disturbance has been applied, there has

been an increase in biological diversity. Therefore, if we reason by analogy which is one of the best ways that you can operate in a -- complex, nonlinear systems like these biological systems, that is one of -- that is one of the best ways that you carry some of your expectations forward, through the process of deduction, which is that rigidly logical part of science.

Q Well, I heard you in your testimony about this theory -- you used the phrase that there could be an increase of biodiversity; is that right?

A That's correct.

Q And what exactly did you mean by that?

A I mean that if you were to quantify the number of different species that existed within the region ahead of time and got a number, and if you also quantified the numbers of each one of them so you have some understanding of relative abundances, and then if you -- and then if you performed that same measurement after the disturbance, I'm predicting that the number of the total count of species would increase and that the numbers would not be so -- as lopsided where there's just one that's -- you know, millions of one and none of another, that there would be more equatability. So I'm making actually two predictions on the basis of that and both of them could be disproved.

Q After the fact?

A They could be disproved after the fact, yes, that's right.
Q You haven't taken any measurements yet to determine so that we could ever disprove it, have you?
A No, but anybody's welcome to do that.
Q And I think you fairly said it's a prediction that you've made; correct?
A That's correct.
Q And understand -- so we're on the same page of what the proposed project is, the proposal as I understand it is to take that 50 by 200 foot spot in front of lot 8 and remove anything down to the solid bottom. Meaning if there are submerged plants, lily pads, other vegetation, invertebrates, whatever is in the way of that path is going to be removed as part of the dredge. Is that consistent with your understanding?
A That's what it sounds like to me.
Q And so right away we know there's going to be a -- we can -- there's no dispute that there is going to be a loss of what's ever in the path of the dredge, that's a given?
A Yeah, and there's also going to be the creation of new habitat.
Q The creation of new habitat? And that new habitat would have no vegetation in it -- correct? -- because that's been removed?
A Perhaps initially it won't. I don't know what it'll have in

the long run.
Q Well, you do know that the Petitioners' permit calls for maintenance dredging; right?
A Yes.
Q And you understand that the maintenance dredging is to clean back out the dredge and remove anything that falls back in?
A I don't think they would dredge it out if there were microalgae growing on the surface of the exposed sediments. I don't think that that creates a problem for them.
Q If that sediment -- because you've used, I think, the phrase several times that it would be reversible.
A Yes.
Q And what I thought you meant by "reversible" was that the sediments might fill back in and it might -- you'd have submerged plants or floating plants that would return and be basically back to its current state. Isn't that what you meant by that?
A I think if everybody walked away from that place, over some period of time -- and I don't know what that period of time is -- the system would revert to the state that it has -- that it is right now, probably a little shallower.
Q And exactly on that point, you have -- you haven't tested the rate at which the dredge would fill back in; correct?
A That's correct.
Q So you have no evidence to offer the tribunal as to whether

it would be a week, two weeks, a year, ten years, any quantitative analysis as to when that dredge spot would fill back in?

A I have not. I was not asked to undertake such an investigation or such a calculation. I don't think that it's impossible to do -- to make a prediction.

Q I don't disagree, but your testimony was that evidence is what's important and I'm just asking if you have any evidence about how soon that dredge will fill back in?

A No, I don't.

Q And when we -- you talk about the intermediate disturbance hypothesis and increase of biodiversity, I assume you're not suggesting that there would be new species introduced into the lake as a result of this dredge?

A No.

Q And I think what you're saying is that now we've removed -- the Petitioner, if this goes forward, has removed the silt and any plants that are in the way of the dredge and so we have a new habitat different from the habitat that exists now; correct?

A That's true, but the habitat that exists now is still going to be there all around.

Q Right. And the increased biodiversity that you're predicting will happen is that there will be fish -- I guess that's what I'm asking is what are you predicting will

happen? What will we see if this project moves forward and we look down into the proposed dredge site?

A Well, my guess is probably a pretty safe bet is that there will be a lot of bait fish underneath the dock. That's just one thing that's pretty safe.

Q And there's bait fish there now.

A Yeah, but --

Q So what's the biodiversity then?

A I say it's a quantitative measurement. It doesn't say we're going to create things that didn't exist before. I mean, there's going to be some -- there will be some things that come in that use that sandy bottom habitat that were excluded from the region previously. So there will be some new things that come in from surroundings. But, you know, yes, there are bait fish there now, there will be bait fish there later. If you do a census of the bait fish, my sense is that in the overall region you're actually going to have a higher number and maybe more diverse.

Q And that's based on your sense, not any evidence?

A It's based on reasoning by analogy with other systems.

Q And what other systems have you evaluated in reaching -- in context of this case?

A In terms of reviewing the literature, perhaps dozens, if not more. It's a very well-established principle and theory. I've seen it and participated in some of the measurements

myself in the Rocky Intertidal of the Pacific Northwest, of littoral zones of Union Bay in Lake Washington. I haven't really done any terrestrial vegetation examples, but I know that the literature is full of it -- or full of examples.

Q Well, your prediction to this tribunal is that if the dredge goes forward, there will be an increased number of bait fish in the area around the dredge site. Is that an accurate statement of your prediction to the tribunal?

A We're going to have to define what -- you know, what an aerial extent of the zone is. And I would, of course, want that to be more than just the dock itself. It would have to include some local region around it. And I would think that some kind of a quadrant could be set up that would, you know, adequately test that hypothesis. Maybe it would have to be, I don't know, 200 meters by 200 meters or something like that.

Q But in answer to my -- do I have it right or not; that your prediction is that there -- if the dredge goes forward, there will be an increased number of bait fish in the area? And it's your hypothesis, so you tell me what the area is if that's the misunderstanding of the question.

A Yeah, I'd go with that hypothesis and then go for the test.

Q And you've reached this prediction based on, you said, analogy?

A That's correct.

Q And what Michigan inland lakes that are similar to Lake Missaukee are you analogizing this to and basing your prediction on?
A Well, I wasn't using Michigan inland lakes as a -- you know, as something that I have to confine this theory to. It seems to translate very well across ecosystems.
Q So does that -- do you have any Michigan inland lake that you're analogizing to Lake Missaukee to come up with your prediction to this tribunal?
A I don't think there's anything that comes to mind right off the top of my head but, you know -- come on -- I'll come up with things out of the literature, if you really insist.
Q You've already come up --
A Yeah.
Q You already made the prediction. I would assume that you had done the analysis before we came to the tribunal and testified. That's what I'm asking.
A Nobody asked me to look up literature about Michigan inland lakes.
Q You made the prediction and I simply asked if there are --
A Yeah, I've made the prediction.
Q And the two lakes that I think you've testified about, one is in the Pacific Northwest; is that right?
A Yeah -- well, they're both in the Pacific Northwest.
Q What lakes are these?

A One is near Seattle.
Q What are they called?
A Union Bay of Lake Washington at Seattle and the outer coast of the Olympic Peninsula of Washington State.
Q Are these salt water or freshwater?
A Union Bay is freshwater, Tatoosh Island is salt water.
Q And what dredging took place on those lakes that you're analogizing to?
A There was no dredging. At Rocky Intertidal there was a purposeful manipulation of the predator populations. And in Union Bay, there was some -- there was some invasion of watermilfoil.
Q Okay. Well --
A I mean, disturbances come in all sorts of forms.
Q Right. But what we're -- what you made a prediction here today about is that there will be an increased number of bait fish in the area that you've defined around the proposed dredge site. And I'm simply trying to find out -- and you've said you made that prediction based on analogy. And now you've identified two lakes that you're analogizing to, and I'm trying to figure out what is the connection between the literature and any other documentation or information you have regarding those two lakes that causes you to think there's going to be an increase in bait fish on Lake Missaukee.

A Okay. Here's how it works: In science, there are two things. There is theory and there is observation. Observations are those things that we can -- you know, you can quantify, count and measure. They are the facts at hand. That's what we mean by fact in science. A theory is a generalization that goes beyond the facts at hand. And we're perfectly free to take that theory and apply it to a situation which is not identical to one that has occurred before. And as I say, in these complex, linear systems, you never find a system that is identical to the one you had before. So instead, what you're trying to do is to generalize what you think are the salient features of those that underlie the predictions that you make and do it in such a way that you can actually test it later on to find out if you're on the right track or not, because your theory ultimately is something that has been created inside your head. You have no way to know absolute truth, but you have a way to know if you're wrong. That's the essence of science. And if you are only proposing something and you assert to the world that this is the way it is going to be, I assert to you that most of the time you're going to be wrong. And I could be wrong. I'm not saying that that theory that I put forward is -- that I guarantee it. I'm saying that it's testable and based on so much of the body of work that has come out, it is a reasonable theory to

advance.

Q What are the salient features of Union Bay and I think -- my pen's running out of ink here, but I think I wrote out "outer coast." Was that the -- outer --

A Uh-huh; yeah; yeah.

Q What were the salient features in Union Bay and the outer coast examples that cause you to draw a connection between what will happen with the bait fish population on Lake Missaukee?

A Okay. In the particular case of the outer coast of Washington State, in the absence of -- the absence of any disturbance, if the site is prevented from being disturbed, it becomes dominated by an almost monoculture of a mussel. Okay? You know -- it looks like a clam called Mytilus californianus. And it's a monoculture of this stuff.

If there's massive amounts of disturbance such as winter storms that drive large numbers of logs -- Douglas fir logs up against the rocks and denude the entire place, there's nothing there. But at an intermediate level at which a certain level of a predator is present that eats some of the mussels but not all of them, it opens up a little bit of new space where things like barnacles and limpets and other kinds of creatures can establish themselves. Also, different types of algae come into the realm. And there's many more species that are present there

than -- boy, that's -- there's so much literature, that this thing has been studied in system after system after system and nobody has been able to disprove the intermediate disturbance hypothesis so far. And it's not that they didn't try, because the easiest way to make your name in science is to find something that's an established theory and prove that it's wrong. Every young scientist has to know that. That's the way you get ahead.

Q The intermediate disturbance hypothesis, though, is not a theory about what will happen, it's a theory about things that might happen; is that right?

A It makes a prediction -- it's -- what it says is out of all possible future states that the system might exhibit given this particular manipulation, there is one, and perhaps only one, future state which is most likely and all other future states are less likely. That's the nature of what's called "restrictive theory."

Q Well, I thought that in your testimony you agreed that some of the larger species of fish, pike, bass, for example, that would feed on bait fish tend to stay in deeper water. Did you agree with that or not?

A That's correct.

Q And so I'm trying to understand your prediction. And your prediction is if we take -- allow the dredge to go forward and make the water deeper in this 50 by 200 foot spot which

to me would suggest more likely that large species of fish would go up into that area, your prediction is that the bait fish population will actually increase. Do I have that right?

A In a regional area, sure, it probably will. And also, you've just pointed out that you're probably going to have increased species diversity because of some sport fish coming in to the area.

Q Well, I didn't point that out, you pointed out there would be an increase of bait fish. That was what you said. That was your prediction.

A Yeah; yeah.

Q And that doesn't strike you as inconsistent?

A No, it doesn't.

Q That there will be more bait fish by making the water deeper?

A No, it doesn't.

Q Okay. Well, one thing -- we've talked about theory and evidence here. One thing that can be tested and we can get evidence on is what actually lives in and around -- but let's just say in the proposed dredge site; correct?

A Yes.

Q And we could observe; correct?

A That's correct. You could make measurements.

Q And we can take measurements. And I assume that's what you

were attempting to do when you took your Ponar Grab samples; correct?

A Well, I was -- certainly. I was taking samples to make measurements.

Q And when you -- in your report, and you're welcome to refer to it, I didn't see any reference in your report where you suggested that there were invertebrate organisms or other organisms -- non-plant life within the proposed dredge site. And, in fact, you made the statement that, "Each sieve was inspected for the presence of macroinvertebrates but not one single macrobenthic organism was found." Is that --

A Yeah, that's correct. You know, I didn't take the samples exclusively to do a -- you know, a benthic survey. I did it in part to measure the chemistry and the sinking rates and the general physical nature and chemical nature of the sediments. But since I had them, I just thought it would be a reasonable thing to find out if there was anybody living there and so I did. And I want to emphasize the fact that when I said "depauperate," I did not mean there's nothing there, that it's sterile. If you look hard enough, you're bound to find something.

Q So you didn't look very hard?

MR. SHAFER: Objection, argumentative.

A Obviously not hard enough to find something. But having taken six replicate samples, I thought that was pretty good.

Q Well, I assume when you drafted this report you intended people to rely on it; correct?
A Sure.
Q And you intended the tribunal to use it in making its decision, I assume; correct?
A I had no idea that it would ever go to this stage. I couldn't believe that it would ever go to this stage.
Q Well, I assume you wanted it to be accurate for somebody to rely on?
A Oh, I want it to be accurate and it is.
Q And when you said that there were no -- you found no macroinvertebrates, not one single macrobenthic organism, you didn't put a footnote or any other acknowledgment that, "Well, I didn't look very hard but if someone looked hard enough, they might find something"?
A The statement speaks for itself.
MR. SHAFER: Objection; argumentative. Total improper question.
JUDGE PATTERSON: I think he answered it.
Q And frankly in your -- you've already testified once -- correct? -- in this proceeding?
A Yes.
Q And in this proceeding you said you didn't see any macroinvertebrates, any large worms, insect larvae or mollusks at the time you were out at the dredge site; is

that --

A That is correct.

Q And in your testimony at the last time you also stated in referring to the Ponar dredge that,

"This was a standard way of looking for what we call macrobenthos, macroinvertebrates and I cannot find a single one. I could not find a single animal, I mean, in those six samples I collected."

A That's correct. That's correct.

Q And, again, during your testimony you didn't suggest that you hadn't looked hard enough, did you?

MR. PHELPS: May I approach, your Honor?

JUDGE PATTERSON: Sure.

Q You've seen -- I'm holding --

A Sure, I've seen that.

Q I'm holding the jar that Dr. (sic) Morrow sampled and testified about. I think you've had an opportunity to look at this, haven't you?

A Yes, certainly; uh-huh.

Q And you see there's little creatures swimming around in there; right?

A Yes; uh-huh.

Q What are those things?

A They're amphipods. They're a kind of crustacean. They look to me to be certainly members of the family Gammarati.

They're probably a species of the genus Gammarus, what has been characterized by some -- a vernacular name called "scud."

Q Do you have any hypothesis as to why Mr. Morrow was able to go down 14 inches below the ice and scoop out a jar full of creatures and your six samples didn't turn up anything?

A I have no problem with that as saying there must be some Gammarus out there somewhere. But I'll bet you anything there's a heck of a lot more Gammarus elsewhere in that lake.

Q You'll bet me but you haven't done any evidence; right?

A Yeah; yeah; right. But we can do it. It's a testable hypothesis.

Q Right. But you haven't done it?

A I haven't done it.

Q Okay. I think near the end of your rebuttal direct examination you testified -- were asked some questions about the wetlands -- do you remember that? -- lakeward of this 20 foot mark?

A Maybe some questions about vegetation?

Q Yes.

A Okay.

Q I think they used the word "wetlands" or maybe the attorney general did and you said you didn't like that word, et cetera?

A It's not that I don't like the word. I said that I'm not using it in a scientific context. I think it carries other meanings with it which maybe I don't understand.

Q And I just want to clarify because when I read your report and on your examination the first day, I thought it was clear that you didn't do any wetland delineation in this case.

A That's correct.

Q And I thought we established you're not a -- certified in wetland delineations?

A That's correct.

Q You didn't catalogue all of the various species of obligate plants in and around the dredge site?

A Certainly not.

Q You didn't put together a map of where the wetlands start, where the end or --

A Nope, certainly.

Q And as I recall at your cross-exam last time, you said you didn't necessarily know how to do a wetland delineation. That's still correct?

A That's correct.

MR. PHELPS: That's all I have.

JUDGE PATTERSON: Questions?

REDIRECT EXAMINATION

BY MR. SHAFER:

Q Dr. Lehman, in all your training and experience, are you capable, however, of observing whether a bog, a swamp or a marsh exists in a certain area of the lake?

A Certainly.

MR. SHAFER: That's all I've got, your Honor.

JUDGE PATTERSON: Okay.

MR. PHELPS: Thank you.

JUDGE PATTERSON: Thank you.

THE WITNESS: Thank you.

(Off the record)

JUDGE PATTERSON: Ready?

MR. SHAFER: We'd call Dr. Evans back to the stand, your Honor.

JUDGE PATTERSON: Okay. Dr. Evans, you were sworn in. You've previously testified

THE WITNESS: Yes, I did.

JUDGE PATTERSON: You're still under oath.

THE WITNESS: Okay.

THOMAS EVANS, Ph.D.

having been called as a rebuttal witness by the Petitioner and previously sworn:

DIRECT EXAMINATION

BY MR. SHAFER:

Q Dr. Evans, you were here for the testimony of Ms. Schmidt and Mr. Arevalo and Mr. O'Neal; correct?

A I was. I was not here for the last part of -- I'm sorry -- Mr. O'Neal I was, yes.
Q Okay. You weren't here for part of Mr. Morrow's testimony; correct?
A That's correct.
Q You recall testimony about the fact that -- I believe it was Mr. O'Neal and probably Mr. Arevalo as well that you would not be able to observe a buildup of lake sediment during one's lifetime?
A I do remember that.
Q And how old are you?
A I am 67.
Q And how long have you been going to Lake Missaukee and particularly the west end of Lake Missaukee?
A Just over 50 years.
Q And on the west end of Lake Missaukee where Indian Lakes West is and where lot 8 is, have you been going out there regularly in the last 50 years?
A I wouldn't say regularly, but certainly 50, 48 -- back then when I was in high school, I was over there fishing regularly by wading from shore.
Q Okay. And that's what I was going to ask you. You actually got out of a boat or shore and you walked into the water?
A I did not have a boat over there so I drove our Jeep over. That's long before any of this development and those roads

were there. And I went on a two-track through the woods and then got out and waded into the water to fish.

Q And as you were doing that, were you able to discern -- feel the sediment below you?

A Sure; sure.

Q And what observations, if any, have you made in regard to the sediment levels on the west side of Lake Missaukee over the last 50 years where Indian Lakes West is located?

A They're certainly deeper now and harder to wade in now than they were 50 years ago. And my judgment is, it is not simply because I have 50 years of growth on my legs. They're deeper. They have accumulated.

Q The sediment has built up?

A The sediment has built up in that time, absolutely.

Q Okay. Now --

A In fact, if I may add, my cottage is actually on Crooked Lake which is just west of Lake Missaukee just through the woods. And if anyone were to look -- and I'm sure there are aerial photographs the same way -- it used to be that on the west of -- still on the west end of Crooked Lake there's a lake called -- or road called "LaChance Road" that runs north out of Jennings. And west of that was a pretty good size open area -- water area, where you could do a little bit of fishing but a lot of good duck hunting. And if you drive by that today, 50 years later, there's essentially no

water. That is covered over with plants and vegetation and there is no open water over there. That has filled in significantly and noticeably in that time.

Q Okay. You've also heard the testimony today of Dr. Jaworski.

A I did.

Q And whether you were here for Mr. Morrow's testimony or whether you just heard me refer to it in my examination today, you're aware that Mr. Morrow, along with Dr. Jaworski, are taking the opinion that if this dredging project was allowed to go forward, that the dredged area would quickly fill back up with sediment, thereby making the whole dredging project superfluous?

A I am aware of that.

Q Okay. Now, you testified when you were originally here that you made your own dredging -- you have undertaken your own dredging project?

A That's correct. I have a permit and I am dredging in front of my place on Crooked Lake.

Q And do you have a continuing maintenance dredging permit?

A Yes, I do.

Q Okay. And if you could, if you could explain to the judge -- well, let me back up and let me lay a proper foundation. We went through all of your various tubes and everything that you took samples of in regard to the west

side of Lake Missaukee the first time that you testified; correct?

A We did.

Q So in addition to the testimony that you just talked about -- about over your last 50 years, you also -- more recently you had an opportunity to observe the sediments on the western side of Lake Missaukee close up; correct?

A That's correct. As I said, I'll change it now because I heard -- I don't know if I heard or if I read -- the part of Mr. Morrow's testimony which I did not hear I did read the transcript of. And I believe he's testified at one point that he had gotten out of a boat and tried to walk and found it dangerous and difficult, so somewhere in that general area. But other than that, as far as I know, I'm the only one who has gotten in the water and actually walked and waded through this sediment on the west side and particularly in front of lot 8.

Q Okay. And you've had the opportunity -- because you took the two core samples, you've had the opportunity to observe these sediments out of its natural environment close up; correct?

A That I have.

Q And I believe also you've brought in some big pieces for us to look at last time?

A I did. They were big chunks. And I'd like to correct one

misinterpretation of my testimony that Mr. Morrow had where he said that when you get down deep, that it consolidates enough that I was able to use a shovel and take big chunks. Absolutely not what I said. It is true that when you get down deep you can take big chunks with a shovel. But it's absolutely true that up high it has enough integrity, enough solidity to it that you can put a shovel in and pick it up and have a noticeable big chunk that you picked up. It doesn't fall off or run off -- or this is not fines, unconsolidated fines. And if you try to walk through it, I testified before, it is heterogenous.

But one of the really insidious things about walking in it -- probably most people would not put me in the flyweight classification. And yet when I walked, there are times when it almost supports me, might even support me for one step and the next step I can go down. Or it will support me for a few seconds and then I start sinking down. So it's not like this whole thing is unconsolidated, loose fines until you get way down deep. Nothing can be further from the truth.

Q Okay. And I don't know if you testified about this previously, but those big chunks that you did bring in here for the judge to look at, were those from the top of the sediment layer or did you dig down deep to get those?

A I did not dig down deep. I don't know that they were the

very top, but I was taking the shovel and they were certainly very near the top, if they weren't at the top.

Q Okay. Now, given all those observations in regard to the sediment on the west side of Lake Missaukee, could you explain to the judge how those sediments compare to the sediments that you have been dredging out in front of your house on Lake -- on Crooked Lake?

A Yes. In fact, they're very similar. When I get -- since I'm on the east side of the lake, I get a lot of wave action, especially in late summer when we get a predominant strong, west wind, I get a lot of wave action. And so probably 50, 60 feet out from shore I've got loose, unconsolidated stuff. It's not really peaty, it's not totally unconsolidated because you can get your foot stuck in and I've lost water shoes out there. Now, I go barefoot because I found that I can lose my water shoes if I -- I'll end up barefoot whether I start out that way or not.

As I get out a little farther, I get into the exact same kind of peaty, fibrous mass as I found out in front of lot 8. And when I dredge that -- and I do not have a cutter head on my dredge. It is an absolute mischaracterization to say that a hydraulic dredge has to have a cutter head. I will grant that in the interest of efficiency big, commercial hydraulic dredges have a cutter head because they probably cost thousands of dollars an

hour. I'm a little less expensive when I hire myself. So I do not have a cutter head. And I've got the same type of structure as I saw in front of lot 8. I've got some fine material on top, although it's relatively thin, and I've got the fibrous, peaty stuff underneath. And I can actually dredge channels through there. And I'll find out this spring because I dredged last summer, but at the end of the summer, my channels were still there. I still had essentially vertical walls in spite of the heavy waves and wind coming in in the late summer.

The last I was out there when I -- I waited almost too long. It was October and I was numbingly cold by the time I came out because all I had on was a bathing suit. It was a difficult day. But my essentially vertical walls through the peaty material were still there. Will it be taken out by the ice over the winter or the spring? I don't know. I'll find that out in a few months. But, again, I'm on the east side of the lake and I will have a much greater problem with waves and ice than lot 8 will.

Q And that was really my ultimate question. And you did your own dredging; correct? Personally; correct?

A That's correct. That's correct.

Q And based upon the dredging and the similarity of the sediments, what observations have you made, if any, in regard to whether those sediments quickly filled in to the

dredge area in regard to your property in Crooked Lake?
A Well, again, as Dr. Lehman said, one has to define "quickly." But certainly in a period of months, the answer is they do not. They absolutely do not. Some of the finest material off the top will come in. And, quite frankly, the finest material off the top is not the problem. I don't think any of -- it would be here for a dredging permit or request if all we had was fine, unconsolidated, loose material. It may not be appealing to go in -- and, in fact, my 17-year-old daughter won't readily swim in that -- but it is not a hazard. It's not safe. It isn't suction. It doesn't trap you. It wouldn't make it -- it wouldn't make it unsafe for my grandchildren to go out there. Okay? So the peaty material -- the vast majority of the material has not washed back in as of last fall.
Q Given that, would you say you agree or disagree with Dr. Jaworski and Mr. Morrow in regard to their statements that this dredging area would quickly fill back up?
A I would say that my data does not agree with their opinion.
Q And I'd also ask you -- you also did hear some testimony -- I believe I was asking Mr. Arevalo this, although I don't know that he knew the exact particulars nor do I. But before you did your dredging, did you try to make yourself aware of any type of slope gradients that general commercial dredgers use in order to maintain the integrity of the

dredge area?

A No, because it depends -- it depends -- I looked at it. I didn't try to make a big thing of it because I quickly found it depends entirely on the medium that you're dredging. The angle of repose is dependent upon the material that you're dredging as well as wave action and current action. A lot of dredging, in fact, is in harbors or channels where there's either flowing water because a river comes in or because there's commercial transportation, big freighters come in. And anyone who's ever looked at the prop wash after a big freighter comes in knows it's a totally different situation from what you get on an inland lake.

Q All right. Moving on to another matter, you heard Mr. Arevalo testify about the fact that he believed that there was delineated wetland area lakeward of lot 8, beyond the 20 foot exclusion zone. Do you recall that testimony?

A I do recall that.

Q And did you have personal face to face conversations with Mr. Arevalo during the application process and the administrative review process for this dredging project on lot 8 in Lake Missaukee?

A Absolutely.

Q And can you tell the judge what those conversations consisted of in regard to wetlands and, in particular, remediation?

A Yes. There were three of us. There was Dale Boughner, myself and a fellow named Larry Julian -- Larry Julian was only a participant for that one meeting -- met with Mr. Arevalo in the Cadillac DEQ office in December of 2006 to review the denial that Robyn had -- that Ms. Schmidt had written earlier that year, I believe, in July.

Q Was anybody else there from the DEQ other than Mr. Arevalo?

A Yes. Ms. Schmidt was there. It was the five of us in the room.

Q Go ahead.

A And the question was raised about wetlands. And I said by my experience, I didn't believe that that met the criterion of either a bog, a marsh or a fen, I think it is, one of those three. And Mr. Arevalo assured me that based on his experience, if this went to appeal, he would win on the wetlands. I said, "Okay. No problem. I don't know anybody who's better equipped to mitigate wetlands and create offsetting wetlands than the owner of this property, Harry Mohney, because he's got thousands of acres and a lot of it has lakes on it or swamps. It would be easy for him to create additional wetlands and mitigate this." And Mr. Arevalo said, "That's not possible because before you can mitigate, it must be a requirement that the proposed activity occur in the wetlands. And you don't have to be in the wetlands because you can pass the near shore area. And

so mitigation is not an option for you because the only wetlands we're dealing with are the" -- I'm not going to say 20 feet because I don't believe that a number was mentioned -- "but the near shore area," he said, "you can get beyond that. You don't have to dredge in that."

And as a result of that, I wrote a letter back. And it said in order to proceed, we needed to do two things. According to Mr. Arevalo, we had to do two things. We had to make our requested area smaller and we had to avoid the wetlands. And I said, "We hereby amend our petition to start on the lakeward side of the DEQ identified wetlands." But I thought -- we could have started out asking for a huge dredge area and then said, "All right. We'll play this negotiation game. We need to make it smaller, so we'll ask for more than we need and then we'll compromise and we'll end up at our 50 by 200." I said, "We didn't do that. We looked at what we thought was a reasonable, practical, minimal size to accomplish what was required. And I don't think we want to do this unless you can tell me how small I have to make it." He said, "I can't tell you how small. Just suggest something and I'll tell you if it's acceptable." And I said, "This is playing `Mother, may I?' This is not how we administer citizens' rights. This is playing a game." "I don't like the number you're putting out, so guess until you get a smaller one and then I'll tell

you if I like that. And if I don't like that, I'll tell you to go back and make it smaller and eventually I'll be happy and then you can go forward." So we did not -- we did not decrease the size. In fact, we kept it 50 by 200. We simply said we would start lakeward of the DEQ identified wetlands.

Q Okay. Now, when you said you sent a letter to Mr. Arevalo, did you -- was it under your signature or did you prepare the letter?

A No; no, I prepared the letter and Dale Boughner sent it.

Q Okay. Could you take a look at tab 15 of the big burgundy book and let me know if that's the letter that you prepared?

A This is one of the letters I prepared, yes.

Q Okay. And if you go to -- this is already in evidence. If you go to the second page, second paragraph from the bottom that starts, "Clearly"?

A Yes.

Q Do you see that?

A Yes.

Q And the last sentence there where it says, "I therefore ask"?

A Yes.

Q Is this the amendment on behalf of the Petitioner then that you drafted to begin the dredging area outside of the wetland area that Mr. Arevalo indicated to you?

A Maybe if I read the sentence that will be clear?
Q Sure.
A "I therefore ask you to issue my permit amended as we discussed so that the hydraulic dredging will start on the lakeward side of the wetlands area you have identified and cover an area 50 feet wide by 200 feet long."
Q Okay. And given that, was it your understanding then that the Petitioner was totally excluding wetlands from the dredging area?
A Yes. Wetlands would not be an issue under the application under those circumstances.
Q And therefore Mr. Arevalo indicated to you that remediation was not required?
A He indicated two things. A, not only was it not required but it was not an option. It was not an option because it is only an option if you're required to harm wetlands. And we were not required to harm wetlands because we could start our dredging lakeward of the identified wetlands that he discussed. So it wasn't like they weren't required, they weren't an option.
Q Okay. Now, you were here for Mr. Morrow's first day of testimony; correct?
A Correct.
Q And you heard him testify that the sediments in the west

side of Lake Missaukee were of a unique nature and did not exist in other areas of the lake; do you recall that?

A I do recall that.

Q And pursuant to -- in regard to that testimony, did I ask you to do something?

A We went out and got some samples from elsewhere in the lake.

Q And explain to the -- okay. Explain to the judge exactly what you did, when you did it, how you did it and where you did it.

A Well, let's go in order. We did it in front of Mr. Morrow's place. We took several samples. This is --

Q And who's "we"?

A Dale Boughner and I. Sorry.

Q Okay. Thank you.

A And we did it on two occasions. We did it the last Sunday in December, I believe it was, because the hearing was supposed to start in early January. And so we went out approximately 150 feet in front of his place, cut a hole in the ice and took a sample. I constructed a device. This (indicating) is it. It holds a glass jar like this. The glass jar sits inside. This wooden bar is to keep the glass jar from moving. It's a tight fit. The glass jar sits in here (indicating). These bungee cords go over the end. I have over there, I could show you, a rubber stopper which fits in the end of this thing. The bungee cords hold the

rubber stopper in place. We screwed two L brackets on here so that we could lower this down to the bottom. A rope on the rubber stopper -- and it's in the pail if you want to see it -- a rope on the rubber stopper comes out here and comes up to the top so that when this is held on the bottom, somebody can pull the rope, it opens the rubber stopper, the water and sediments rush in, let go of the rope, the bungee cords pull it tight and we're able to bring it up and have a sample.

Q How do you -- I'm just curious. How did you come up with this idea?

A Because I looked at other alternatives and I couldn't find or buy anything that I thought was practical in the short period of time I had. So there's an expression about necessity being the mother of invention or something like that.

Q Okay. So what did you then do?

A I believed there were sediments in front of his place for two reasons. One, I'm a scuba diver and I've done enough diving in inland lakes to say that if you get offshore a little ways in a Michigan lake, unless it's a marl lake that is clear at the bottom, there is sediment. Absolutely, it's a fact of life. Because for -- well, according to Dr. Jaworski, for 14,000 years in this lake -- and probably for a lot of lakes in Michigan, certainly for thousands and

thousands of years, there have been leaves and plants and other things dying. It doesn't disappear, they're sediment on the bottom.

Furthermore, when he testified that I think it was in the late '60s or early '70s when Tom's Bay was originally dredged and this cloud -- or this turbidity went throughout the lake for a couple years, it was so bad -- second law of thermodynamics says it is impossible for that to end up just on the west side of the lake. There are no known violations to the laws of thermodynamics. Second law of thermodynamics says that has to be distributed throughout the lake which means it has to be in front of the south side also. So we took two samples. This (indicating) is one. The date is here, the location, the GPS coordinates. It was approximately 100 feet offshore directly in front of Mr. Morrow's place and it was in 42 inches of water, from the top of the ice to the bottom -- went down, opened it up and there's (indicating) the sediment we got. And I think if you look at it, you'll find at least qualitatively it is not distinguishable from the sediment that he got from in front of lot 8. We then went out to 150 -- 150 to 160 feet from shore -- hard to say for sure because there's snow and ice. And I can't tell exactly where shore starts and GPS coordinates aren't better than plus or minus 10 feet, so you have a 20 foot uncertainty anyway. But, again, the GPS

coordinates are there. Oh, look at those things swimming around. You can see there was something just swimming around there.

Q Is that the sample that you took out there?

A This is the sample that we took at 150 feet and it is 66 inches to the bottom. So it's 5-1/2 feet of water.

Q And that's lakeward of Mr. Morrow's house?

A This is lakeward of Mr. Morrow -- see this little thing swimming here (indicating)? I mean, I think qualitatively it is extraordinarily similar to what he found that was supposed to be unique sediments on the west side of Missaukee Lake.

Q Did you do anything else?

A Yes. As I said, being a scientist, I agree with Dr. Lehman that data is better than opinions because we all have our opinions and we all think our opinion is superior to everybody else's, but data is hard to argue with. There seems to be a lot of misconception in the entire hearing as to the nature of the sediments that are there. As I said, they're not all loose. To say that they are loose, unconsolidated sediments is a gross mischaracterization of what is there. How did I determine that? These (indicating) are the two L brackets that I used on the bottom of that. So when we were done with our sampling, I took the sampling box off and we simply attached this. Went

over in front of lot 8 and chopped -- Dale, Mr. Boughner, cut a hole in the ice with his chainsaw the same as we did to get the samples. And we carefully dropped this down just as the DEQ and Mr. Boughner did on the 28th of February a year ago -- and dropped it down until we could just start to lose it in the top sediment, and that was 33 inches. And then I let go of it. It went less than 2 inches and it stopped. It would not sink beyond 2 inches. And then I took --

Q What did that tell you?

A It told me that the loose layer, the stuff that will wash in and go throughout the lake, is certainly no more than 2 inches thick. And then I took and tried to push it down and I'm able to push it but with a reasonable amount of difficulty. And then I turned it over and I pushed it down. And I pushed it down to here (indicating) but I didn't have rubber gloves and it was ice water and I didn't push all the way down. But the depth was greater than this in spite of the fact that anybody looking at it would say there's only 33 inches of water there.

Q Okay. What did that tell you?

A That told me that the majority of the material underneath is well-consolidated material, undoubtedly the same peaty material which I am able to pick up with a shovel and which I am able to semi walk on and absolutely not the kind of

stuff that will immediately flow back in or wash throughout the lake.

Q Is there anything else that you did that I haven't covered?

A Not that I can --

Q I'm not saying that there is, I'm just --

A Not that I can think of.

MR. SHAFER: Okay. That's all I have, your Honor.

JUDGE PATTERSON: Okay.

CROSS-EXAMINATION

BY MR. REICHEL:

Q Mr. Evans, you testified a few minutes ago that you'd observed an area that over time from your youth -- you weren't clear on the date of this but perhaps in the late 40's, early 50's?

A I'm only 67, so it wasn't in the 40's.

Q I'm sorry.

A It was in the late 50's.

Q Oh, I'm sorry. I thought at one point you had said '48, whatever.

A If I did, I misspoke.

Q Okay.

A My parents bought on Crooked Lake in '55, so I've been going there for 52 years, 53 this year.

Q Okay. Excuse my math. So from the late 1950's then?

A Yes.

Q Okay. Thank you. Now, you testified that there was an area that you recall seeing -- and I want to be clear, just so the record is clear on this -- not on Lake Missaukee.
A Correct.
Q Not even on Crooked Lake. It was some other area, if I understood your testimony correctly, farther west of Crooked Lake that over time -- that at one time there was standing water when you were a younger man and then at some later date -- I wasn't clear when -- you couldn't see standing water there anymore?
A I'll say this: If the road hadn't been put in -- if LaChance Road weren't there, it would be the far west end of Crooked Lake. Okay? It's clear from looking at the topography there that that road, I don't know, maybe 100 years ago was put in. And I'm talking about the area west of LaChance Road which would have been the west end of Crooked Lake.
Q Right.
A Yes.
Q Which is thousands of feet away -- presumably hundreds or thousands of feet away from Lake Missaukee; correct?
A No, not hundreds of thousands, absolutely not.
Q No, hundreds or thousands.
A Oh, yes; yes; yes; yes; yes. I did that only -- I referenced that only to illustrate the fact that in my

lifetime in that area, I have seen areas that had water fill in with accumulated detritus.

Q Okay. I don't want to spend a lot of time on this because I'm not sure what it tells you. But just to be clear, you were talking about the dredging in front of your property on Crooked Lake?

A Correct.

Q And I believe you -- when did you first dredge that, sir?

A Last year.

Q Okay. What time of year?

A Early June, late May.

Q Okay. And so you -- and did you dredge -- when you undertook that dredging, sir, was it your objective to dredge down to remove all accumulated organic material? That is, to dredge down to sand?

A That's correct.

Q Is that what you did?

A That's what I am doing. I did not finish it last year. One of the difficulties was that it turns out we had a bad case of swimmer's itch and I didn't realize that until it was too late. And I don't know if you've ever had it, but it is an extraordinarily uncomfortable thing where these little things burrow in your skin and they last for a couple weeks and they itch and they're terrible. And after you have it a time or two, you say, "I'll find a different time to work on

this."
Q Understood. I'm just trying to establish the chronology, sir.
A Yup.
Q So in June of last year at some portion of the property lakeward of your place on Crooked Lake, you dredged --
A Yes, I started dredging; correct.
Q Okay. You started dredging and then you went out there -- you ventured out there in the cold in October in the same area --
A That's when I finished.
Q Oh.
A I dredged in June. I dredged a little bit in July. I certainly dredged in late August and I dredged in September.
Q Okay. So, bottom line, this was on Crooked Lake not Lake Missaukee?
A Yes; correct.
Q And you're talking about what your observation were regarding a dredging process that began in June and ended in August?
A September.
Q Excuse me. In October?
A Or, yeah, October.
Q Okay. So that's -- to the extent you're asking this tribunal to draw some inference about how rapidly things

might or might not fill in, you're -- based upon your --
A It did not in those months -- and I'll see when the ice is out what the effect of the ice in the winter had.
Q Counsel asked you a series of questions about your communications with Mr. Arevalo and Ms. Schmidt of the DEQ about this proposed permit -- or that took place after the permit was initially denied. Do you remember that line of questioning?
A That's correct.
Q Okay. And I believe you testified that it was your understanding that in this letter that you wrote for Mr. Boughner that appears as Exhibit 15, Petitioner's Exhibit 15 -- was your understanding that you were proposing to eliminate any activity in regulated wetlands.
A No, I believe what I said was that we would start lakeward of the DEQ identified wetlands, which he had said -- which both Ms. Schmidt and Mr. Arevalo had said was that area near shore that showed the emergent vegetation. That was in our discussions. We did not have discussions whether that was 20 feet wide, 22 feet wide, 25 feet wide. But it was clearly identified as the area with emergent vegetation near shore. And I said, "We will start lakeward from there."
Q Who used the word "emergent vegetation"?
A Probably all of us. If you ask who first used it, I don't remember. But just as both you and I just used it, I think

all of us used it that day.
Q Okay. With regard to this project that you and Mr. Boughner undertook, I think the last stage of this in December last -- the last part I want to focus on.
A If I can add one thing? If we look at Exhibit 12 --
Q This is in response to my last question?
A Yes. In the same book, the letter dated 21 December after that meeting with them, it said,

> "You" -- "You" being Mr. Arevalo -- "mentioned two areas to concentrate -- to move on in our negotiations. The first is to eliminate the request to dredge in what you called `wetlands near shore.' I will discuss that issue with Mr. Mohney. The second item was that you'd look more favorably on it if we were to scale back the size," which is what I said earlier.

Q Okay. But just for the record, this Exhibit 12 -- and this is -- it's in already in evidence -- this is your letter?
A That's correct.
Q This is not a letter authored by Mr. Arevalo?
A That's correct. This is a letter directed to Mr. Arevalo.
Q Right. Going back to the last part of your testimony on direct examination today, you testified that you and Mr. Boughner I believe in December of last (sic) went out in front of lot 8 and cut a hole in the ice and used the apparatus that you've described here?

A No, not December of last.
Q When was that?
A That was Monday of this week.
Q Oh, Monday of this week?
A Yes. The date's on the sample, but, yes.
Q Well, I don't want to confuse you. I heard you testify about a series of things. I believe you testified that -- I heard you say, tell me if this is wrong -- that in December, late December, you and Mr. Boughner went out in front of Mr. Morrow's property -- or a location that you believed to be Mr. Morrow's property; correct?
A That's correct.
Q Okay. I wasn't asking about that.
A I understand.
Q I understood you to testify that at some time, I thought originally it was around the same time, but whenever it is, that you went in front of lot 8 and used that stick there and tried to --
A If I can clarify it for you?
Q Please.
A When we thought that this hearing was going to resume in early January -- I don't remember the specific date that we had set after we left in December -- we went out. And I think it was the last Sunday in December, but I won't swear to it, but I think that's accurate. And we took a sample at

150 to 160 feet offshore in front of Mr. Morrow's to show that there was, in fact, sediment there qualitatively very similar to what he had found in front of lot 8.

Q All right. Well -- go ahead.

A Okay. And then I took that sample home and I had it in my garage. And there were -- I'm not a biologist. Okay? There were little things swimming in there. I said, "Wow." I didn't know what they were. And I kept it in my garage for a month or so. And I looked and I said, "I don't see anything swimming in there anymore"; probably not surprising since the top of the water froze and, you know, it was down -- it was covered and not exposed to oxygen and things. So I said, "I'm not sure this sample is representative anymore." And so when this thing got rescheduled to start today, I said, "We'll get a fresh sample." So last Monday I went back up and Mr. Boughner and I went out and we did the three things. We took the sample in 42 inches of water approximately 100 feet offshore; we took the sample in 66 inches of water approximately 150 to -60 feet offshore and we went over in front of lot 8 and cut the hole and did the experiment to see how thick that unconsolidated layer was. That was all last Monday.

Q Okay. Thank you for that clarification. I wasn't -- I was really -- what I really wanted to ask you about was this last bit of activity that you embarked upon in an area that

you understood to be offshore of lot 8.

A Okay. Yes.

Q Okay. Now, first of all, did you attempt to estimate or measure how far offshore you were when you cut this hole in the ice?

A We did attempt to estimate. The others I paced off because if you're going 100 feet and the GPS is plus or minus 10 -- I got the GPS coordinates but I don't think it's more accurate than pacing. But for the reasons that were referred to earlier, you can't easily pace it offshore at lot 8 because there's springs and there's open water up there and I was not -- I didn't have my waders on. I didn't feel like falling through. So my guess is we were in the range of 150 feet give or take. Could it be 120? Yes. Could it be 170? I suppose.

Q Okay. So in that area within the range you've just described, you've estimated?

A Yes.

Q Cut a hole in the ice?

A Yes.

Q And then you lowered the flattened end of that stick or probe or whatever you want to call it.

A Device?

Q Device. Thank you. You lowered that device --

A I lowered it like that (indicating) until I could start to

see the top disappear in the sediment.
Q Okay. That's my first question. So you lowered it until you could no longer observe it?
A Slowly until I could just see it start to disappear.
Q And did you attempt to -- did you estimate how far that was below the water surface?
A No. We had a tape measure with us and we looked at the mark on there and measured it. It was 33 inches.
Q Okay. And then what did you do next?
A (Indicating)
Q You released it?
A I released it.
Q And then what did -- what happened next?
A We marked it again.
Q You marked it again with what?
A We marked it with a finger, like so (indicating). Here's the water level --
Q No, I mean -- I'm sorry. You marked -- you let go of it and --
A I marked the level of the water on the thing. Okay?
Q Okay.
A And then brought it up and Mr. Boughner had the tape measure and he measured it.
Q Okay. But the point at which you chose to mark it with your finger the second time --

A Yes, is where it was self-supporting, wouldn't go any further, where it stopped after I let go of it.
Q Okay. And what did you observe -- or using this technique you've described, what is that depth?
A Pardon me?
Q At what depth below the water surface was this?
A 33 inches is where it started -- where it looked like I was starting to lose it. 35 inches is where it would self-support which told me that the depth of the thickness of the loose, unconsolidated layer at that point was approximately 2 inches. Now, I couldn't replicate the experiment because once you do that, now the turbidity is such that I said, "Oh, let me make sure," well, now I lose the -- I can't determine the thing anymore because the stuff is so riled up that I can't determine where the top is any longer.
Q Okay. And just so I understand this -- I'm not sure what significance -- then the next thing you did if I understood you correctly was to push it down, exert pressure on it?
A The next thing I did is to say, "Could I push it down?"
Q Push the flat end down?
A Just like this (indicating). When it was self-supporting, now, after I took it out and measured it, can I push it down? And the answer is, yes, I could somewhat, but it took a reasonable amount of effort. And after that, I said,

"Okay."
Q Let me interrupt you there.
A All right. Go ahead.
Q When you pushed it as far as you could with what you've described --
A I did not push it as far as I could.
Q No; no. I'm sorry. Let me finish the question, sir. Having pushed it as far as you believed you could with, quote, "a reasonable amount of effort" -- okay? -- did you then attempt to or purport to measure what depth that was?
A No.
Q Okay. So what did you do next?
A It was no more than six inches, but I said that was enough. Then I did this (indicating).
Q You inverted it. And so the record is clear, you've inverted this --
A I inverted it so the 2-by-2 part was down and pushed it down.
Q And let the record reflect that this 2-by-2 is --
A Well, 2-by-2's are now an inch and a half by an inch and a half.
Q Whatever. But the 2-by-2, the end that you're now pointing to the ground, is partially sharpened?
A Yes, it is.
Q It's cut at -- what? -- an angle --

A Well, it's not cut at all. In fact, originally -- I'll explain. Originally I thought we might have to go to much deeper water to find this stuff and so I had two brackets here (indicating), just straight pieces of steel that I would put screws in on both sides and I have another one this big, so I could go to 11 or 12 feet if I needed to. And you can see the screw holes in here. And you can see what happened is when this (indicating) screw went in, the grain was such that it split. So it wasn't cut. That's just a shear plane that the screw caused it to break.

Q Okay. Well, in any event, sir, I think we can --

A And the other piece is over there if you want to see it.

Q No. Just so that this -- whatever significance this has on the record, I'm just trying to -- the fact is when you pushed, when you turned it over and stuck this other end of the two by two into the -- through the hole in the ice, the end of that was not flat. It has some sort of a --

A Correct. Point.

Q -- point. Thank you. Okay. And then you pushed that until what?

A I pushed it until if it went any farther my hand would get wet. And quite frankly, we'd gone over there on snowmobiles and I had on just jeans and we'd had some problems and my fingers were wet and I was getting cold and I said, "That's enough."

Q I'm not -- don't take any criticism. Just trying to understand what the --

A No, that's fine. Yup. I pushed that down until to go further would have required my gloved hand to go under water.

Q Okay. And did you either measure or are you able to calculate by the length of this thing which I assume you -- a stick, I assume you measured?

A I think I said it was 66 inches.

Q Okay.

A I didn't know how else to determine the thickness of this fines layer.

Q Did you, Mr. (sic) Evans, undertake a similar experiment in Crooked Lake where you dredged?

A No, I did not.

MR. REICHEL: Nothing further at this time.

MR. PHELPS: Dr. Evans, a few follow-ups on this.

CROSS-EXAMINATION

BY MR. PHELPS:

Q With regard to the dredging that you did at your cottage on Crooked Lake, did you do any type of analysis of the soil or the fines or the sediment that were dredged at that cottage?

A Yes, I did.

Q And what were the results of that?

A They are in my application that the DEQ has a copy of. By

law I was -- because where I was depositing it was not my property -- it was called "depositing offsite" for my spoils area. So I was required to get analysis for something like 12 heavy metals, PNA's and PCB's. PNAs are polynuclear aromatics and PCB's are polychlorinated biphenyls. The results were -- and they wanted them measured in something like six different areas. And I sent a sample in and had all these things measured. And the PNA's were non-detectable. The PCB's were non-detectable. I talked to the DEQ chemist who was a most reasonable guy and I said, "Look, this has been there for a hundred years. If they're non-detectable here, they're going to be non-detectable there. I can save a thousand bucks if I don't have to do all those." He said, "Fine. Just get the metals at the others." The metals, some of them were detectable, no surprise -- calcium at, you'd have to look, a few parts per million. In terms of the toxic, heavy metals, no issues so my permit was issued.

Q Okay. Good to know. But what I'm driving at here, did you bring a sample? I see -- both the samples on the desk, those are from Missaukee Lake; right?

A That's correct.

Q And do you know what the grain size is of the sediment out in front of your cottage that you --

A I do not. And I think you'd have to be -- specify pretty

carefully where it is. I tried to explain, near shore where I've got a lot of wave action, in fact, it looks like what I'd call good, hard sand has been mixed in with the crud or sediment. And so when you go out there, it's kind of a soft, black mess. By the time I pump it and it goes through the pump, it separates on the other side where it comes out and you can see this beautiful, beautiful sand and then what looks to be black mud beside it. It separates during that process.

Q So do you know what the -- you know, what the percent sand, what the percent gravel, what the percent fines or other organic is of the sediments out in front of your cottage that you were dredging?

A Well, again, it would depend on where you are. In terms of gravel I think it is probably zero because I'm not aware of any gravel or stones out there. As you're near shore in the shallower water and the heavy wave action, the percent sands undoubtedly goes up significantly. When I'm farther out, I think the percent sand from what I can tell is zero.

Q Right. Well, what about quantitative analysis as opposed to a generalization?

A I do not have a quantitative analysis on that. There was no requirement for it. I have no interest in it.

Q Okay. So with regard to the dredging project that you've testified about on Crooked Lake that you're comparing to the

proposed dredging project on Lake Missaukee, you can't tell us quantitatively the grain size or the percentage of various types of soil that were the subject of that dredging project?

A Yes; correct. Absolutely correct.

Q Okay. And the samples you brought with you, those are Missaukee Lake samples?

A Those are Missaukee Lake samples.

Q Okay. And I take it you didn't bring a sample of the sediment from Crooked Lake?

A No, I did not.

Q And so there's no way for --

A It would be no problem. I could get a lot of it, if you want it.

Q We're here today.

A How many cubic yards would you like? Tell me and I'll have it delivered.

Q And so there's no way for me --

A That's correct.

Q -- or the tribunal to compare the types -- even by observation, compare the types of sediment at issue in Missaukee Lake to the types that are the subject of your dredging project?

A That's correct. I'm telling you that based on my experience of having been in both, sampled both, walked in both,

shoveled in both, that as far as I can tell, they're very similar. I didn't say they're identical, but they're similar.

Q Right. And you don't purport to be an expert in agronomy, do you?

A I do not purport to be an expert in agronomy, absolutely not.

Q Okay. And you've done no quantitative analysis?

A That's correct. Not on Missaukee Lake.

Q With regard to the jars that you do have that are samples that you took out of -- you say, out in front of Dick Morrow's place, you do recall Mr. Morrow testified that there were some of these loose sediments in front of his place?

A When he testified -- when I was here, he testified there was none in front of his place. When I looked at the transcript of the subsequent testimony, I saw where he had amended that to say if you got out a ways, you got some loose stuff, yes.

Q Okay. And the first jar -- which is the white lid; is that right?

A Well, what do you mean, first by what?

Q Well, the first one you talked about would be the green lid?

A That's this (indicating) one. This is 42 inches to bottom.

Q 42 inches to bottom? And that is how many feet out from shore?

A Approximately 100.
Q Okay. You didn't take any samples closer than 100 feet?
A No.
Q And --
A And I can give you the GPS coordinates, if you want it.
Q I don't need the GPS coordinates. You say it's about 100 feet?
A Yes.
Q And you're in 40 -- almost 4 foot of water?
A No, 42 -- well, 3-1/2.
Q 3-1/2 foot of water? And the second jar is -- would -- 5 or 6 -- 5-1/2 feet of water?
A Second jar is 66 inches, 5-1/2.
Q All right. So from the top of the water to where these loose sediments are out in front of Dick Morrow's place is at -- according to your measurements, is at least 3-1/2 feet?
A Correct. However, I have absolutely no reason to believe that when we chopped a hole about 100 feet out that we hit a hard edge, that there aren't sediments closer to shore than that.
Q You don't know one way or the other?
A I said I have no reason to believe that.
Q And there are in front of lot 8 these type -- assume they're the same -- these types of loose sediments are much closer

to the surface of the water out in front of lot 8?
A Yes. In some places in front of lot 8, yes.
Q In some places in front of lot 8? So boat action, wave action -- you know, a boat draft of 2 feet or 3 feet would go through some of the sediments in front of lot 8; correct?
A If it were in front of lot 8, yes.
Q In front of lot 8?
A Yes.
Q And it would stir those up?
A Probably.
Q A boat propeller spinning around would certainly stir up these loose sediments?
A Yes. If the boat were on plane, in fact, the propeller is only six inches under the water, so it doesn't have a prop wash going down very far at all. If you're in the water and starting out to go on plane, you go through what's called "over the hump" where the stern goes down, the bow goes up and then it comes over and levels in. And when it's in this process you get prop wash that will certainly go down in four and five feet of water.
Q And from the testimony -- Mr. Morrow's testimony, you don't have any reason to believe that these sediments that are at least 3-1/2 feet under water, according to your samples, pose any problem for Mr. Morrow or anybody else along his side of the lake?

A Quite the contrary. I was going to say that generally these kinds of things don't pose a problem in the lake; correct.
Q Okay. But you're aware of no complaint of these sediments being kicked up out in front of Mr. Morrow's from the bottom of the lake?
A I'm not aware of a serious complaint of them being kicked out in front of lot -- kicked up in front of lot 8.
Q You didn't read that part of Mr. Morrow's testimony?
A I probably qualified it by saying "a serious complaint," but, no. All right. Sorry.
Q You don't know where these sediments came from, meaning the two jar samples you took from Mr. Morrow's place?
A I know they came from the bottom of the lake at the place that I indicated. If you ask --
Q Well, you don't know how they got to the bottom of the lake in front of his cottage?
A Almost certainly they sank.
Q Okay. And you don't know where they sank from?
A Higher in the lake but, no.
Q They could have been kicked up from Redman's Island back 40 years ago, floated across the lake and then deposited there?
A They could have come from leaves that decayed in 1623.
Q You don't know?
A I don't know.
Q And so for all you know, these samples that you brought with

you actually support -- could support Mr. Morrow's position that sediments get stirred up on the western end of the lake, travel across the lake over time and are deposited out in front of his cottage?

A I think what these support is that the sediments are widely distributed throughout the lake and based upon Dr. Jaworski's testimony and Dr. Lehman's testimony, they come from detritus from living organisms that are present in the lake and on the shores of the lake. And so I would expect to find them throughout this lake. As my scuba diving experience tells me, I find them throughout essentially every Michigan lake unless there's enough wave action in shallow water to move these light materials to deeper water.

Q Right. The point, Dr. Evans, you can't -- obviously you don't know where they came from?

A That's correct.

Q And Mr. Morrow's testified that he has seen plumes -- turbidity plumes of sediment floating across the lake. Do you recall that testimony?

A I recall that.

Q And you don't -- you can't dispute -- you're not in a position to dispute, whether some of these sediments that you sample in front of his cottage could have, over time, come from the western end of the lake?

A I'm not, although I have not heard him testify that those

plumes necessarily end up in front of his place. It would take an unusual prevailing wind for that to be the location for them to end up. Because the winds are generally out of the west and it should be on the east side of the lake over by -- closer to Lake City where anything stirred up there should come in. Just like I'm on the east end of Crooked Lake and I get lots of stuff blowing up on my beach.

Q Well, Mr. Morrow is to the east of the western end of the lake.

A East of the south side of the lake.

Q He is east of where lot 8 is?

A He is east of lot 8 and he is south of lot 8.

Q Okay.

A Certainly if you start out on lot 8 and go east, you aren't going to come very close to Mr. Morrow's place.

Q Well, if you had a southeasterly -- or at that wind --

A I said if you start out and go east, you aren't going to come very close to his place.

JUDGE PATTERSON: Due east.

Q The green notebook, Exhibit 11, last page?

MR. SHAFER: I'm sorry. What?

THE WITNESS: Exhibit 11, last page.

MR. PHELPS: Exhibit 11.

MR. SHAFER: Okay. Thank you.

THE WITNESS: In the green notebook.

JUDGE PATTERSON: Or red.

A It says, "plate 4"?

Q Yeah. This is a --

A Page 14?

Q -- Appendix to Dr. Jaworski's report and it's a particle size analysis. And we can read further in the report, if we wanted to --

A I'm sorry. What -- what --

Q Last page.

A Of tab what?

Q 11.

JUDGE PATTERSON: I've got a picture.

A Yeah, page --

MR. SHAFER: Yeah, I got a picture on the last page, 11.

JUDGE PATTERSON: I've got what Dr. Evans has.

MR. SHAFER: I've got four plates as the --

THE WITNESS: Mine says, "page 14, plate 4."

MR. SHAFER: Correct. That's what I've got.

JUDGE PATTERSON: I think what we're looking for is Appendix D. It's the tenth page. It's right before the plates.

MR. PHELPS: Well, do you not have -- well, you've got it right there.

MR. SHAFER: Yeah, it's just not the end.

MR. PHELPS: It's not at the end of that, though?

MR. SHAFER: No. There's a bunch of pictures --

Q Well, Appendix D. It's the last page of mine.

A Okay. Okay.

MR. SHAFER: And then there's also this chart after it, too.

MR. PHELPS: I don't even have that.

Q But at any rate, I'll --

A Is this (indicating) what I'm looking for?

Q It is.

A Okay.

Q That's a particle size analysis of sediment -- lake sediment out on the west end of the lake. This one happens to be in between lots 11 and 10. And you'll see three-quarters of the way down it says, "Breakdown by percent weight." Do you see that? "Gravel 0, sand 3.9" according --

A No. I don't see where you're looking particularly. Show me. Oh, all right. "Breakdown," yup, below the chart.

Q Right.

A Okay; yup.

Q You've testified about your shovel experience out on the lake and scooping out the sediment.

A Yes.

Q And you've testified a little bit about your characterization of what's fines and what's consolidated and

what's unconsolidated, et cetera?

A Uh-huh (affirmative).

Q And, again, coming back to quantitative analysis as opposed to observation, this -- according to this quantitative analysis, 92 percent of this sample, which is an appendix to Dr. Jaworski's report, describes the sediment as fines. You see that?

A I see that.

Q And, again, you haven't done any quantitative analysis to dispute this quantitative analysis?

A I have not. My question would be, as with any experiment, before you can interrupt the results, you have to know what the experiment was. I could take my samples and if I messed them up enough, I can make them much finer than they are now. I doubt --

Q And are you suggesting somebody's mashed up the sample and blended it?

A I'm saying that unless you know how the experiment was run, you can't interpret the results. Okay? I know that many times for doing a particle size analysis -- because I have, in fact, done some of those in my career as a chemist -- there's a sample preparation procedure that one goes through to homogenize the sample, perhaps to break up clumps and that will give these results.

Q Okay. That's all very interesting, but that's -- you're

just speculating about things that happen or might happen.
A I'm saying I don't know.
Q You don't know.
A And unless you know, none of us knows what was done here.
Q Well, I know and I know this is part of the record and given that it's after 5:00 and in the interest of time, the admitted evidence will speak for itself. I was simply -- this quantitative analysis is in evidence. And I want to make certain it's clear that you didn't do a separate quantitative analysis to dispute this one; correct?
A I think you've asked me that question and I've repeated it previously. I have done no quantitative analyses on these -- on samples from Lake Missaukee.
Q Okay.
A Neither particle size nor other.

MR. PHELPS: That's all I have.

MR. SHAFER: I just have one question; hopefully one.

REDIRECT EXAMINATION

BY MR. SHAFER:
Q Do you believe that the samples that you and Mr. Boughner picked up and Mr. Morrow picked up are the same or different than the large, chunky samples that you dug out with a shovel?
A Oh, I believe they're different.

Q Okay. And in what regard?
A These are clearly unconsolidated fines.
MR. SHAFER: That's all I've got, your Honor.
JUDGE PATTERSON: Okay.
MR. REICHEL: I have nothing.
JUDGE PATTERSON: Okay. Thank you.
THE WITNESS: Thank you.
JUDGE PATTERSON: We need to take a break. She has to move her car.
(Off the record)
MR. SHAFER: Recall Dale Boughner, your Honor.
JUDGE PATTERSON: Okay.
JUDGE PATTERSON: Mr. Boughner, I'll remind you as I have the other witnesses, you were sworn previously and you're still under oath.
THE WITNESS: Yes, sir.

DALE BOUGHNER

having been called as a rebuttal witness by the Petitioner and previously sworn:

DIRECT EXAMINATION

BY MR. SHAFER:
Q Mr. Boughner, if you could open up the big binder to tab 2 and go to the fourth page which should be two photographs?
A How far in?
Q Page 4 -- it actually has a number 4 on the bottom.

A Two photographs.
Q Okay. You see the top photograph?
A Yes, sir.
Q It has a couple little boats?
A Yes, sir.
Q Whose boats are those?
A The one boat belongs to Mr. Mohney and the other boat is mine.
Q Okay. When Mr. Arevalo came out to the property and you met with him, was one or both of those boats there so if Mr. Arevalo wanted to get in the water, he could have done so?
A The boat on the right is there -- it's there all the time. We leave it right on the shore upside down.
Q Okay. So there was a flat-bottom boat there when Mr. Arevalo was there?
A Flat-bottom boat, yes, sir.
Q Okay. Now, if you could go over to the lake -- Land and Water Management Division's binder -- I'm not sure what color that is.
A The green one?
Q That's probably the Intervenor's. We haven't really talked about the Land and Water Management.

DR. EVANS: There were only two up there, I believe, on that desk.

JUDGE PATTERSON: Yeah, I don't have the other

one.

Q Yes, that's theirs. If you could go to tab 7 and then go to page 10, there are numbers at the top right-hand corner.

A I've got a diagram.

Q Yes, sir. You see that diagram?

A Yes, sir.

Q Who did that diagram?

A I did.

Q Okay. Now, there is a -- if you take a look, there's a hatched mark lakeward of the shoreline and then it says, "Approx 20 feet -- ft -- wide wetlands." You see that?

A Yes, sir.

Q Who came up with that figure?

A I asked Ms. Schmidt to come over one time when I was getting ready to make out this permit. And her and I stood out there and we kind of just picked that number. She said there was wetlands along there and I didn't know exactly how much it was and she said, "Well, just put down approximately 20 feet," so --

Q Okay. So you put down the number she gave you?

A Yes, sir.

Q Okay. Now, in this area around lot 8 in the western side of the lake, you are there on a regular basis as the caretaker?

A Yes, I am.

Q You're there through the summer and the winter?

A Yes, I am.
Q You come in through with snowmobiles from time to time?
A Right.
Q Like your son did on me last weekend with the Boy Scouts?
A Right.
Q Do snowmobilers drive on Lake Missaukee on the western side where Indian Lakes West is?
A Yes; yes, they do.
Q And so would a permanent dock in that area be a hazard to snowmobilers?
A It could be, yes.
Q Now, Mr. Boughner, if you could take a look at -- I'm hoping this is in the green binder as Exhibit 23, this picture diagram photo. I guess it's a photo.
A I've got a loose one on 23. In the green binder?
Q Well, let me take a look at what that is. That just might be theirs. No, it should be in here (indicating) hopefully as 23.
A Picture of the lake?
Q Yes, sir.
A Uh-huh (affirmative).
Q Does that also have -- it says "1," "2" and "3" -- numbers on there in circles?
A Yes, it does.
Q Okay. Now, you've been here through the entire trial;

correct?
A Yes, I have.
Q And you know that -- you know that those numbers were where Mr. Morrow marked as potential alternative locations for Mr. Mohney to have lake access for lot 8?
A Right.
Q You understand that?
A Yes.
Q Okay. And number 3 is to the east of lot 8; correct?
A Yes.
Q And numbers 1 and 2 are basically to the north?
A Right.
Q Now, could you explain to the judge, knowing this area, what one would have to do to traverse from lot 8 where Mr. Mohney's home is to alternative sites number 1 and 2?
A To get to site number 1, you'd probably have to try to walk along the shoreline or beach or along the edge of the woods. It would probably be about, oh, half mile out to there and it's brushy, high weeds. There's no road there.
Q Okay. What if you wanted to travel by vehicle, say you had small children or you had fuel for your boat or you had to take something to your boat or --
A If you wanted to get there by a vehicle, you'd probably have to go around by the Crooked Lake gate. There's an iron gate over there. It's -- to come back in to get your site number

1 1 or 2-, you've probably got about a mile and a half. It's
2 a two-track road. You probably would not be -- not use a
3 regular car. You'd probably have to have your Jeep
4 four-wheel drive or something like that.
5 Q Okay. And in regard to site number 1 -- do you see that
6 there? It's like to the north of that sandbar?
7 A Yes.
8 Q When you have your vehicle on this road but you get to a
9 point about where site 1 would be, how far would you have to
10 then walk from the road to the shore if you're going to put
11 a dock out there?
12 A To get to area number 1, you'd probably have to walk several
13 hundred yards through high weeds. There's no shore to --
14 sandy beach on -- like that over there.
15 Q Well, I was going to ask you when you say "high weeds,"
16 that's wetland area, is it not?
17 A Yes, it is.
18 Q Okay. And is that the same thing with number 2 that's to
19 the north of that?
20 A Same thing.
21 MR. SHAFER: That's all I've got, your Honor.
22 MR. REICHEL: I have nothing.
23 MR. PHELPS: With regard to that same thing --
24 MR. SHAFER: I had one other question. Is it
25 okay?

MR. PHELPS: Go ahead.

MR. SHAFER: I forgot one question.

Q Have you observed Mr. Bails in his pontoon boat from time to time?

A I've seen him leave his dock and go to the water, yes.

Q Okay. Does he have easy access out or has he had problems?

A He has problems usually getting in and out. If he's got a full boatload, a lot of times he has the people walk around to the point.

Q Okay. And why does he have problems?

A It's just the depth of the water he's got right there. It's a muddy water.

MR. SHAFER: Okay. That's all I've got, your Honor.

CROSS-EXAMINATION

BY MR. PHELPS:

Q How many feet is Mr. Bails' dock?

A Pardon me?

Q How many feet is his dock?

A I believe he's got 40 feet, but I'm not sure. I never measured it. He could have between 40 and 60, but I don't know for sure.

Q Okay. And when you go out from his lot, the further out you go the deeper the water gets; right?

A Pardon me?

Q The further you go, the deeper the water gets?
A I would assume, but I've never been out there.
Q With regard to Exhibit 23, have you observed people out there using the sandy sandbar or beach swimming?
A Sandbar out there?
Q Yeah.
A There are boats out there every weekend.
Q Is that a -- would you classify that as a good swimming area?
A I've never been to it. I've seen the boats out there.
Q You've seen people swimming out there?
A I have not seen them swimming because I've seen them walk around. The water isn't very deep right there.
Q Well, what do they do with their boats when they go out there?
A They either drop an anchor or just pull them up on the beach the best they can.
Q They get out and wade around, is that --
A They get out and walk around, drink beer, pee in the water.
Q And same thing with --
JUDGE PATTERSON: Goes along with drinking beer.
Q Same thing with regard to site 2?
A Site 2 is a little more difficult. It's a weedier area over there. There's probably more -- there was some campers over one time and they pulled a few of the weeds out of the

wetlands, but it's pretty well growed (sic) back in now again.

Q Well, from this photo -- this aerial, it looks like there's a sandy spot right in the middle of the circle on number 2. Isn't that sand that we see there?

A That's correct; uh-huh.

Q Any reason why you know someone couldn't swim or wade off in that sandy area?

A Because once you get to right where it's blue, it's all muck right there.

Q Right where? Right at the edge of the sand?

A Right at the edge of the sand. It's not very deep there, probably about a foot of water.

Q How far out does the foot of water go out on the sand?

A Oh, probably from the shoreline 30 feet.

Q Okay. So you'd have --

A It's a fairly shallow area.

Q All right. So you'd have 30 foot of sandy beach before you got out --

A Well, the sand's not 30 feet. I'm talking about to the mud out in there. There's probably only about anywheres from 10 to 15 foot of sand along there right now. It's growed back up.

Q Okay. And this light colored line that kind of runs east to west and if it kept extending it'd go between the circles of

1 1 and 2, that's a little road or --
2 A That line along there?
3 Q Yeah.
4 A It's an old logging road or trail road.
5 Q Okay. And I think you said people camp back there?
6 A At one time that land was leased to a -- campers. They'd
7 come there in summertime with a tent for two weeks, but
8 they're no longer there.
9 Q Hasn't there been a trailer out there?
10 A There was a trailer there about five years ago. We had it
11 pulled out.
12 Q I assume that while it -- during -- at some point when it
13 was out there, that somebody used that or they camped out of
14 that trailer?
15 A That trailer was a deer hunting cabin. They used to come
16 there like November 15th through 30th. That was strictly
17 deer hunters.
18 Q Okay.
19 MR. PHELPS: That's all we have.
20 MR. REICHEL: I have nothing.
21 MR. SHAFER: Nothing.
22 JUDGE PATTERSON: We're done?
23 MR. SHAFER: Your Honor, the only -- last thing I
24 would say is you reserved the issue on Mr. Groves' testimony
25 in regard to the Tom's Bay matter.

JUDGE PATTERSON: Oh, I did, didn't I?

MR. SHAFER: And I just want to make a couple last comments. You've now heard Dr. Jaworski's testimony -- you've actually heard all the testimony now. And Mr. Groves' testimony is particularly relevant in regard to, as the court will recall -- I wasn't there, but you were, although I've read the testimony -- he was the one that did the vegetation analysis or, you know, the counting. And he was the one that was testifying in regard to the plethora of the vegetation through the area. And as the court pointed out earlier, I don't have the right to subpoena him. This was their expert witness. They listed him as an expert witness and he has testified as to a matter that's clearly relevant because, you know, everyone else is guessing.

You've got the guy and the testimony who, you know, made the analysis. And I point out, your Honor, AP rule 24.275, it says, "The agency may admit and give probative effect to evidence of a type commonly relied upon by reasonably prudent men in the conduct of their affairs." This is sworn testimony. He was sworn under oath. He was before your Honor. So we would ask that his testimony be admitted, your Honor.

MR. PHELPS: And, your Honor, I'm going to renew the objection. It is -- under the Court Rules, it is hearsay and it does not meet the hearsay exception of being

former testimony because we, the Intervenor, was not a party to that prior action. We had no opportunity to cross-examine him. And, frankly, even if the Intervenors had been a party in the prior action, the subject matter was completely different, the context was different. It had nothing whatsoever to do with dredging on the west end of the lake. And so anything that Mr. Groves said in that testimony that they seem to want to use to support their position on the west end of the lake, no one had an opportunity to refute that. So if you admit that testimony, you're going to admit testimony that's going to be presumably taken into account then by the tribunal and it will be testimony that was never subjected to cross-examination by my client and never subjected to cross-examination by anybody with regard to the issues in this case. That is wholly inappropriate.

And I noticed there was no direct response to my interpretation of -- and the rule that I cited to the court before which is in 804 or whatever it was the rule under the Michigan Court Rules.

MR. REICHEL: And, Judge, we stand by our previous objection. Obviously the DEQ was a party in that proceeding, but the subject matter of this witness' testimony was not done in the context of an issue that is presently in this case. In other words, even though the DEQ

was represented in that proceeding, we had no knowledge that the testimony offered by that witness would be used in this different context.

MR. SHAFER: Could I just make one last comment, your Honor?

JUDGE PATTERSON: Sure.

MR. SHAFER: This is a bench trial. There's not a jury here. You can separate the wheat from the chaff. The point is that Mr. Groves testified -- he testified in regard to the analysis he did because of the concern that the loss of vegetation in Tom's Bay would result in a -- you know, same thing here, cataclysmic event because there weren't other areas in the lake for fish to go and have food and shelter. And his analysis was that there was stuff all throughout this lake -- and he did his analysis. It doesn't matter that he's not testifying in regard to the dredging project here. That's not what we want his testimony for. We want his testimony for what is in the lake because the fish can go there. That's the point, your Honor.

MR. PHELPS: On this wheat from the chaff, the due process is that we get the right to bring things to your attention and elicit testimony through cross-examination. That's why we've had the hearing structure the way it has been and that's why we've had cross-examination. And so your Honor won't have the full story and the full benefit of

cross-examination, so you won't know if there's a problem or issue raised in some of the testimony. That's the issue.

JUDGE PATTERSON: Okay. What I'm going to do -- it's been a long time since I reviewed that, obviously. I'll take a look at it and review the deposition and --

MR. SHAFER: Thank you, your Honor.

JUDGE PATTERSON: -- and I'll make a written ruling.

MR. SHAFER: Thank you

JUDGE PATTERSON: I just don't remember.

MR. SHAFER: It's been awhile.

JUDGE PATTERSON: I have a hard time remembering last week let alone two years ago.

MR. SHAFER: Thank you, your Honor, and thanks for staying late.

JUDGE PATTERSON: Oh, no problem.

MR. SHAFER: It's very late and --

JUDGE PATTERSON: Do you want to do written closing arguments?

MR. SHAFER: Yes, your Honor.

JUDGE PATTERSON: Okay.

(Deposition concluded at 6:05 p.m.)

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