ORIGINAL

ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
WATER QUALITY STANDARDS AND	)	R08-09
EFFLUENT LIMITATIONS FOR THE	)	(Rulemaking-
CHICAGO AREA WATERWAY SYSTEM	)	Water
AND THE LOWER DES PLAINES	)	
RIVER: PROPOSED AMENDMENTS	)	
TO 35 Ill. Adm. Code Parts 301,	)	
302, 303 and 304	)	

REPORT OF THE PROCEEDINGS held in the above entitled cause before Hearing Officer Marie Tipsord, called by the Illinois Pollution Control Board, taken by Steven Brickey, CSR, for the State of Illinois, 100 West Randolph Street, Chicago, Illinois, on the 16th day of May, 2011, commencing at the hour of 9:00 a.m.

A P P E A R A N C E S

MS. MARIE TIPSORD, Hearing Officer
MS. ALISA LIU, Environmental Scientist
MR. ANAND RAO, Senior Environmental Scientist
MR. TANNER GIRARD, Acting Chairman
MR. THOMAS JOHNSON
MR. GARY BLANKENSHIP
MS. CARRIE ZALEWSKI
ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
(217) 782-5544
BY: MS. DEBORAH WILLIAMS

SNR DENTON
BY: MR. ARIEL TESHER
233 South Wacker Drive
Suite 7800
Chicago, Illinois 60606
(312) 876-2380
ENVIRONMENTAL LAW ON POLICY CENTER
BY: MR. ALBERT ETTINGER
53 West Jackson Boulevard
Chicago, Illinois 60604
(773) 818-4825
BARNES & THORNBURG, LLP
BY: FREDRICK P. ANDES
One North Wacker Drive
Suite 4400
Chicago, Illinois 60606
(312) 214-8310

MR. SCOTT BELL

REPORTED BY:

Steven J. Brickey, CSR
CSR License No. 084-004675

I N D E X

THE WITNESS: SCOTT BELL

THE WITNESS: SCUDDER MACKEY

E X H I B I T S

MS. TIPSORD: Good morning, everyone. My name is Marie Tipsord and I've been appointed by the Board to serve as Hearing Officer in this proceeding entitled Water Quality Standards and Effluent Limitations for the Chicago Area Waterway System Lower Des Plaines River, proposed amendments to 35 Ill. Admin Code 301, 302, 303 and 304.

This is Docket No. R08-9. This is Subdocket C. With me today to my immediate left is acting Chairman G. Tanner Girard. To his left, Board Member Andrea Moore. To her left is Board Member Gary Blankenship and Board Member Carrie Zalewski will be joining us later on this morning. To far my right is Board Member Thomas Johnson. To my immediate right is Anand Rao and to his right is Alisa Liu from our technical staff. I don't think any of the interns have joined us today.

Today's hearing is the fifth day in the hearing of Subdocket C, but the 48th day of hearing overall in this proceeding. A prehearing conference was held on March 7th, 2011, and a schedule was decided upon. I did not do a Hearing

Officer order so here is the schedule as we are where we are now.

We will begin with Mr. Scott Bell on behalf of the District. He began his testimony on March 10th and I believe we completed questions by the IEPA.

Mr. Bell's testimony was admitted as Exhibit 447. After -- with Mr. Bell, we will begin with Prairie Rivers and Sierra Club and then go to Midwest Generation for questions. After Mr. Bell is done, we will proceed with Scudder Mackey who also will be testifying on behalf of the District. He will be questioned first by the IEPA and then Prairie Rivers and Sierra Club, then Open Lands, Midwest Generation and finally by Citgo.

Following Mr. Mackey, if we have time today, nobody laugh, we will begin with Jennifer Wasik who will be questioned by the IEPA, then Prairie Rivers and the Sierra Club and concluding with Midwest Generation. We will then have David Zenz and Andrea Moore testify later on this week.

All testimony will be marked as

an exhibit and entered as if read. Anyone may ask a follow-up question. You need not wait until your turn to ask a question. I do ask that you raise your hand, wait for me to acknowledge you. After I have acknowledged you, please state your name and whom you represent before you begin your questions. Please speak one at a time. If you are speaking over each other, the court reporter will not be able to get your questions on the record. Please note that any questions asked by a Board Member or staff are intended to help build a complete record for the Board's decision and not to express any preconceived notion or bias.

I also want to note for the record the IEPA is on their way. They told us it would be about 10:00 before they get there, but to begin without them. Dr. Girard?

MR. GIRARD: Good morning. Welcome to Hearing Day 48. The Board is very grateful for all the time and effort that's been put into this rulemaking. We look forward to your questions and testimony today. Thank you.

MS. TIPSORD: With that, Mr. Bell, I'll remind you that you have been sworn in and

you are still under oath and I understand there's a clarification you would like to make from your testimony at the last hearing?

THE WITNESS: Yes, that's correct. At the last round of testimony, I was asked to produce a table which explained how we assign certain fish species to certain fish metrics and this was important because it was the basis for us calculating what we called our combined fish metric and that was the measure of fish community that we used to compare to habitat and water quality in our study.

When we produced that table, it didn't look right and several people noticed that. When I returned to the office, we looked into that. We found a transcription error that had been made. Some of the fish species had been assigned to more than one metric and they should not have been.

We corrected the transcription, reevaluated the analyses and it changed none of the conclusions of the study. Some of the numbers changed very, very slightly, but my testimony did not change.

MR. ANDES: So we have a revised table?

THE WITNESS: We have the revised table.

MR. ANDES: With no heading on it.

MS. TIPSORD: I have been handed a table -- Mr. Bell, do you remember which table precisely this is correcting?

THE WITNESS: No. Actually, this was something that was submitted independent of our report during the last hearing. So I don't know. It probably has a number. Fred, do you know?

MR. ANDES: Not offhand.

THE WITNESS: It's not a table that appeared on one of the reports or in the testimony or attachments. It was something that was specifically requested in response to one of Illinois EPA's questions.

MR. ETTINGER: Is it an exhibit?

MS. TIPSORD: I'm trying to figure out which exhibit this might have been just so we can be clear. Does anybody recognize it right away? I don't have the exhibits with me. Do you

guys recognize it? All right. We'll admit it as an exhibit.

MS. MOORE: He thinks it might be 454.

MS. TIPSORD: If there's no objection, we will mark it as 474.

MS MOORE: 454.

MS. TIPSORD: It might be 454.

MS. MOORE: Do you have it?

MS. TIPSORD: Exhibit 452 looks similar.

MS. MOORE: 454.

MS. TIPSORD: I just want to be clear so we don't use Exhibit 454 or whatever it is. We're going to go ahead and admit it as Exhibit 474 if there's no objection. That is the correct number, isn't it? Am I remembering or am I going too far? 474, if there's no objection. Seeing none, it's Exhibit 474.

(Document marked as IEPA Exhibit No. 474 for identification.)

MS. TIPSORD: With that, if you're ready, we'll begin with Mr. Ettinger's questions.

THE WITNESS: Certainly.

E X A M I N A T I O N

MR. ETTINGER

Q. As long as we have this, I just want to ask a little bit more about this.

A. Sure.

Q. I think you described it briefly, and I don't want to go over everything that was gone over with 454, but what is this exhibit about again?

A. Right. So the table shows a list of fish species along the left-hand side and along the top are ten fish metrics that are just different ways of describing the fish community. Those are the ten we used to develop our combined fish metric, which is the measure -- the single measure of fish health that we used in our study.

So as you move across the table for any given species, the species is assigned to one or more of these metrics and that's indicated -- where an assignment is made, it's indicated by a darkened box. The writing in the box refers to the specific technical reference or in the case of the letters BPJ that means best professional judgment on the part of our

biological staff.

So when we produced this table, we noticed that there were -- and I don't have the exact count, but there were some of the species that were identified as both existing in the last two columns. That's the percent insectivore column and the top carnivore column and they shouldn't have been double counted that way. So that was an indicator to us that we had a transcription error and this table is the corrected version.

Q. Okay. So I guess we can use that second to last column as percent insectivore?

A. That's correct.

Q. Okay. So if we go down, we see black stripe top minnow and USGS eight is what I see there in the darkened area?

A. Mm-hmm.

Q. So what does that mean?

A. That means that black stripe top minnow as a species was assigned to the metric percent insectivore. So a fish sample that contained a black stripe top minnow would have its percent insectivore metric calculated using black

stripe top minnow and the lettering means that we determined that assignment from that reference and I apologize. I don't have the list of references in front of me.

Q. And the fact then that you had found a black stripe top minnow would mean you counted that towards the percent insectivore and that would figure in your fish metric?

A. Yes, that's right.

MS. TIPSORD: Just for clarification. I think I said 474. This is actually Exhibit 454. We haven't gotten that far. The exhibit is actually 454 for this table that has come in.

MR. ETTINGER: I obviously don't want to repeat all the testimony as to the earlier exhibit. Do we know what the earlier exhibit was?

MS. TIPSORD: We're thinking 452, but we're not positive on that.

MR. ANDES: I'll check.

MS. TIPSORD: Sorry for the confusion. It is Monday morning.

BY MR. ETTINGER:

Q. You'll be happy to know that I went

through the last transcript and tried to eliminate a number of the questions I had listed, but you'll be unhappy to hear I was unable to eliminate as many as I would like. So why don't we start with number two which says on page 20 of the Habitat Evaluation Report you mentioned inflows of storm runoff deposits fine sediment from the urban drainage area, how does that effect habitat?

A. The quoted statement refers to the input of fine sediments with storm water from the urban area and fine sediments are generally detrimental to habitat because in areas where coarse substrate, coarse sediment exists such as gravel or stone, if you will, the fine sediment can fill in the gaps between those and effectively blanket it and lessen or even eliminate its benefit to biota.

The other reason is, of course, that it can increase turbidity because some of this stuff doesn't settle out. It stays in suspension in the water column and turbidity is generally not a desirable condition and the last is that a lot of these sediments from urban areas contain chemicals that are detrimental to fish and

aquatic life.

Q. Okay.

MS. TIPSORD: Okay. For the record, the Habitat Evaluation Report is in the record as part of Public Comment 284.

MR. ETTINGER: I'm sorry. It's public comment what?

MS. TIPSORD: 284.

MR. ETTINGER: 284.

BY MR. ETTINGER:

Q. So basically as I heard the answer it fills in the gravel and it creates turbidity which are two of the problems and then the third problem is also the fine sediment itself contains harmful substances?

A. That's right. And I should clarify. We didn't make a specific study of this condition in the cause, but I mean it's generally one that is recognized in urban areas.

Q. I think we'll get to more of that later. On page 21, the Habitat Evaluation Report refers to fluvial habitat, is no such habitat present in the CAWS?

A. The statement on page 21 refers to

the sequence of pools, riffles and runs that occur in natural streams and rivers which are beneficial to aquatic life and we did not observe these conditions in the CAWS.

Q. Is it present in waterbodies that are connected to the CAWS from which fish can swim into the CAWS?

A. We did not study tributaries to the CAWS.

Q. Page 28 of the report you discussed a decision to develop a System Specific Index. For what other waterbodies has such an index been developed?

A. System Specific IBI's, indices of biological integrity are fairly common. They've been developed for several waterbodies, including the Ohio River, the Wabash River and the Seine River in France are some of the examples and I have citations. We have papers that discuss those if you'd like them. I also have a note of the Willamette River Valley in Oregon.

Waterbody specific habitat indices are less common. We have identified only a few in the literature, but they are common on a

geographic basis, so statewide habitat indices such as Michigan or Maryland, and it's notable I think that where these habitat indices have been developed for specific political boundaries that it stands to reason it might be reasonable to develop one more system, a waterbody itself, because the fish are likely to be more effected by conditions within a waterbody than a political boundary.

Q. So what is the point of a specific -- System Specific Index? I mean, if I have a general index, I can compare the water quality and say the Illinois River and the Ohio River, but if I have an index that is specific to the Illinois River, it won't help me compare it to another waterbody, will it, or what is the point of that?

A. The rationale for developing a System Specific Index depends on the conditions you're dealing with, but in our case we looked at the CAWS and we looked at available indices and the bases for those existing indices and decided that because they were developed for systems that were so different in nature from the CAWS that

none of them were adequate to differentiate habitat within the CAWS or measure the factors that were really important in the CAWS. They either didn't vary or didn't exist. I mean, the factors that were measured by existing indices either didn't vary or didn't exist in the CAWS. So, as a tool, those existing indices would be very limited.

Now, that's not to say you couldn't use in your example a fish index for the Illinois River in another river if that river were similar to the Illinois River.

Q. But you didn't do that? You were working off of your own index?

A. That's right.

Q. So I can't look at any number that you produced for, say, the North Branch of the Chicago River and compare that to the Calumet River -- I'm sorry. The Cuyahoga River. I couldn't take a number from the North Branch of the Chicago River that you developed and compare that to the Cuyahoga River in any way?

A. I'm not familiar with the conditions in the Cuyahoga. I will say, though, that --

well, I'm not as far.

Q. I took the Cuyahoga off the top of my head because it happened to be another river that most of us would agree has had some work done in it?

A. Yes.

Q. But I'm just saying you can't because it's a System Specific Index. There's no way I can use your number to compare a water within the CAWS to a water outside the CAWS?

A. I'd say that you'd have to make a case by case determination. You'd have to look at the factors that are evaluated in a System Specific Index like the CAWS, habitat index, and then look at the conditions that exist in the waterbody that you're considering using it for and then make a determination on whether the two waterbodies are similar enough that it would be an appropriate tool.

Q. So if I were, say, a chief governor of Ohio I might take your index and see if I couldn't take the same factors and apply them to the Cuyahoga?

A. You might do that.

Q. To your knowledge, nothing like that is done so we can't look at an index of your -- your index and compare it to any other existing index for waters outside of the CAWS?

A. Are you talking about taking our index and applying it to waters outside of the CAWS and then compare the numbers?

Q. I'm just trying to figure out. Let's say I've given a particular water within the CAWS, I forget how your index works, but a 75. So you got a number 75 for a particular segment of the CAWS. I can't use that number to compare it to some other number that's been developed in another state?

A. No.

Q. Where has the Non-wadable Habitat Index been used?

A. You're referring to the Michigan Non-wadable Habitat Index I assume and protocols for that are still under development by the State of Michigan. So it's not being widely used right now because the state hasn't determined how they want to use it.

Q. How did you use it?

A. We didn't use the index itself. We looked at the technical methods that were used in its development and used several of the approaches that were used.

Q. On page 31 of the Habitat Evaluation Report states that the macroinvertebrates were similar across the system and they were all pollution tolerant. Did I interpret page 31 correctly?

A. I believe so.

Q. Do you have an understanding of what factors caused this?

A. We didn't investigate the reason for the similarity across the system with respect to macroinvertebrates and I would defer to Ms. Wasik on that question because she has made a much more detailed study of that.

Q. You did do -- we'll do this more later, but you did look at macroinvertebrates to some extent?

A. Yes.

Q. So are the same pollutants in the whole system that you found in the macroinvertebrates or what did you do there?

A. Well, we didn't look for pollutants in the macroinvertebrates, but what we looked at were sediment pollutants across the system where data were available and compared that to macroinvertebrates. Similar pollutants were found in a number of locations across the system. I would not say that they are the same across the system.

Q. Isn't it actually a little -- I mean, not knowing anything, wouldn't it be a little surprising to find that the macroinvertebrates were similar across the system given that they're sort of the most localized critters in the system and would be most likely to be effected by the sediments?

A. I'm sorry. Can you just repeat that?

Q. Let me start over. I think we know that the sediments vary within the system. Some of the areas are more heavily industrialized than others, is that correct?

A. Yes.

Q. So wouldn't you expect not knowing anything else the macroinvertebrates to be more

dissimilar from different parts of the system than the fish because the fish can swim from one part of the system to the other, but the macroinvertebrates are fairly localized? So I would expect going in that the macroinvertebrates would vary more from spot to spot than the fish that can go from wherever they please?

A. I see what you're saying. We didn't observe that to be the case and I don't know the reason for it, but it may be that the conditions, the benthic conditions, the sediment conditions, are so uniformly poor in the CAWS that the result is that the macroinvertebrate populations show less variation. That's not to say they don't show any variation, but they show less.

Q. And that gets perhaps back to the fine sediment that we talked about earlier?

A. That would be a factor, yes.

Q. Okay. Let's go to eight. How did macroinvertebrates figure in your conclusions in your report?

A. We compared the macroinvertebrate data to sediment contaminant data to determine which sediments contaminants were most correlated

with poor macroinvertebrate condition and then added those sediment contaminants to our habitat evaluation as habitat variables.

Q. I'm missing something. How did the macroinvertebrates effect the habitat?

A. The macroinvertebrates -- let me start over. We weren't going to directly evaluate macroinvertebrates and the relationship to fish or habitat, but we recognized that poor macroinvertebrate condition or poor macroinvertebrate communities could have a role in effecting the fish community because the fish -- some fish may feed on them and if there's a poorer food source, that could damage the fish.

So we wanted to try to account for that in some way. So we recognized that macroinvertebrates will have a more direct response to sediment contamination than fish will. So we said, well, sediment contamination is a habitat condition that indirectly for the most part effects fish. We should try to consider that and so the way we did that was we tried to determine which sediment containments. We didn't want to use all of them because they're hundreds

of chemicals that you could use. So we wanted to come up with a list that we thought were the most important sediment containments. So we did that by comparing them to the macroinvertebrate data using the macroinvertebrates as sort of indicators of which chemicals were the really bad actors and then those were three chemical measures that we used as habitat variables.

Q. I thought we decided earlier that the macroinvertebrates were uniformly lousy throughout the system?

A. They are.

Q. So how could you use anything to --

A. That's not to say they don't vary, though.

Q. Let --

A. I'm sorry.

Q. Why don't you go on. You were saying something fruitful while I was asking my question.

A. I apologize.

Q. How do they vary? What were you about to say?

A. I was just going to say just because

they're uniformly poor doesn't mean they don't vary.

Q. Okay. So they vary between poor and very poor or what did you mean to say there?

A. What I meant to say was that they vary to a degree that's sufficient to correlate them with sediment contamination.

Q. So they're poor throughout the system, but in some places they're poorer in other places and you can use that difference to come up with something you can measure?

A. I would agree with that except from recollection I don't know that I can absolutely say they're poor everywhere.

Q. Okay.

A. I would have to go back and look at those data.

Q. The good news is while I didn't find I could eliminate much because of Ms. Williams question I was able to find a great deal of repetition within my own questions. So I am hoping to only ask this one, but in your study you looked at various fish metrics, how was the fact that some of the fish in the CAWS came into the

CAWS in the Great Lakes or the Upper North Branch or other waters figure into your evaluation?

A. We had no way to determine which specific fish came into the CAWS from outside the study area obviously, but we did try to mitigate the influence of fish species that had fewer counts by eliminating metrics for which there was less than two species identified.

So if a fish metric was poorly represented by the species we were counting, we eliminated that metric from use.

Q. Now, I don't have all your numbers in front of me, but there are some places within the system where routinely a number of Great Lakes species slip in, would you agree with that?

A. I'd have to go back and look at the data.

Q. Okay. So my biology certainly is not as good as yours, but I think the chinook salmon, for example, is unlikely to have bread within the CAWS, can we agree with that?

A. I agree with that.

Q. So if we found an area in which there were a number of chinook salmon, how would

you have taken care of that?

A. Again, we didn't specifically eliminate species from that -- from our study just based on the suspicion that they migrated in from elsewhere. But if they happened to be representative of a fish metric that if a fish metric were considered -- that only counted those and there were only one or two such species considered in that metric, that metric would have been eliminated from consideration.

Q. We'll get into something more specific later. With regard to the physical habitat data, how were decisions made as to what was there?

A. We evaluated existing data for suitability in the study by examining several factors including whether the data existed for the fish sampling stations that the district used. We wanted to be able to use the existing fish data so we wanted to make sure that we could characterize habitat in those locations. So we considered spatial coverage and also temporal coverage. We wanted to make sure we had enough data for the periods of when -- to the extent that we could for

the periods when the fish were sampled and then whether or not there was enough -- a qualitative enough measure of those variables.

Q. I was wondering about this. I'm going to go off script for a while. I was a little confused about qualitative versus quantitative. For example, one of the factors that I believe turned out to be important in your study was whether or not there was a manmade structure in the water. How far up and down from the site did you look for such a structure?

A. All of the habitat data that we used in comparison to the fish data were collected in 400 meter reaches. So that would be 200 meters upstream, downstream from the central point of a fish collection station.

Q. And what counts as a manmade structure particularly when you're within a manmade waterbody?

A. The specific structures that we considered manmade structures were piers, bridge abutments and dolphins, which are the large structures that stick up out of the water.

Q. You didn't count like a sunken barge

or a used car?

A. No.

Q. What about a fish hotel, would that be a manmade structure?

A. In our study, no.

Q. I was worried about that. Okay. We went over this a little bit, but on page 41 of the Habitat Evaluation Report it refers to high turbidity in most of the system. I think you answered this, but what exactly is turbidity?

A. Turbidity is a measure of the ability of light to pass through the water column.

Q. So it would be the same thing as measured by Secchi depth?

A. Yes.

Q. You say most of the system is characterized by high turbidity. Do you recall what parts of the testimony are not characterized by high turbidity?

A. In general, the parts of the system closest to Lake Michigan are less turbid.

Q. Then, again, on page 42, you mention that visibility is limited to less than 0.5 meters outside of the Chicago River. What portion of the

Chicago River had more visibility than 0.5 meters?

A. So just to clarify, that statement referred to our attempt to use underwater digital video to examine bank conditions, submerged bank conditions. So we were making those measurements at several feet of depth trying to examine whether there was refuge in the banks. That attempt failed because the visibility at that depth where it was attempted was generally less than 0.5 meters. We didn't do this measurement everywhere. So we can't make a system-wide comparison using that same measure.

Q. So you didn't look at Secchi depths?

A. We did look at Secchi depths, which is a different measure. It measures the same condition, but it measures it from the water surface down. So the two values can't be compared directly I should say.

Q. Okay. So is there a meter on your underwater digital video equipment as to the distance it can see or how did you read that?

A. By eye because we know how close the camera is to, say, a sheet pile wall.

Q. Okay.

A. And when you start to see the sheet pile wall, you know that the visibility is 0.5 meters if you're 0.5.

Q. The visibility is crumby both looking down and sideways in most of the waters you checked?

A. Yes, generally.

Q. You refer to the amount of data that would be required to validate the technology was not available. What do you refer to there? This is on page 42. Besides side scan sonar was tested at four reaches and although it showed promise in revealing subsurface structure and bed conditions, it was determined that the amount of data that would be required to validate the technology in the CAWS was not available. What do you mean by that?

A. The side scan sonar was used in an attempt to categorize and quantify submerged structures that could be used for fish habitat or by fish as habitat. And when we looked at the imagery, although it appeared that it could discern objects such as sunken cars or tree trunks or that sort of thing, we felt that for it to be

-- for us to put it out there as a definitive measure of habitat, we would have to do some valuation and in this system that would require visual inspection of what the sonar appeared to be showing us to confirm that it was a car or a tree or sunken tires or boulders or whatever and because of the limited visibility, that would mean putting divers down and we decided because of a number of factors, including; schedule, budget and difficulty in finding people willing to do that that we weren't going to do that.

Q. Basically, it was -- it relates, again, to our turbidity problem that we can't see anything down there?

A. Yes.

Q. Question 17, what kind of data was obtained from the bathymetry?

A. From bathymetric measurements, we quantified the overall channel cross section, meaning the width, the depth, and the shape of the channel as well as the uniformity of those conditions along the reach.

Q. How did that figure into your conclusions?

A. We used that information to quantify several variables that we used in our evaluation. A few of them would be the maximum depth of the channel, for example, or the ratio of the channel width to channel depth. Even in some cases, it was used to verify the steepness of the side walls. And then all those were translated into variables that were used in the analysis.

Q. So that's part of where we get our eight habitat variables? The conclusion is from you used this to confirm your visual observations in some of those other areas?

A. Yes.

Q. So page 43, there's a really -- I don't know what to say about it. It's orange. I've seen waters below coal mines that actually look like this, but I don't think that's the Illinois River or any part of the CAWS. So could you tell me what this is?

A. It's actually an example of the site. As the caption reads, it's an example of the side scan sonar imagery which is the orange part that runs from the top to the bottom of the figure. It was collected in the Upper North

Branch of the Chicago River and it's superimposed on an aerial photograph. So the width of that colored ban that you see, and although my copy is black and white here, I think you're right that it is orange. The width of that represents the width of the North Branch at that location.

Q. Why is it orange?

A. I don't know the answer to that. It's not a visual image. So the color is, I think, an arbitrary assignment that the processing software makes. The image was collected and processed by Dr. Mackey and I would defer to him to explain the coloration.

Q. Then, why do you think that's possible, woody debris is in there?

A. Simply based on the shape of the object, a possible interpretation of that is that it's woody debris. You can see the difficulty in using the data.

Q. All right. Well, we addressed the orange mystery and we can go on.

MR. ANDES: You're free to ask Dr. Mackey later why he picked orange.

MR. ETTINGER: That can be later,

but I'll have to see if Ms. Williams wants to ask that first.

MS. TIPSORD: Excuse me. As we're speaking to Ms. Williams, I just want to note that although Ms. Williams is not here there are representatives from the IEPA that have been here since 10:00. Mr. Scalewski and Mr. Stratton are both here.

MR. ETTINGER: Correct, they are here.

MR. ANDES: That means you can't say anything bad about them.

MR. ETTINGER: I didn't say anything bad about them.

AUDIENCE: Can we say anything bad about them?

MR. ETTINGER: I think that was a question for the Hearing Officer.

MS. TIPSORD: I'll consider it rhetorical.

BY MR. ETTINGER:

Q. To my question 19. On page 46, different types of sediment are discussed; plant debris, inorganic silt and organic sludge. Which

of these are most desirable?

A. Of those three, I'd say plant debris is most desirable.

Q. But inorganic silt and organic sludge are not helpful to the system?

A. No.

Q. And does that reflect the storm water pollutants and other things that we referred to earlier as to this turbidity problem?

A. The inorganic silt is likely contributed by runoff from the urban area. The organic sludge is less likely to be related to storm water runoff, but possible.

Q. Where could it come from?

A. Past industrial activities.

Q. How far around each station was evaluated for these substrate variables?

A. The district collects four samples at each station, sediment samples, substrate samples, and then uses polling, which is the process of pushing a metal rod into the sediment to manually determine consistency. They use that to qualitatively assess how representative the samples are that they collected.

Q. There's a discussion of hydrology on pages 47 and 48 of your paper here. How did that ultimately figure into your conclusions?

A. Hydrology can be very important to natural systems, but I think it's much less important in the CAWS. In the end, hydrology really didn't factor into our conclusions.

Q. I think we already answered 21. You explained which manmade structures counted and fish hotels and sewage discharge points were not manmade structures for purposes of this study. Let's go to question 24. I'm sorry. I'm referring to my own questions. Do you have those with you?

A. Yes, I do.

Q. Page 54 of the Habitat Evaluation Report refers to the Minarik report. What was that or is that?

A. The Minarik Report 2008 is -- I believe it's the annual water quality report produced by the District. I don't have the exact title in front of me and I don't know if it's been made part of the record.

MR. ETTINGER: May I ask, Mr. Andes,

whether it has been made part of the record?

MR. ANDES: I don't believe so. It is available on the District website. Ms. Wasik is one of the authors. So we can certainly provide the document.

MR. ETTINGER: I would ask that. I attempted to get it off of the District website and I needed a password I think that you somehow neglected to give me.

MR. ANDES: I don't know how that happened.

MR. ETTINGER: I don't know either. It's surprising. We're such good friends. I think that would be helpful.

BY MR. ETTINGER:

Q. Was that data one of the documents that you used to determine what the dissolved oxygen levels have been that underlie your overall conclusions comparing habitat and dissolved oxygen?

A. The hourly CDOM data was what we used. It was made available to us by the District. I don't know if that report presents all the data. It summarizes the data, but the

data was provided electronically to us and we used that hourly data.

Q. All right. I'll just -- you refer to this as CDOM data?

A. Yes. Continuous dissolved oxygen monitoring.

Q. I had seen various District reports that had summaries of that data. I don't believe I've ever actually seen the underlying hourly data, but that's what you looked off of?

A. That's correct.

Q. I'll ask Ms. Wasik about that later.

MS. FRANZETTI: If I can just add, Albert. I know there's dissolved oxygen hourly data on Exhibit 46, a CD ROM, that's been admitted in this proceeding.

MR. ETTINGER: Exhibit 46?

MS. FRANZETTI: I'm pretty sure that's the number, but the District a while ago produced a CD that had both at least temperature and dissolved oxygen data and it included certain stations where they take continuous DO and temperature data as well as stations where they monitor less frequently and I think it's Exhibit

46.

MS. TIPSORD: For the record, that was -- your name?

MS. FRANZETTI: Susan Franzetti, counsel for Midwest Generation.

BY MR. ETTINGER:

Q. I saw some DO data, but it all looked like -- there were graphs and numbers, but they weren't sufficient to see hourly figures. They were sufficient to see daily or they looked like this.

A. Right. That's not what I'm talking about, but the exhibit I've reviewed is -- goes on for hundreds of Excel spreadsheets tabbed by station and it's the actual individual data results either by the hour or by date at each of the various Midwest -- I'm sorry. MWRD stations.

MR. ETTINGER: That seems very exciting so I will have to look at that.

MS. FRANZETTI: It's not that exciting, but it is there.

MR. ETTINGER: There's nothing more exciting than continuous DO data.

MS. TIPSORD: Could we go off the

record for just a second?

(Whereupon, a discussion was had off the record.)

MS. TIPSORD: Back on the record. I would note that Ms. Williams from the IEPA is here. So the EPA is represented fully.

BY MR. ETTINGER:

Q. Now, we're on page 62. It says please explain Figure 4-1. What does the X -- I'm sorry. What does the Y axis mean in terms of habitat quality?

A. The Y axis of Figure 4-1 is a numerical scale representing substrate quality. A key to the meaning of the numbers is given beneath the figure title and by themselves these numbers don't necessarily say anything about habitat quality.

Q. That's what kind of confused me here. You've got numbers for plant debris is one and two is clay and three is inorganic silt, but those don't represent any sort of qualitative judgment or judgment as to how good the area is as habitat quality?

A. Those numbers represent

classifications of the sediment measured at each station, but they don't necessarily -- if I follow your question, they don't necessarily translate to something like one is bad, ten is good.

Q. Right. So, actually, we believe the cobble is better than inorganic silt, right?

A. Generally, yes.

Q. So if I went into a stretch of river and found cobble, I would get a better number for habitat than if I found inorganic silt?

A. You would get a different number for the sediment metric and you may get an overall better habitat number.

Q. Right. So I guess to get back to this one through ten here on the Y axis, how do I assign a one through ten number based on my findings?

A. So you would collect a measure or a sample of sediment and if you observe that -- you would observe what the dominant characteristic of the sediment was. So if it's mostly organic sludge, you would give it a four.

Q. Okay.

A. Then you would know that that's

different than another sample that has a seven because you'll know that sample is predominantly cobble.

MR. ANDES: But let me clarify. You're not saying that ten is better than one here?

THE WITNESS: No.

BY MR. ETTINGER:

Q. That's how I don't understand you get from your numbers -- I understand giving things in number for denotation purposes. I don't understand how we get from our findings as to what is down there to our qualitative reading that I think your Y axis is there?

A. What we measure in the field has to be translated. For our study, what we measured in the field had to be translated into numerical values because we were using statistical techniques to compare that to fish. So we're looking for variables that vary and that can be compared to the fish data, but the numbers don't necessarily have to run from what is considered poor to good or poor to excellent. They just have to differentiate.

Q. Okay. So I get it now. The zero to ten doesn't represent any sort of quality reading, it's just all we know from this is that in the Chicago River it's inorganic silt throughout that entire stretch?

A. That that's the dominant characteristic.

Q. Okay. So if I can find one that is uniform. The South Branch it's entirely number three, which is inorganic silt?

A. That would be the dominant sediment characteristic.

Q. Okay. I see. Whereas the Sanitary and Ship Canal varies between other inorganic silt and sand?

A. Yes.

Q. So we can use this table, though, to determine what is the predominant surface or substrate as to each of the stretches in the water that you measured?

A. Yes. Let me clarify. This refers to what we call the dominant deep substrate which was the substrate at the deepest part of the channel. There was also dominant shallow

substrate which was measured near the bank. So that might be a different substrate quality.

Q. Skip 26 and go to 27. Did you look at the potential effects of endocrine disrupting chemicals in the system?

A. No.

Q. I have a reference here, but I don't know where I'm referring to. Okay. On page 64 of the report states referring to certain head capsule deformities of macroinvertebrates using sonar particulars, these observations suggest that anthropogenic chemicals in CAWS sediments are effecting macroinvertebrate populations directly and suggest an indirect effect on fish as well. What's the suggested indirect effect upon fish of anthropogenic chemicals?

A. The fact that certain chemicals appear to be directly effecting macroinvertebrates suggests that they can indirectly effect fish. As I stated before, some fish species rely on the macroinvertebrates for food sources and if the chemicals diminish quality or abundance of macroinvertebrates, that can diminish the food source. They can also -- the chemicals in some

cases can reside in the tissue of the macroinvertebrates which are then ingested by the fish and in some cases those can accumulate in the fish tissue and have undesirable fish effects.

Q. So by indirect effect, you mean it effects the fish through its effect on the macroinvertebrates?

A. Yes.

Q. I think we've done this, but I'm not sure. On page 65, the Habitat Evaluation Report identifies a habitat limitation, quote, suspended sediments that result from a combination of urban surface runoff discharges, CSO's, treated discharges and navigation resuspension. Did you measure the suspended sediment levels?

A. No.

Q. Are suspended sediment levels uniformly high throughout the system or are they worse in some areas than others?

A. Although we didn't measure them, the District routinely measures total suspended solids and they also have turbidity measurements and the levels are not the same throughout the system.

Q. Do you have an understanding of what

parts are better than others?

A. Generally, if I recall from the data, the TSS or total suspended solids data are typically much better in the Chicago River than other parts of the system.

Q. The Chicago River, you mean the part of the river that is closest to the lake?

A. Yes.

MS. TIPSORD: Mr. Harley, you have a follow up?

MR. HARLEY: Keith Harley, attorney for the Southeast Environmental Task Force. In these four categories that you identified; urban surface runoff, second, CSO's, third, treated discharges, poor navigation resuspension, for the record, did you try to evaluate the relative contributions among these four sources of sediment?

THE WITNESS: No, we did not attempt to measure the relative contribution among them nor did we confirm that each of those is contributing. It's simply a general statement about what is typically contributing to suspended sediments in urban systems.

MR. HARLEY: Those suspended sediments that you identify, are those ultimately faded to become the fine sediments that you described earlier in your testimony that would effect habitat as they settle?

THE WITNESS: I would say that in part they may contribute to sediment solids on the bottom of the channel, but we have no way of knowing if something is in suspension right now. We have no way of knowing without further study whether it is going to settle eventually. So I can't exactly answer your question.

MR. HARLEY: Based on your general knowledge, if you were to eliminate CSO overflows, would that improve suspended sediment conditions in the waterbody?

THE WITNESS: I can't answer that.

MR. HARLEY: Why can't you answer that?

THE WITNESS: I don't know the answer to that. I haven't made a study of whether that would be the case.

MR. HARLEY: Thank you.

MS. TIPSORD: Mr. Ettinger?

BY MR. ETTINGER:

Q. Okay. I think my next question is what is the import of Figures 4.3 and 4.4 on page 67 here? I'll ask a slightly different question. Here, the Y axis actually means something as a percentage as opposed to a grading, right?

A. Yes.

Q. So -- I take that back. What does the Y axis mean here on the submerged aquatic macrophyte cover? Is that a percentage of how much macrophyte cover there is?

A. It's a percentage of macrophyte cover within a sample reach.

Q. Okay. So just to look on the bright side here. We've got the North Shore Channel at Touhy Avenue. That looks to be somewhere maybe about 13 percent, is that correct?

A. It looks like it's about right.

Q. So that means there's like something like 13 percent submerged aquatic macrophyte cover in that particular stretch of the North Shore Channel?

A. Yes. For the 400 meter sample reach.

Q. And then these other stretches that have nothing or show no bar, they have no macrophyte cover that you could find?

A. None were observed.

Q. Then, on 4-4 it says overhanging cover and, again, this represents a percentage. The Y axis represents a percentage figure of how much overhanging coverage you found?

A. Yes.

Q. I'll skip 31. On page 78, you have data on summary of major flows into and out of the CAWS. Here you do look at flows of tributaries. I guess I think I asked this question before, but I just want to make sure. What did you look at as to the tributaries of the CAWS? Just flows or what?

A. I should clarify. That table is meant to describe sort of the inputs to the system, but we didn't use the data in that table quantitatively in our evaluation. So we didn't use flows from tributaries as a metric in our quantitative analysis.

Q. So this is just background information?

A. Yes.

Q. Did you look at the tributaries at all?

A. No.

Q. So no more tributary questions. So also my next question had to do with 4-8 and 4-9, but we'll skip them because you didn't actually do anything with the flow data, is that correct?

A. Tributary flow data, no.

Q. What about the flow at the CAWS sampling stations in Figure 4.8 and Figure 4.9, is that just background information or did that figure into our conclusions in some way?

A. It is not background information. Well, it is not just background information and although it didn't ultimately figure into the conclusions, we -- flow is not measured at all of the sampling stations, but computer models have been developed to calculate flows and we attempted to use some of the output from one of those models to characterize flow conditions at fish sampling stations. Ultimately, though, we didn't see that it was a good indicator of fish. It wasn't statistically related in anyway and we ended up

not using it.

Q. Now, some of the reaches of the CAWS are rather stagnant. No flow basically. But you couldn't find any difference between those reaches and other reaches in terms of habitat quality?

A. In terms of fish quality?

Q. Could it be that some of the stagnant areas have other factors that counter their stagnant nature?

A. I'm not sure I understand your question.

Q. That's all right. I'll move on to other questions. I'll go back. The North Shore Channel above the north side sewerage treatment plant, that's one of the stagnant areas, right?

A. I don't recall.

Q. Then, we'll drop it.

MS. FRANZETTI: Albert, if I could just have a follow up question? Did you consider at all whether sudden significant changes in flow was a factor effecting the fish?

THE WITNESS: We attempted to do that. One of the measures of hydrology that we tried to look at was what is called flashiness

which is what I think you're referring to which is an abrupt change to flow, short lived rapid acceleration and then deceleration of quality of flow, but we just -- we didn't observe it to be a strong factor.

BY MR. ETTINGER:

Q. I have --

MS. FRANZETTI: I'm sorry. Can I ask one more?

MR. ETTINGER: Sure.

MS. FRANZETTI: When you say you looked at it, can you give us a little bit of a description as to what extent you looked at it.

THE WITNESS: We, as I said, used modeling output and calculated -- and I can't recall the exact calculation we made, but we tried to calculate a representation of that flashiness at each sampling location and use that as a quantitative measure of the flashiness and then use that measure as a habitat available.

MS. FRANZETTI: Okay. Albert, I'm sorry. Can I go one more? Am I right that generally in your approach to coming up with your index, that as you went along you had a number of

variables that you were looking at, correct?

THE WITNESS: Yes.

MS. FRANZETTI: So when you speak about a variable like this, the flashiness dropping out, that you're referring to your process of culling down the large number of variables you had to the smaller number that you actually used due in your index?

THE WITNESS: Yes, that's correct.

MS. FRANZETTI: So the one that you saw or determined had a more significant correlation between the variable and the quality of the fish community, those were more likely to survive the cut and wind up among those variables you did use to come up with your index?

THE WITNESS: Yes, that's correct.

MS. FRANZETTI: Thank you.

THE WITNESS: I should also point out on page 112 of our report, the Habitat Evaluation Report, one of the issues we encountered with flashiness was flashiness is generally considered to be a bad thing for fish, but what we observed was when we compared it to the fish data it appeared to have the opposite

effect, that it was -- where flashiness was more prevalent, the fish quality appeared to be better.

So this was a counter intuitive result and we saw some other examples of this and sometimes they're explainable. In this case, we, I think, attributed it to a numerical anomaly. That it was one of those things that wasn't strongly enough defined as to relationship to fish that we couldn't draw conclusions from it.

BY MR. ETTINGER:

Q. Let's continue this flashy discussion on our dull lives. Where did you find more flashiness?

MR. ANDES: You're talking about your life?

MR. ETTINGER: You're right. I should speak for myself.

BY MR. ETTINGER:

Q. Let's discuss flashiness. Where did you find things were particularly flashy?

A. I don't recall. I'd have to look at the data.

Q. Michigan Avenue or something?

A. As I said, I don't recall.

Q. Okay. So you don't recall and it doesn't seem to have had an effect?

A. Right.

Q. We'll get back to these pretty charts which are flashy to me. On page 85, bank pocket areas in CAWS sampling reaches and off channel bays and parts of some reaches.

First of all, what is the difference between a bank pocket area and an off channel bay?

A. A bank pocket area is a small depression in the bank that can serve as temporary refuge for fish and we had some -- off the top of my head, I don't recall the dimensions, but we had certain dimensions that we applied that had to be larger than a certain size to count. So when we did our habitat evaluation, we counted these in each sampling reach and that would be the measure that we used.

Q. Now, if a bank pocket area got really big, it became an off channel bay or what would be the distinction?

A. An off channel bay refers to something different. An off channel bay in a

natural system would be an abatement off the main body of the channel so fish could swim into a larger area and they would seek refuge. Those don't really exist in the CAWS, but there are areas that are created by some of the uses and structures in the CAWS that effectively shield -- provide an opportunity for fish to seek refuge off the main channel so that they can kind of get away from passing boats or something like that.

Q. Okay. Again, I keep having problems with this Y axis. What does the Y axis represent in the back pocket areas in Figure 4-11?

MR. ANDES: This is, by the way, bank pocket areas.

MR. ETTINGER: I'm sorry. Bank pocket areas.

BY THE WITNESS:

A. In both Figure 4-11 and 4-12, the number of the Y axis represents the counted quantity of these variables in each sampling reach.

BY MR. ETTINGER:

Q. So is it number of bank pocket areas per mile or per segment?

A. It would be for in the 400 meter sampling reach.

Q. So is that an average for the segment? Some of the segments are bigger than 400 meters?

A. No. When I say 400 meters, I mean the 400 meter sampling reach.

Q. Okay.

A. So if the number is 30, the field crew counted 30 in the 400 meter sampling reach.

Q. And then each of these segment boxes here actually represents a 400 meter sampling reach?

A. That's correct, and they correspond to the District's annual water quality monitoring stations. So those are -- the numbers along the bottom are numeric designation of that and then those numbers correspond to that as well.

Q. So some of these areas are actually -- I guess a lot of them are longer than 400 meters, right? So your sampling reach is not as large as the whole segment?

A. That's right.

Q. So, actually, when we say Cal-Sag

Channel at Alsip, what we mean by that is that is not the whole segment, that's the 400 meters around that particular sampling station?

A. Yes.

Q. Okay. Just to confirm. On page 89, Figure 4.13, here the Y axis is tonnage of navigation traffic, is that correct?

A. It's commercial tonnage. Commercial tonnage as reported by the Corps of Engineers.

Q. So those are just figures you got from the Corps?

A. That's correct.

Q. And there's basically no commercial traffic on the North Shore Channel or the North Branch above Goose Island?

A. Not that the Corps of Engineers knows of.

Q. You used the ship traffic for 2001 and 2004?

A. Yes.

Q. Do you know whether the ship traffic has changed any since 2004?

A. No.

Q. On page 95 of the Habitat Evaluation

Report, MWR fish collections is discussed. To your understanding, was all of the data collected through electrofishing?

A. Yes, all the data in our study was collected through electrofishing.

Q. Okay. On page 97, we have Figure 5-1 nonhybrid fish observation in the CAWS study. We have a number of fish here. Which of the ones that are listed here are present in such a small quantity that they would have been filtered out from your calculations?

A. I don't recall the answer to that. I'd have to go back and look at the data.

Q. So, presumably, the nile tilapia didn't have a great deal of weight here in your final conclusions, but we don't know whether the yellow perch got into the diversity study or not?

A. Actually, I do recall because I think one of your questions specifically asked about that in the Coho. So I checked on that and I do know the yellow perch was kept in.

Q. The yellow perch was kept in?

A. But it's likely true that they had little effect because of the small number of

samples that it occurred in.

Q. Alewife, chinook salmon, these all would have figured into the count as far as the diversity figures go?

A. Again, the only two that I checked recently were the coho and the yellow perch because you or another person asked about them. I didn't look at those other species.

Q. Okay. Yellow perch as shown by this chart there were fewer of them than alewives, so presumably you counted everything to the right at least of the yellow perch?

A. Again, the number of individuals wasn't the measure we used. We looked at how much metrics -- let me say this differently. When we were evaluating fish metrics, we eliminated metrics that were representing two or fewer species, but the number of fish caught wasn't a determining factor to whether the data was kept or not.

Q. Skip 40 and did Limnotech create any new fish metrics for its analysis or did it use established tests for the health of the fishery?

A. On pages 19 and 20 of Appendix A of

the Habitat Evaluation, we report the metrics that we used and there were 39 fish metrics that we got from other established indexes and studies and then we created seven additional metrics for use in this study.

Q. What is the five ecological function categories mentioned on page 99?

A. Ecological -- the five ecological function categories are described on page 99 and listed in Table 5.2 on page 100. They are abundance and condition, reproductive function, trophic function, indicator species, and species richness and composition.

Q. So you said they were listed where?

A. Table 5.2 on page 100.

Q. Okay.

A. In this second category, it lists the correspondence of the five categories to the fish metrics we looked at or we used, but you'll see there are only five variations in the second column and those are the ecological function categories.

Q. On -- skip down now to question 45. On page 107 regarding Table 6.2, which attributes

are positive and which are negative?

A. In that table, the attributes that we've considered negative would be percent diseased or with eroded fins, lesions or tumors and the proportion of Illinois tolerant species and the Illinois ratio of generalist feeders and the others would be considered positive.

Q. We've done the perch and coho enough.

MR. ANDES: Would it be possible to take a break soon?

MR. ETTINGER: Yes.

MS. TIPSORD: All right. Let's take ten minutes right now then.

(Whereupon, a break was taken after which the following proceedings were had.)

MS. TIPSORD: I think we're ready to go back on the record. Whenever you're ready, Mr. Ettinger.

BY MR. ETTINGER:

Q. All right. Let's go down to -- let's go down to question 49, which refers to a statement made on page 109, which summarizes some

discussion of Secchi depth and macrophytes. It says in this study a metric reflecting macrophyte growth was already included so Secchi was in this sense redundant. Could you explain that a little better as to what it would mean for Secchi to be redundant in this case?

A. Yes, Secchi is a measurement of turbidity. The ability of light to penetrate the water column as I said previously and macrophytes -- submerged macrophytes, large plants, need sunlight to grow. So we were directly measuring those plants and so the use of Secchi as a measure of the ability of plants to grow was unnecessary.

Q. Are there potential problems with macrophytes in addition to lack of sunlight?

A. Yes.

Q. What would those be?

A. In some cases, you could have substrates that are unfavorable to the macrophytes. You could have active clearing of macrophytes by some human activity, for example.

Q. Skip down now to page 112. In general, is large substrate good or bad?

A. In general, we expect large substrate to be a good thing --

Q. Why is that?

A. -- for fish.

Q. Why is that?

A. Large substrate refers to cobbles, boulders. Boulders can provide refuge and shelter for fish. Cobbles and gravel can provide habitat for spawning for fish and for forging. So those conditions are generally believed to be more favorable than, for example, fine silt.

Q. I was a little confused by this statement on page 112. The percent large substrate in deepwater appeared as both negatively and positively correlated and positively correlated variable of fish depending on which other habitat variables were used in a particular regression. What is that about?

A. It refers to the multiple linear regression where we compared many habitat variables at once with fish data and what we observed with that metric, that percent large substrate in deep water was that sometimes it appeared to be positively related to fish

condition and sometimes it appeared to be negatively related to fish condition depending on what other variables were used in the regression.

This sometimes happens because of the data and it happens where the data aren't strongly enough differentiated. So we call that -- I call that an unreliable variable.

Q. We're not discussing that there's some change over time, the boulders aren't moving?

A. No.

Q. It's just -- is it a statistical problem or do you think there's something underlying we're not getting the results we would normally generally expect from the size of the gravel?

A. I think it reflects the interplay between variables and habitat studies because it reflects on the difficulty of focusing on a single variable. It shows you that in some cases a variable that reflects a condition that we expect to be a positive factor in fish health can, in fact, because of other things going on be positive or negative. So I think that's what is going on.

MR. ANDES: To expand on that a

little bit. Are you saying that -- I want you to explain two things. One is, was it used or not used in the regression analysis and I think part of your discussion is why you couldn't use it in the regression analysis, but you did factor it in later, correct?

THE WITNESS: That's right. We attempted to use it in the regression analysis and that -- those results were where we saw it being both positive and negative. So, ultimately, we decided it was unreliable and removed it from the analysis, but because it's generally believed to be something that's desirable for fish, we added it into the index ultimately as a measure with the expectation that it should be accounted for in some way because it is generally believed to be a positive factor.

BY MR. ETTINGER:

Q. So what does adding it into the index do?

A. When we built the index, we started with six habitat variables that were based on the statistics which we believe were the strongest indicators of habitat condition, but when we

looked at those, we recognized there was, for example, no indication of substrate quality and we said, well, it's a good thing to have some measure of substrate quality when you're going out and comparing sites or that might be something that someone would ultimately want to try to improve and you'd want to have a measure of that ultimately. So we added some variables into the index that weren't present in the statistical -- the multiple linear regression.

MS. FRANZETTI: Susan Franzetti for Midwest Generation. So did you add back into the index the large substrate variable?

THE WITNESS: Yes.

MS. FRANZETTI: Okay. When you said that including the large substrate variable in the multiple linear regression gave you both positive and negative correlations, were you able to pinpoint the cause of getting both positive and negative correlations to the inclusion of the large substrate variable?

THE WITNESS: No.

MS. FRANZETTI: So how do you know -- Strike that. Do you know that the

inclusion of the large substrate variable was a factor in getting both positive and negative correlations in your multiple linear regression?

MR. ANDES: If you need to explain it in two steps.

MS. FRANZETTI: That is what is getting confusing here. I can't tell how you knew that large substrates was causing that apparent inconsistency in terms of getting positive and negative correlation.

THE WITNESS: When we conducted the multiple linear regression, we looked at a wide range of numbers of variables and types of variables. We didn't just plug in a set of numbers and look and then plug in another set. We ran dozens of them with different combinations and then we tried to identify which variables seem to be giving the most consistent results and that's when we observed this large substrate variable sometimes appeared as a negative and sometimes appeared as a positive. Why it was doing that specifically we didn't drill down and figure out, but we could identify that it was having that effect or that it was having that response I

should say. That's a better way to say it. A response in the regression. And it didn't -- because of this sort of vacillating between positive and negative depending on what other variables were in the regression we decided that from a statistical standpoint it was an unreliable variable.

MR. ANDES: In your statistical analysis resulting in you selecting six variables to focus your index on?

MS. FRANZETTI: That's right.

MR. ANDES: Later, you added five more variables into the ultimate index that you thought for a variety of qualitative reasons were important?

THE WITNESS: That's right.

MR. ANDES: And that included the large substrate?

THE WITNESS: Yes.

MS. WILLIAMS: Would you mind for the record now just listing which five were added in for qualitative reasons?

MS. TIPSORD: You need to identify yourself for the record, please.

MS. WILLIAMS: I'm Deborah Williams from Illinois EPA.

THE WITNESS: The five variables that we included in the index that didn't come from the statistical analysis were; percent overhanging vegetation, bank pocket areas, large substrate in shallow parts of the channel, large substrate in deep parts of the channel and organic sludge.

MS. WILLIAMS: Thank you.

MS. TIPSORD: Mr. Ettinger?

BY MR. ETTINGER:

Q. Okay. I'm going to skip down to 56 now and say and also call your attention to Table 6.4 on page 114 of the Habitat Evaluation Report. And Table 6.4 says summary of regression model for system-wide comparison of fish and habitat data for 2001 to 2007. As I understand this, you have various calculations showing the importance of those various habitat factors for fish metric, is that correct?

A. Yes, essentially that's correct.

Q. Now, I'm going to read the question. It's kind of a runon question. So I'm going to

read the whole thing for purposes of the record and then you can respond to it however you think is most rationale. Was any effort made to break down -- break the data down by segments of the CAWS, is it thought that all of the factors are equally important to each segment and is there enough data to breakout R squared numbers for particular segments?

A. We did not evaluate the CAWS on a reach by reach basis because there wasn't enough data to do so and we don't have enough data to know whether all the factors are equally important in each segment of the CAWS.

Q. So it's possible that there are some segments in which changing one factor would be more important than other segments?

A. Yes.

Q. Were you able to break that down as to any of the water quality factors?

A. No.

Q. So we're really looking at the effect of habitat versus the effect of dissolved oxygen on the system as a whole?

A. Yes.

Q. On question 57, I made a mistake and misquoted you. The question should be -- it says what does it mean on page 117 that it is assumed the residuals are independent?

A. The test for residual independence is a test to determine -- it's a test of the regression. The residuals are the difference between the predicted and measured values and what you want to determine is that there is no pattern among those things that you're not accounting for in your regression and that's why in Figure 6.5 we show a scatter plot of these residuals that is essentially random. There's no evident pattern to it.

What that means is that if there were a pattern, that could indicate that there is something that you haven't accounted for in your regression or there's some other maybe a co-dependance of variables that you haven't included. So you don't want to see a pattern. You don't want to see a straight line in that analysis.

Q. Then, we get back to -- I kind of touched on this. Was the effect of dissolved

oxygen broken down for any particular segment?

A. No, it wasn't.

Q. Now, when you had the dissolved oxygen data in front of you, did you have a profile of the site or is that just one data point for each site?

A. The --

Q. Was the DO taken at different depths within the site or across the stretch of the river or was it just one data point?

A. We used the District's CDOM, or CDOM, data and if I recall correctly those measurements are taken at fixed depths at specific points in the system. So I don't believe -- I think that the depth at which the measurements are taken may vary from station to station, but we didn't use profile data if you want. I think that's what you're getting at.

Q. Depth profiling?

A. Depth profiling, no.

MR. ANDES: We can certainly when Ms. Wasik is here she can answer more questions about the District's data.

MR. ETTINGER: That is important,

but I'm asking Mr. Bell what he saw.

BY MR. ETTINGER:

Q. So is it your understanding that the depths vary from site to site? I believe you said that.

A. My recollection is that's the case.

Q. Do you know whether it's -- did you look at how the dissolved oxygen data related to the effectiveness of your electrofishing gear?

A. No.

Q. Let me -- it's not your electrofishing gear. It was the District that did the electrofishing again?

A. The District did the electrofishing for the data from 2001 to 2007 and then in 2008 we collected some of our own in conjunction with our activities. So we both electrofished.

Q. Did you do any of the electrofishing personally?

A. Personally, no.

Q. Are you knowledgeable about electrofishing?

A. I'm not an expert in electrofishing.

Q. Do you know at what depths it's

effective?

A. I've read that it's effective to depths of three or four meters.

Q. Three or four meters. Do you know how the dissolved oxygen levels related to the depths at which your electrofishing is effective?

A. I don't.

MR. ANDES: I think both Dr. Mackey as well as Ms. Wasik can answer further questions about the electrofishing in the District's data.

MR. ETTINGER: Good.

BY MR. ETTINGER:

Q. I think we'll skip to 62 which refers to page one, statements on page 21 in which you discuss the fish variability at the various sites. I guess the question I want to ask is would you expect to see similar levels of fish variability in data taken in other waterbodies?

A. I'd say it's not unusual to see substantial variation in fish over time. In general, I would add, though, that the factors that contribute to that may differ from waterbody to waterbody, but the variability is not unusual to observe.

Q. We're not able to -- on page 124 of the Habitat Evaluation Report stated that a wide range of water quality metrics were evaluated with respect to fish data. I believe we discovered earlier that the only water quality metrics we actually looked at were dissolved oxygen and heat, is that true?

A. Those were the primary water quality parameters that we evaluated. We considered several others that are described in Appendix C. We subsequently -- I think I might have mentioned this previously to you during the last hearings.

We've evaluated other water quality parameters using the CART analysis that was attached to my testimony. We've used that same analysis to evaluate dissolved oxygen, temperature, ammonia, chloride and turbidity as well to evaluate whether any of those factors in combination with others might be important.

Q. Is this discussion contained in the analysis of the relationship between fish and water quality?

A. Yes. Appendix C describes the original analyses.

Q. Getting back to temperature. What temperature factors did you look at?

A. I'll have to find the list. I think we did, but I don't know where it is.

MR. ANDES: We can provide those.

BY THE WITNESS:

A. I just don't have the list in front of me. I can recall some of them and I can name them, but it wouldn't be a complete list from memory.

BY MR. ETTINGER:

Q. Okay. You mentioned that the -- on page, I think, 24 of this analysis the CDOM temperature data from 2001 through 2007 were evaluated to assess the rates -- what the rates of compliance would have been had the proposed standards been in place during the data period and how that would relate to fish in the CAWS.

We're looking now at the analysis of relationship between fish and water quality. Does anybody know this is probably an exhibit already?

A. That's Attachment A.

MR. ANDES: That's Attachment A

to -- Attachment C.

MS. WILLIAMS: None of it has been entered as an exhibit.

MS. TIPSORD: It's all part of Public Comment 284, correct?

MR. ANDES: Right.

MR. ETTINGER: This is all part of Public Comment 284, I believe.

MR. ANDES: Yes. Attachment C, I believe.

MR. ETTINGER: I'll just refer to it as Attachment C of Public Comment 284.

MS. WILLIAMS: There's probably two attachments because the Habitat Evaluation Report and Habitat Improvement Report are both Public Comment 284.

MS. TIPSORD: And, actually, the analysis of the relationship between fish and water quality is actually Appendix C, not Attachment C.

MR. ETTINGER: Okay. Appendix C.

BY MR. ETTINGER:

Q. Looking to -- do you have that in front of you or can you cause it to be made to be

put in front of you?

A. My copy doesn't have the appendixes so I think we have it electronically.

MS. TIPSORD: I have a copy if you need it.

BY THE WITNESS:

A. I have it.

BY MR. ETTINGER:

Q. We're on page 24 and I'm just trying to understand what was analyzed in terms of this heat versus fish in the CAWS that you looked at there and maybe the best thing for me to do is let you read this sentence under 3.1.2 proposed temperature standards and maybe you could tell us a little bit about what was done with regard to that?

A. So you're asking me to read the first sentence?

Q. Actually, the sentence that I just read into the record, the CDOM temperature data were evaluated to asses what rate the compliance would have been had the proposed standards been in place during the data period and how that would relate to fish in the CAWS?

A. Okay.

Q. So what more can you tell us about that?

A. So we used the 2001 to 2007 temperature data from the CDOM stations to calculate the percent of time that the proposed daily maximum temperature standard would have been exceeded in the 12 months, the 12 months preceding a fish sampling event in each year and compared that percentage of time that the standard would be exceeded statistically with fish metrics.

Q. Okay. So let's say we had a particular site and it exceeded proposed temperature standard 20 percent of the time. You would have -- that would be one data point you'd have and then another site that exceeded the proposed heat standard no percent of the time or always comply with the current standards and you compared a -- for a fancy way of saying it statistics that you compare basically those types of situations?

A. That's correct, and we did that to determine whether there was a correlation between the fish metrics and that percent attainment or

percent exceedance which is what I think we used.

Q. Was there any effort made to look at what the fish metrics were at the time the exceedances were occurring?

A. No. What we were doing is we were trying to determine whether there was an indication the temperature should be brought along with the analysis with dissolved oxygen.

Q. Okay. Fish like warmer temperatures in the winter, don't they?

A. I suppose some fish do.

Q. Some fish do. So you'd expect on a yearly basis that those fish would be more likely to be in the warm spots than the cool spots, wouldn't you?

A. Perhaps.

MS. WILLIAMS: Can I ask a follow up, Albert?

MS. TIPSORD: Go ahead.

MS. WILLIAMS: Didn't you testify last time that the temperature DO data was not taken in the same location as the fish data, am I correct?

THE WITNESS: That's correct. The

sampling stations are at different locations. They're close, but they're not the same.

BY MR. ETTINGER:

Q. You're here for one purpose, but how much do you know about temperature and fish? Is that something you've studied?

A. I'm not an expert.

MR. ANDES: I'm sure we'll be hearing more about temperature later.

BY MR. ETTINGER:

Q. Perhaps, but perhaps not from Mr. Bell.

BY MR. ETTINGER:

Q. Let's talk about -- let's go down to 69. I think we touched on this in a few ways, but just to ask more generally. Might areas outside the CAWS to some degree provide off channel habitat?

A. Yes, it's possible.

MS. TIPSORD: Mr. Harley has a follow up.

MR. HARLEY: Before we move onto Albert's questions regarding the Habitat Improvement Report, I want to go back to question

62 which is would you expect to see similar levels of fish variability in data taken from other waterbodies? In answering that question, I was wondering if you would clarify or elaborate on something which is contained in your pre-filed testimony.

There's a technical memo in your pre-filed testimony January 14th, 2010, technical memo and the conclusions to that memo on page seven you state there is a dominant fish community that occurs throughout the CAWS. This population includes species representing multiple trophic levels --

THE COURT REPORTER: I'm sorry. Louder.

MR. HARLEY: -- and predator/prey relationships commonly observed in natural waterways within the region. Is that a response to question 62 in terms of how CAWS compares to other waterbodies that occur in the region?

THE WITNESS: Question 62 asked if we would expect to see fish variability in other waterbodies and the answer to that is you would expect to see variability in most waterbodies, I

think, and what you're referring to is this comparison of our observations of what makes up the fish community in the CAWS and the fact that we identified this dominant fish community that has representation of different trophic levels.

So what we would expect to see in other waterbodies is that there would likely be a dominant group of fish that would be representing various trophic levels, but probably or -- let me say this. Not necessarily the same group that we see in the CAWS. Does that answer your question?

MR. HARLEY: In what sense is CAWS similar to natural waterways within the region as stated in this technical memo?

THE WITNESS: In the context of that technical memo, the CAWS is similar to other waterways because it contains a dominant fish community that represents the major trophic levels that you would expect to see.

MR. HARLEY: On page eight of the same technical memo you talk about ubiquity of the dominant communities suggests the CAWS is supporting a viable, structurally complete and

regionally appropriate fish community under the existing unmanaged conditions. Do you recall that?

THE WITNESS: I'll take your word for it. I don't have the memo in front of me, but I assume it's correct.

MR. HARLEY: In what sense is the CAWS similar to other regional waterbodies in terms of the dominant community that exists within the CAWS?

THE WITNESS: The sentence that you're referring to, and I don't have the memo in front of me, I apologize, but my recollection is that the intent of that statement was the fish that we observed in the dominant fish community and actually the other clusters of fish that we observed are different fish than we see anywhere else. They're the same types of fish that occur in other systems regionally not to say that the dominant community is the same, but it appears within the CAWS that that dominant community is ubiquitous. I mean, at all system stations it is the dominant fish group and it is apparently stable because it represents a variety of trophic

levels.

MR. HARLEY: What is meant by the specific phrase regionally appropriate?

THE WITNESS: I think that -- again, going from recollection the phrase regionally appropriate refers to the fact that within the CAWS given the nature of the system in the context of systems that are different elsewhere in the region for that system that's probably an appropriate fish community. It's apparently what fish succeed there right now.

MR. HARLEY: Thank you.

MS. TIPSORD: Ms. Franzetti?

MS. FRANZETTI: Mr. Bell, do I understand correctly then that when you in that sentence refer to regionally, the region you're referring to is the CAWS?

THE WITNESS: Again, I don't have it in front of me. My recollection is that's the case, though.

MS. FRANZETTI: Okay.

MS. TIPSORD: Mr. Ettinger, back to you.

BY MR. ETTINGER:

Q. Okay. This has been very helpful as they ask you questions. I was able to eliminate more of my redundant questions. This is exciting. Still, we go to page 138. We touched on this a little, but I just want to be clear. This is page 138 of the Habitat Evaluation Report which has Figure 7.2 results of CAWS habitat index score for major CAWS reaches.

MS. FRANZETTI: Albert, I'm sorry to interrupt, but for us trying to follow, is this a pre-filed question or no?

MR. ETTINGER: I'm building up to a pre-filed question. It's going to be pre-filed question 68, but I wanted everybody to get to the right place in their programs.

MR. ANDES: This is like a prequel.

MR. ETTINGER: I was trying to be helpful and tell you where to start looking before I read question 168 -- 68.

BY MR. ETTINGER:

Q. What is the significance of the CAWS habitat index scores?

A. I'm referring to page 138. We see a

histogram of those scores. The significance is that these scores give you a way to differentiate overall habitat quality between major reaches in the CAWS using the variables that we identified as being the most important variables to fish in the CAWS.

Q. Okay. Now, if I had a hundred, nobody scores a hundred, but if I had a hundred, would that mean I have all of the positive factors found in the CAWS, right?

A. Yes.

Q. But there are positive habitat factors that are not found in the CAWS, is that correct?

A. Yes.

MR. ANDES: And there are also negative habitat factors in the CAWS that are not found elsewhere?

THE WITNESS: Yes.

MR. ETTINGER: I'll ask that question again. I thought it was interesting what you were getting at so do you want to go ahead?

MR. ANDES: There are negative habitat aspects in the CAWS that are also not

addressed in the index, correct?

THE WITNESS: Yes.

BY MR. ETTINGER:

Q. Right. So -- and that hundred actually reflects both the absence of negative as well as the presence of positive?

A. Yes.

Q. So the Upper North Shore Channel which is near where I live, so I'm happy to see that it scores best, it is the best within the CAWS and it has the most of the positive factors and the least of the negative factors present in the CAWS?

A. As reflected in the index.

Q. As reflected in the index. Okay. Now, I, of course, was disturbed to hear the potential for percentage increase was the lowest in this segment, but isn't that almost a factor of mathematics when you're at 70 it's a lot harder to make a bigger percentage improvement than when you're at two?

A. I thought that's what you might be asking. Yes, I would agree. I think it's a reflection of the fact the index measures

conditions within the CAWS, not within the universe of possibilities.

Q. Right. Now, is there some reason why we couldn't add something to the CAWS that doesn't currently exist in the CAWS?

MR. ANDES: Something being a body of water?

BY MR. ETTINGER:

Q. Something positive like, let's say, hypothetically that the presence of a sunken battleship is a positive factor. Analytically, is there some reason why we couldn't put that somewhere in the CAWS in our analysis?

A. I think you had me up until our analysis. I don't know what that means.

Q. Well, here is what confused me. It seems to me when we did our Habitat Improvement Report we looked at the same factors as were currently in the CAWS, right?

MR. ANDES: Let me stop you there. I'm not sure what factors you mean. They did discuss a variety of possible actions to improve habitat in that report that were not addressed in the other report.

BY MR. ETTINGER:

Q. Well, let's use a slightly less ludicrous example. We decide one of the things the CAWS doesn't have that might be is a good habitat factor in other waters is riffle habitat. Did you consider whether riffle habitat might be created in the CAWS?

A. No.

Q. Why not?

A. I don't think -- well, first of all, it's not something that can be created system-wide and we try to -- most of our evaluation was focusing system-wide. So the index is posed to be a representation of system-wide conditions.

Now, you could add riffles -- I don't know if you could add riffles, but we did look at the possibility of adding channel complexity which is usually what generates riffles and pools in a natural system and the nature of -- most of the reaches of the CAWS are very straight and don't lend themselves to sort of the riffle pool sequencing that you'd normally see, but I'm not really answering your question directly, but I can't really recall why we didn't specifically

look at riffles, but it wouldn't be the first thing I'd consider adding.

Q. I just used that as an example, but there are, for example, critters that breed in riffles and then spend the rest of their life in another area or another type of body of water.

A. Right. And we did look at the possibility of adding modifying substrates. So adding large substrates. So adding gravel and usually these riffles -- gravel is what you use often when you're building rivers and stream restoration. So we did look at the possibility of adding substrate.

Q. Did you look at constructed wetlands?

A. No.

Q. Why not?

A. Are you talking about constructive wetlands within the channels of the CAWS?

Q. Anywhere in the system.

A. No, we didn't. We were looking at improvements that could potentially be made within the waterways themselves.

Q. You actually are -- reading your

resume, you're pretty knowledgeable on constructive wetlands, aren't you? You've done it in Columbus, Indiana, Alton, Illinois?

A. For different reasons other than habitat.

Q. For different reasons other than habitat. What reasons would those be?

A. In those cases, those were for water quality improvement.

Q. What was the problem?

A. A variety. Storm water was one. Another one was CSO treatment.

Q. You don't have anything like that in the CAWS?

A. Again, treating quality water -- improving water quality, wasn't the focus of the habitat improvement study.

MR. ANDES: So you -- am I correct the constructive wetlands projects were routing effluents through constructive wetlands?

THE WITNESS: That's correct.

MR. ANDES: Not routing entire waterbodies through constructive wetlands?

BY MR. ETTINGER:

Q. Well, if you had a constructive wetland that was connected to the waterbody, might that not add some habitat to the system?

A. Yes.

MR. ANDES: Do you have any particular place where we would add?

MR. ETTINGER: Yes, I have some ideas. So do some other people.

MR. ANDES: You don't want to ask Mr. Bell about them, though?

MR. ETTINGER: I'm going to get there. It's one of my pre-filed questions when we get down to our program. We've jumped off a little bit.

BY MR. ETTINGER:

Q. Down to regarding the Habitat Improvement Report. I've cut out one and two as redundant and the first part of three has also been covered, but the last sentence in three of the questions regarding the Habitat Improvement Report did you consider whether any changes in operations by the commercial or navigational operations using the manmade structures would

improve habitat?

A. I don't know what you necessarily mean by -- could you clarify what you mean by changes in operations?

Q. Yes. I didn't want to set too much prologue. I was criticized for that. So now I'll have to explain. I think we decided that the manmade structures are effecting the fish conditions, but we're not quite sure why, but -- correct me if I'm missummarizing any of your testimony, but we think it has to do with the operations that are using those manmade structures, is that correct?

A. It's the possibility that that's the case, yes.

Q. You wouldn't -- you were surprised to find that manmade structures were as an important a factor as they turned out to be in your study?

A. I'm not sure I'd say surprised. At the outset, it probably wouldn't have been at the top of the list of things that we would have said that's going to be an important thing later on.

Q. These manmade structures in

themselves might be good or bad? I mean, the structure might be --

A. That's true.

Q. I don't have the text right in front of me, but I think you suggested that it might be the operations going on around those manmade structures that were actually having those effects. So up here might actually be -- not have any effect, but the boat going to and from the pier might have some effect?

A. That's correct.

Q. So my question, now properly introduced, was did you consider whether any changes in the operations using those manmade structures might improve the habitat conditions?

MR. ANDES: Mean less frequent use? Less frequent barge traffic, is that what you're asking about?

MR. ETTINGER: That could be one possibility. Different propellers, whistling twice to give the fish a chance to get out of the way.

BY MR. ETTINGER:

Q. Anything that -- did you consider

anything that would be different in the operation of those manmade structures that might improve the habitat?

A. No, I didn't.

Q. Question four, were you asked to look at any steps that might be taken to address the high turbidity which the Habitat Improvement Report identifies as a problem at page ten?

A. We were not asked to do that.

Q. Did you do that?

A. No.

Q. When you built the constructed wetlands for these various places, did they result in reduced turbidity?

A. Turbidity was not a measure of water quality parameter in any of those cases.

Q. What were you mainly aiming to get at with those wetlands?

A. Nutrients and bacteria.

MR. GIRARD: Let me just clarify. You were removing nutrients and removing bacteria?

THE WITNESS: That was the intention, correct.

MR. GIRARD: Thank you.

MR. ETTINGER: Thank you.

BY MR. ETTINGER:

Q. You didn't look at any of the tributaries as to whether there could be any habitat improvements there that could lead to an improved fish population within the CAWS?

A. No, we did not.

Q. Did you consider whether any changes in the operation of the Corps of Engineers might improve conditions for aquatic water life?

A. No, we did not.

Q. Might any changes in the operations of Metropolitan Water Reclamation District benefit aquatic life?

A. We didn't evaluate that.

Q. Okay. Now, I hope -- my numbers get very funky on this list of questions here. You'll have to take my word for it that I am aware that three normally does not follow eight, but it does on the sheet I'm reading here. So I'll just have to read the question.

Are you aware of proposals that were developed to establish periods of shallow aquatic areas in Bubbly Creek, the Collateral

Channel and South Branch slips by the wetlands in connection with development of mitigation sites from the O'Hare airport expansion?

A. I am not aware of those proposals.

Q. Did the District tell you anything about proposals it had or considered for habitat improvements in the CAWS?

A. I don't remember any specifics it may have been. I can't say there were no conversations about proposed actions. We were primarily interested in activities that had been completed and preferably ones where the habitat project had been completed and where there have been some measures of the effect on fish.

Q. I guess I don't understand. I guess the point of the Habitat Improvement Report would be what could be done in the future that might improve habitat?

A. That's right, and we wanted to base that on data, a knowledge of what had been done and perhaps actually had an effect.

MR. ANDES: Can you describe the kind of projects that you did assess in the Habitat Evaluation Report?

THE WITNESS: Well, just to be clear. There were two different aspects of the habitat improvement that we investigated. We tried to find projects that had been completed where people could say, yes, this had a real involved beneficial effect on fish and then there were hypothetical improvements that we evaluated to determine what the quantitative benefit would be in the context of applying the index scores. So how could you improve that score. So those are two different things.

MR. ANDES: Why don't you describe the type of projects that were contemplated in both of these analyses?

THE WITNESS: In the first case, we had no preconceptions about what those projects might look like. We tried to contact agencies, the City of Chicago and Friends of the Chicago River and various other entities and I think they're identified in our report and ask the question what have you built and have you got any data that we can use to demonstrate this is a good thing? And then in the second case we looked at the habitat variables that were contained in the

index and said if those things are bad or not good enough, what would you do to change those?

So we looked at, for example, the possibility of modifying a vertical bank wall to something other than that that might look like -- more like a natural channel. So removing the vertical structures and sloping the bank back and adding vegetation and that sort of thing.

MR. ANDES: And adding channel complexity was one of those?

THE WITNESS: No. Actually, we classified potential actions as improvable or not improvable and channel complexity was one of the ones that we didn't think would be on a large scale something that could be improved. You couldn't add riffles in pools in most of the systems. You couldn't remeander it. Just the use of the system would preclude that. If you tried to create riffles in pools in most of the system or in the dredge portion of the system, the water is too deep and someone might come along and dredge it out anyway.

BY MR. ETTINGER:

Q. So make no small plans, but did you

make any large plans either? Did you consider redirecting the North Shore Channel or reconnect to Lake Michigan?

A. No.

Q. You didn't consider filling in much of Bubbly Creek to make a constructed wetlands that would address some of the CSO's?

A. No.

Q. Do you know what the Collateral Channels are?

A. The Collateral Channels?

Q. Yes.

A. Yes.

Q. What are they?

A. Those are the channels that -- correct me if I'm wrong. I don't want to get the definition wrong.

Q. Actually, let's drop that. Did you look at any of the slips that are currently on the South Branch of the Chicago River and consider whether they could be filled in for 28 days or wetlands?

A. No.

MR. ANDES: I would add as to the

specific projects asked about in question nine, Ms. Wasik will be prepared to respond in more detail.

MS. TIPSORD: Mr. Harley has a follow up.

MR. HARLEY: I just want to ask Albert's question about the Calumet River system. Are you familiar with boat slips that exist in the Lake Calumet River system?

THE WITNESS: Yes.

MR. HARLEY: Did you consider making use of any of those boat slips, for example, to create off channel bays or other habitat improvements to that water system?

THE WITNESS: No.

MR. HARLEY: Why didn't you look at those boat slips as a possibility?

THE WITNESS: We assumed that the existing uses of the system would need to be retained.

MR. HARLEY: And you're convinced that all those boat slips are presently being used for commercial purposes?

THE WITNESS: No, we didn't do a

thorough evaluation of all of the boat slips. So I can't say how many are or are not currently in use.

MR. HARLEY: Could a boat slip serve as a basis for creating an off channel bay or other habitat improvement?

THE WITNESS: It could if it's not used as a boat slip, I think.

MR. HARLEY: Thank you.

BY MR. ETTINGER:

Q. Did -- I'm sorry. I had gone through your resume. Have you personally worked on habitat improvement projects?

A. I have worked on only a few.

Q. Have you worked on any that worked?

A. In what regard worked?

Q. They improved habitat and you had data that showed the fish population in some way was improved?

A. I have not worked on anywhere the collection of post project data has been funded. It's very uncommon to see that.

MR. ANDES: Are there challenges to improve habitat that often lead to those projects

not being successful?

THE WITNESS: Yes.

MR. ANDES: What are some of those challenges?

THE WITNESS: Well, the channels can be very site specific. Among them can be competing uses, lack of maintenance. I'd say those are the two big ones. Over time, I mean, when one tries to restore aquatic habitat, often you're forced to work within a certain part of the system and you can't change the whole system. So it's necessary to protect the project in ways against ongoing uses that might be damaging or go back and perform maintenance to ensure the conditions you tried to construct are having the desired effect and that can be very expensive.

Q. Have you worked in the River Rouge in Detroit?

A. Yes, I have, but not on habitat.

Q. What did you do on the River Rouge?

A. I suppose it was indirectly related. We did a large study on the main one two branch of the Rouge. It was a comprehensive investigation of erosion and deposition sediment in the system.

Basically, inventorying the entire system to determine the nature and location of erosion and sediment deposition problems and prioritizing future actions, helping constituent communities prioritize future actions for improving those conditions.

Q. How was your study used?

A. There were -- our work was for the County of Oakland and there were ten participating municipalities in that study as well and each of them was provided information on portions -- of what we found in their portion of the system and they, in turn, have gone out and prioritized projects to protect infrastructure, reduce -- to mitigate erosion to private property, they've sought grant funding for various funding to improve portions of the stream.

Q. How did they improve portions of the stream?

A. This related specifically to the work we did. It was to stabilize existing erosion problems. So putting in bioengineering techniques and that sort of thing to prevent ongoing erosion.

MR. ETTINGER: Are other people

going to ask questions or should I ask --

BY MR. ETTINGER:

Q. Getting back to the CAWS. Did you study how fish move within the CAWS?

A. No, we did not.

Q. Do you have any idea of how far fish move in the CAWS from one place to another?

A. No, I haven't studied that.

MR. ETTINGER: We don't have any further questions.

MS. TIPSORD: Mr. Harley?

MR. HARLEY: This is one of Albert's pre-filed questions I wanted to ask. Is it correct to say -- this is question 13 regarding the Habitat Improvement Report. Is it correct to say that habitat could be most improved in the Cal-Sag Channel?

THE WITNESS: I don't know what the basis would be for saying it exactly that way, but we found in our study that the South Branch of the Chicago River had the highest potential based on its index score potential.

MR. HARLEY: Then one other just quick follow up. The decision to not evaluate for

habitat or water quality data on a reach by reach basis, was that your decision or was that Water Reclamation District's decision?

THE WITNESS: I don't recall the specific thought process, but it would have been as I said previously it was based on the lack of sufficient data for the type of statistical analysis we were doing. So it would have been our recommendation when you work for someone and they tell you to do it, if it can be done, you could do it, but we would recommend that it wouldn't have value because of the lack of sufficient data.

MR. HARLEY: Was that limitation in the scope of the work agreements?

THE WITNESS: No.

MR. HARLEY: It was just something that you discovered as you were undertaking the analysis?

THE WITNESS: That's right.

MR. ANDES: Would it take a lot more data to do this on a reach by reach basis?

THE WITNESS: Yes, it would.

MR. ANDES: Are there also benefits to looking at a sort of the whole watershed in

terms of how habitat factors effect the fish?

THE WITNESS: I'm not sure I know what you mean.

MR. ANDES: I'll drop the question.

MS. TIPSORD: Ms. Franzetti?

MS. FRANZETTI: Susan Franzetti, counsel for Midwest Generation. Would you just briefly explain why it would take a lot more data to do this analysis on a segment by segment basis?

THE WITNESS: Yes. Our analysis has been mentioned many times was a statistically based analysis and for the statistical analysis to bear fruit, to give you meaningful and reliable results, you need a lot of data. On a segment by segment basis on some cases we -- for example, in Bubbly Creek, I think there was only one fish sampling station and in many cases at stations there were only two sampling events over the seven year data we used.

So to sort of go reach by reach, we might have ended up with maybe two or four or even as few as seven fish samples and then to try to do a statistical analysis of that with some other factors such as water quality or habitat

wouldn't be sufficient quality to get reliable results.

MS. FRANZETTI: Thank you.

MR. GIRARD: Mr. Bell, I have sort of a general question here before we hopefully wrap up for lunch. The question deals with the area of channel substrate. In fact, I'm looking at your pre-filed testimony on page six. In that area, you were dealing with the concept of habitat limitations in the channel substrate and sort of a summary of all the data you were gathering and you talked about how you sample the substrate at 28 stations in the CAWS and at 16 out of those 28 stations you characterize the substrate as inorganic silt. At five of the stations, you characterized it as bedrock and you considered both of those categories as being undesirable from a habitat prospective.

So for 21 out of the 28 stations, you said you had an undesirable channel substrate type so, therefore, you concluded that the channel substrates was poorer in composition and texture than the CAWS.

Now, if you had gone, let's say,

to some place like Canada and you found a river system which was relatively unimpacted by human activity, so we'll call it natural, and you established 28 channel substrate testing stations and you found the same results, would you characterize that channel substrate as being poorer in compensation and texture?

THE WITNESS: Yes.

MR. GIRARD: So natural systems can have substrates that you would characterize as being poor?

MR. ANDES: Would -- if I can ask a clarification? Would you be surprised to see natural systems where the substrate was bedrock or inorganic silt?

THE WITNESS: Yes, I would be surprised in a natural system. I can't remember the wording that you used, but I think you said unimpacted by human activity or something along those lines?

MR. GIRARD: Yes.

THE WITNESS: If I was up in Alaska?

MR. GIRARD: Wherever you want to put it.

THE WITNESS: It would be surprising to see those conditions in a system like that. It's not to say they can't occur, but it would be surprising, but if you did observe them I would conclude the substrate conditions are relatively poor there.

MR. GIRARD: When you use the term surprised, in other words you're biased against finding that kind of situation in nature?

THE WITNESS: I think I would be based in the sense that my -- what I've observed and what I read and what I've learned leads me to expect a different condition when we look at rivers and streams that are unimpacted by human activity and that's what I mean by I say I'd be surprised.

MR. ANDES: What in a natural system -- why would you have, say, bedrock be the substrate? Have you ever heard of --

THE WITNESS: The bedrock substrate is perhaps less surprising because you could have a channel that's eroded down to bedrock and ceases to erode more. That's not surprising. But the original question if I recall if I went to a

natural system and I measured 28 locations that I believe were representative of the entire system and I saw that the proportion was fine sediments or silts and a smaller fraction were bedrock would that be generally poor substrate and it would be generally poor substrate for aquatic life and I would be surprised to find that in a natural stream at that proportion.

MR. ANDES: Because?

THE WITNESS: Because in cases where you have a natural system unimpacted by human activity, there is a better developed sediment balance and you tend to see more sands and gravels and rock, cobbles in the substrate. You don't have this overwhelming loading of fine sediments in a natural system. You can have fine sediments certainly, but to see it so ubiquitous in a natural system would be an unexpected outcome I think because that's not what you typically see in a watershed and in a waterbody that are uneffected by human activity.

MR. GIRARD: Could you conceive of a geological situation where flow rates, water table down below -- I mean, any sort of conditions you

could think of where you could have a system that is dominated by fine sediments?

THE WITNESS: I certainly can't rule it out. You could -- there would be -- I mean, you could have conditions that would create that. I can't deny that.

MR. GIRARD: So if it was a natural system, your use of the word poor might change?

MR. ANDES: But when you say poor, are you talking about the extent to which it supports a viable fish community?

THE WITNESS: When I say poor, yes, to the extent it benefits the fish community, I think it would still be less desirable than other types of substrate.

MR. GIRARD: When you're talking about desirable, you're talking about expecting to see a specific species diversity or abundance of certain individuals? If you had a natural system, the species that are there are the natural community?

THE WITNESS: You're right.

MR. ANDES: Just to be clear. You could expect in that kind of a situation a less

diverse, less viable fish community in a number of respects than, say, in a natural waterbody that had cobble, coarse substrates, et cetera?

THE WITNESS: I don't know if I can say it'd be less diverse or less viable, but it would probably be different.

MS. WILIAMS: Mr. Bell, by definition is it what is natural or what is desirable?

MR. ANDES: I'm sorry?

THE WITNESS: I don't know if I can answer that.

MR. ETTINGER: Seems like a theological question to me.

THE WITNESS: That's almost too general for me to answer. I think that floods are natural and not everyone would agree.

MS. TIPSORD: Anything else? All right. Let's go ahead and break for lunch. We'll come back around 1:00 and start with Midwest Generation.

(Whereupon, a break was taken after which the following proceedings were had.)

MS. TIPSORD: Ms. Franzetti, when you're ready.

MS. FRANZETTI: Good afternoon, Mr. Bell. My name is Susan Franzetti. I'm counsel for Midwest Generation. I'm going to be asking you some questions today. I did make an attempt over the lunch hour to try and eliminate questions if I thought they were duplicative of Mr. Ettinger's questioning, but that may not have been a fully complete effort.

So if I ask you a question and you feel you've answered it before, please feel free to tell me that you believe you've answered the question in your prior testimony or perhaps a portion of it and go on and answer the part that has not been asked because my purpose is not to have you repeat answers to questions. Okay?

A. Great.

Q. Let's begin with the first question which relates to understanding what the qualifications that you had on your curriculum vitae attached to your pre-filed testimony.

What qualifications does one need to have to become a, quote, board certified

environmental engineer by the American Academy of Environmental Engineers, end quote, as you state on page one of your pre-filed testimony?

A. As you said, the certification is offered by the American Academy of Environmental Engineers and the requirements that the Academy has established are as follows; A, be a person of good moral character and high ethical integrity and professional standing as determined by the Academy's Board of Trustees. B, possess a degree in environmental engineering or any other engineering field acceptable to the Academy's Board of Trustees. C, hold a valid license or certificate of registration to practice professional engineering issued by the lawfully constituted registration board of any state, territory, possession or district of the United States. D, be professionally engaged in environmental engineering activities on a full-time basis. E, have had at least eight years progressively more responsible engineering experience following receipt of a baccalaureate degree and, finally, pass both written and oral examinations administered by Academy

representatives.

Q. Moving onto question two. Please explain the extent of effort involved in conducting the Limnotech habitat study of the CAWS in terms of the extent to which this study should be viewed as extensive or rigorous evaluation of the habitat conditions in the areas of the CAWS you studied? I'm trying to get a sense of what the magnitude was of this study or level of effort as compared to studies generally.

A. Okay. Well, focusing on the words extensive and rigorous. I think I used those elsewhere. We believed this was an extensive and rigorous evaluation of habit conditions in the CAWS for several reasons.

First, we -- our field scientists traversed the entire 78 mile length of the study area by boat. We just didn't go out and hit spots. We studied the entire system. We collected information from the entire system including digital video which allowed us to then go back and quantify, for example, bank condition over the entire length of the study area. Where possible, we characterized these features, the

habitat features, over the entire length of the system. Not just the sampling stations. Where existing data weren't as sufficient as we'd like or where we were limited by the visibility of the water, we attempted new technologies to improve our understanding of subsurface habitat such as use of digital video or side scan sonar.

So we tried to push the envelope a little bit on what had been collected previously. The methods we used to analyze the data were accepted methods supported by ample references from available technical and scientific literature and we were supported in our effort by a number of outside scientists.

A couple of our collaborators on the study and report were Dr. Kelly Wessell who was one of the developers of the Michigan Non-wadeable Habitat Index and Dr. Dave Wall who holds due appointments with the University of Illinois and the Illinois Natural History Survey.

We also collaborated with scientists from the District who have probably studied the system more than anyone else and were able to provide a lot of insight into the data we

were collecting. And then upon completion of the Habitat Evaluation Report or rather the draft Habitat Evaluation Report, we had it independently reviewed by three national experts to get their input on what we might try to do differently.

Q. I'm going to skip three. I think that's been adequately covered. Moving to four. In the course of the CAWS Habitat Study Report referring to the reports submitted January 6th, 2010 as part of Public Comment 284 in this proceeding there is a review of the major large river habitat assessment protocols CEG report of pages 22 to 26.

It's noted that using a habitat evaluation protocol that is developed and validated for aquatic biota was considered important because one of the habitat study objectives was to determine what modifications to physical habitat in the CAWS would be required to improve aquatic habitat and that's when they report Section 2.4.1 of page 25. This report goes onto state that, quote, only the Ohio EPA Qualitative Habitat Evaluation Index (Ranken 2004) was found to be explicitly -- was found to

explicitly reference fish in its development documentation citing Ranken 1989, end quote. That's at pages 25 to 26. Would you please explain the meaning of this statement with regard to only the Ohio EPA Quantitative Habitat Evaluation Index was found to explicitly reference fish in its development documentation?

A. Yes. The habitat indices and protocols are typically developed by comparing habitat conditions to some other conditions such as biota. Perhaps fish, perhaps macroinvertebrates. The idea is that by comparing these two sets of data you can determine a descriptive relationship between habitat and the biotic variable.

We were most interested in the relationship between habitat and fish in our study. So one of the things we would want to see if we were to use an existing habitat protocol was that it had been developed using fish data and when we reviewed major habitat indices that were used in the report the only one that we could determine that had been used -- developed using fish data was the QHEI.

Q. In this respect then, is your index -- does your index share that same characteristic as the Ohio index?

A. Yes.

Q. Moving to question five. Is it correct that the CAWS habitat index was developed because due to the manmade nature of the CAWS it was determined that none of the existing habitat indices adequately addressed these unusual features of the CAWS?

A. Yes.

Q. Question six. In the CAWS Habitat Study Report, page 106 Section 6.2.1, a representation of fish data in the analysis of habitat data at the end of the first paragraph it states, quote, a fish index of biological integrity (IBI) was not available, but incorporated the selected metrics. Although the process used to select the fish metrics was exactly the same process used in many fish IBI studies. Please explain the meaning of that statement.

A. The process used to develop IBI's elsewhere has been to assemble a group of fish

metrics and then sequentially reduce them into the set of metrics that one wants to use in the index and the process of reducing those potential metrics to the final set is the same process that we used in developing our combined fish metric.

So, in that regard, they share many of the same developing characteristics and some of those -- there are many commonly cited papers for index development that I could provide that to do that. They were also cited in our report.

Q. So it is a common approach to developing an index to first start with a larger number of variables than you wind up using in the final index itself?

A. Yes.

Q. So that's not something unique to your index?

A. No, not at all.

Q. I'm going to skip to 6a. I think that's been adequately addressed. Moving onto 7. On page eight and in attachment three --

MR. ANDES: Can I follow up?

MS. FRANZETTI: Sure. Sorry.

MR. ANDES: I just want to make sure we're clear on one issue. Mr. Bell, would you explain how it is your index and IBI or is it something different and if it is something different, just explain how that is. What are the ways in which it differs from an IBI?

THE WITNESS: The difference between what we did and what you would do in developing a full IBI is an IBI, an index of biotic integrity, is at the end of its development able to give you a measure of goodness of the biological community. Ours wasn't designed to determine what was good and what was poor. It was designed to create a gradient, a way of measuring differences across the system, but not to assign value to them.

MR. ANDES: So a grade of 75 isn't like a B score in terms of relative to other waterbodies that are out there?

THE WITNESS: That's right.

MR. ANDES: It's just relative to other waterbodies within the CAWS?

THE WITNESS: Yes, that's right. It just means in your example a grade of 75, which I don't think we could get, but if we could would be

better than a grade of 50, but it doesn't tell you whether the 75 is good or bad.

MS. FRANZETTI: Thank you. That is helpful and I do think I understand it.

BY MS. FRANZETTI:

Q. So the scores that you generated in your index, they can be used within the CAWS to make some qualitative judgments in terms of which areas of the CAWS are better than other areas, correct?

A. I would say quantitatively it describes which areas are better or -- which areas have better fisheries than other areas.

Q. So, in that respect, I can look at your values and interpret them based on a numerical ranking from one to a hundred that if you get a higher score you're better than the areas that got the lower scores, can I say that accurately?

A. Yes, except we didn't use a one hundred scale, but the idea is the same.

Q. What was your scale?

A. I don't remember the exact range.

Q. Okay.

A. Usually, another difference is if you were creating an actual index that someone was going to use you could normalize it to a scale that people are familiar with like zero to one hundred which is really an arbitrary scale. So we could have done that. It just wasn't necessary to do that to complete our study.

MR. ANDES: So when you have waters at the top of your scale, at 75, it doesn't mean that that's a really good, clean water goal?

THE WITNESS: It's unrelated to that.

MS. FRANZETTI: Okay.

BY MS. FRANZETTI:

Q. Mr. Bell, let me ask you. Read to yourself question 7a. Do you think you've answer that before?

A. All the parts?

Q. Just 7a.

A. Okay. Yes, I do believe I have.

Q. I thought so, too. Let's move onto B, which I'm going to modify a little bit since I'm not asking A. Let me read the intro to question seven. On page eight and in attachment

three of your pre-filed testimony you discuss the applicability of existing habitat indices to the CAWS. In figure one of attachment three, you compare QHEI scores with what is termed the CAWS habitat index which includes a combined fish metric consisting of 11 physical habitat variables, is that correct?

A. Figure 1 of attachment three shows comparison of QHEI scores for 20 fish sampling stations in our study compared to the combined fish metric for those stations. It does not include any values of CAWS habitat status.

MS. FRANZETTI: Okay.

MR. ANDES: Just a clarification. It's a comparison to QHEI's between combined fish metrics?

THE WITNESS: It's a comparison of fish to habitat as measured by the QHEI.

BY MS. FRANZETTI:

Q. And that combined fish metric is what consists of the 11 physical habitat variables or no?

A. No.

Q. That's where I have the disconnect.

The combined fish metric consists of what?

A. Just fish data.

Q. Just fish data. Good thing I asked that question. Now, with respect to the six variables that are mentioned in question seven, I'm not going to read them all off, those do explain 48 percent of the availability in the fish data, correct?

A. Yes.

Q. So then proceeding on with question B. If those six variables explain 48 percent of the variability in the fish data, does the use of the 11 variables (see CAWS habitat index) likely explain more of the variability or am I comparing apples and oranges?

A. Not there.

Q. Not there?

A. But --

Q. Help me.

A. I would say that -- no, you're not because you're comparing habitat variables to fish which is what we were getting at here, but I think the question has to do with by adding the five variables that are in the index that weren't --

adding those five to the original six does it increase the explanatory power or the ability of habitat variables to explain fish data and I would say that under present day conditions system-wide I'm not sure that it does because if those five variables were able to explain a significant -- a statistically significant additional amount of fish data, they probably would have shown up in the original analysis. So they're more descriptive, but their statistical explanatory power probably isn't that great under present conditions.

Q. I'm going to skip 6. 7c, I think you answered that. Moving onto D. You agree that most IBI type indices produce only positive values?

A. Yes, I do agree.

Q. So would you explain how or why does the CAWS combined fish metric produce negative values?

A. The metrics used to calculate the combined fish metric some of those are negative so there are --

Q. Can I stop you? I'm sorry. What

does it mean for it to be negative in this context?

A. In this context, they're indicative of a quality of fisheries that is poor. So, for example, the presence of lesions and tumors, that would be a thing that is a negative condition. So a high score for that metric would be -- would decrease the combined metric. So it would be a subtracted value, if you will.

Q. Okay.

A. So we have ten metrics and, say, three are negative, that would decrease your score and seven are positive which would increase your score. If you represent the three negatives as negative decimals and you add all those things up with your positives, sometimes you're going to get negatives. If we were going as I said before to create an index to make it more useable by people down the road, you might then say let's just transform that range of negative 20 to plus 20, let's just transform that to a 100 point scale and there's a couple mathematical things you can do without changing the values or the differences between the values, but you just shift them all

into the positive range of numbers.

We didn't bother to do that because it wasn't necessary. We weren't trying to represent anything with the numbers, per se, except provide a description of fish that represented the variation across the system and that variation would have been the same if we described it on a negative 20 to plus 20 scale or a 40 to 80 scale or a 0 to 100 scale.

Q. So if I'm using a factor that is deemed to be a positive factor, has a positive effect, and I do my first positive one and my score that I get with your index is ten, but then I move onto the next factor and it's in the negative factor category and my score on that factor is 20, that 20 is going to get subtracted from the 10?

A. Using the approach we used, yes.

Q. Using your approach, right. I understand now. Did you ever actually try to calculate what your maximum range of scores is for your index?

A. I'm sure we did. I don't recall what it was, though.

Q. Moving onto question 7f. One of the CAWS fish metrics is the, quote, number of Illinois native sunfish species, end quote. Does this metric include all members of the sunfish family?

A. The metric includes all Illinois assigned native species belonging to the sunfish family as defined in table two of the draft Illinois IBI and I've got it cited as IDNR 2000. I think it's got a date 2000 on it, but it's been updated since then. It's a document that we got from the state.

Q. Do you know or does your counsel Mr. Andes know whether that is in the record already?

MR. ANDES: I believe it is and we can certainly provide.

BY MS. FRANZETTI:

Q. Moving onto D. With respect to the counting of native sunfish or native minnows for purposes of the CAWS fish index, are hybrid fish included in these counts?

A. No.

Q. Moving onto question eight. On page

three of the attachment three to your pre-filed testimony you state that, quote, linear regression of these two sets of variables results in an R squared value of 0.02. This indicates that the QHEI explains about two percent of the variability in fish data from the CAWS for this dataset, end quote.

Given that the QHEI was developed and calibrated against fish metrics developed and calibrated in Ohio, would you agree that it is not surprising that the QHEI explains very little of the variation in the CAWS index which has different metrics that were developed for a system with a very limited fish community?

A. Yes, I would agree.

Q. Moving onto question nine. On page three of attachment three to your pre-filed testimony you state that, quote, it is also worth noting that the QHEI results in a relatively narrow range of scores (34 to 56) for the CAWS stations indicating that the QHEI may be limited in its ability to discern variability in physical habitat within the CAWS, end quote.

Although you conclude that this

indicates a potential limitation of the QHEI to discern physical habitat variability, is this narrow range of QHEI scores from 34 to 56 also an indication that habitat throughout the CAWS is limiting and poor practically everywhere?

A. Yes, I would agree.

Q. Moving onto question ten. On page 11 of your pre-filed testimony, you indicate that the R squared value of 0.48 for your CAWS habitat index is very good compared to other habitat indices, specifically with regard to the R squared of 0.45 for the QHEI. Do you agree that the developer of the QHEI, Mr. Ed Ranken, used data only from reference sites as a means to minimize the influence of factors other than habitat on the biological scores generated by the QHEI?

A. To my knowledge, that's true.

Q. Subquestion A of ten. Because of the highly disturbed nature of the CAWS, is it true that such, quote, reference sites within the CAWS do not exist and hence Limnotech could not use them?

A. Yes, that's true.

Q. Question B. Do you think it is

likely that the approximately 50 percent of variability not explained by the CAWS habitat index is also explained by the existence of other factors such as water quality, sediment contamination, barge traffic, water level fluctuations, urban runoff, et cetera, and not solely the inherent variability of biological data?

A. We found that of that half not explained by physical habitat, most 70 percent of that portion, or 35 percent overall, could be explained by the natural variability, but I think there are multiple factors that explain the fish variability in the system that's not explained by physical habitat and they might include the factors you've noted in the question.

Q. So if I understand you correctly, based on the results of your study you think those other factors could explain about another 15 percent?

A. Potentially, yes.

MS. TIPSORD: Ms. Franzetti, before you move on, I want to back up to your sub A and I think it's partly because of the way you phrased

the question. I want to ask Mr. Bell. The question talks about the highly disturbed nature of the CAWS. Would you tell me what -- how you interpret that phrase?

THE WITNESS: I interpret that to mean the manmade aspect of it.

MS. TIPSORD: Thank you. I thought that's what you were saying, but I wanted to make sure we were all on the same page.

BY MS. FRANZETTI:

Q. Question 11. Actually, one more follow up on your last answer to B, Ms. Tipsord's question. How was it that you were able to determine that about 50 percent of that -- excuse me. Sorry. I'm saying it wrong. How were you able to determine that about 70 percent of that 50 percent was attributable to natural variability?

A. First of all, it could be attributable and the way we did that is we looked at -- we did our regression with the habitat data and the fish data and we got our -- the result that showed about half of the variability could be explained by habitat and then we looked at the difference between what was predicted and what was

actually measured in fish. What was predicted by the habitat and what was actually measured and there's some variation there. There's a difference, a delta between observed and measured and that sort of reflects the other half of what -- if it was a perfect description, if it was a hundred percent, you'd get a dead on, straight line match, but that's not what you get.

You get a little bit of variation around that line. So if you take those differences, those residuals, and calculate them and compare that quantity to other things then you can get some idea of what is causing that variation that you're not accounting for with habitat and one of the things we looked at was the change in fish metrics over time at each station and when we compared that we found there was a relatively good correlation between those two, an R squared of 0.7.

So that's what we mean when we say that that's one factor that could explain as much as 70 percent of that half that's not explained by habitat.

Q. Moving onto question 11. In Table

4-1 of page 60 of the Habitat Evaluation Report, Public Comment 284, it is stated that some of the QHEI metrics are not useful for the CAWS because these metrics when applied result in the same score for most or all of the stations. Are the QHEI scores you were referring to here accurately described, though, as very low scores including many zero scores?

A. Yes.

Q. So moving onto A. Given the consistency of the very low or zero score results for the CAWS, is this additional relevant evidence that several habitat features that are important to supporting a balanced fish community such as riffle, bends in the river and shallow areas are either absent from the CAWS or very close to being absent?

A. I agree with the statement. I don't know if I would say that they're evidence of the absence of these things. I would say the absence of those things necessarily results in very low scores.

Q. Okay. Moving onto 12. On page 27 of the CAWS Habitat Study Report Table 2-4,

Limnotech characterizes the QHEI as not being a, quote, quantitative, end quote, protocol. Is it your opinion that the scoring system used in the QHEI cannot be considered a quantitative protocol?

A. When we characterized the QHEI as not quantitative, we meant it includes a number of qualitative scoring variables. For example, when evaluating substrate, the scores we estimate percentages rather than make actual measurements. There is also some qualitative judgment associated with measuring or assessing imbedidness of substrates or the presence of in stream cover.

So although numerical values are assigned to a number of these things, they're not actually measured. There's a greater allowable degree of judgment on the part of the person applying the score. So, in that sense, we categorized it as a quantitative -- you may even have said semiquantitative -- or semiqualitative, but it is more qualitative than others in that regard.

Other things such as morphology metrics are judged using terms like high, moderate low which are qualitative descriptors, not

quantitative, in the sense that they're not measured in numerical quantities.

So -- and, lastly, I think those are the reasons it's called the Qualitative Habitat Evaluation Index because it's recognized by the developers that it is a qualitative assessment in this regard. Even though you come up with a number score, a lot of things you do to apply it are qualitative measures.

Q. Okay. Just to get a little more comparison between your index and the QHEI. There are, however, though, some of the metrics in the QHEI which you would agree are quantitative?

A. Yes. Don't ask me to name them, but I know they're not all quantitative.

Q. I won't ask you to name them. So what you're saying is your index is more quantitative than is the QHEI?

A. I would say that.

MR. ETTINGER: There are some -- when you looked at macrophyte cover, to your knowledge, did someone go down and measure how much the macrophyte cover was?

THE WITNESS: What we did was we

setup sample plots of a certain dimension and then measured how much of the sample plots and there were several within each region. I don't recall the exact numbers or sizes, but those were measured. So the judgment was applied in where to select those sample sights because this and this and this are most representative, but there was measurements.

The difference I think is that for the most part we tried to minimize -- because we thought and believed and rightly believed this would be subject to some scrutiny we wanted to try to minimize subjective aspects of it.

MR. ETTINGER: Did you have a measure of how crumbly the vertical wall was, for example?

THE WITNESS: No, I don't think we did.

MR. ETTINGER: And in terms of a manmade structure, did you differentiate between size of pier or measure?

THE WITNESS: No.

MR. ETTINGER: So it was either present or not present?

THE WITNESS: We counted them. I mean, it was -- yeah. It wasn't each individual present or absent, but then they were counted.

MR. ETTINGER: Then they were counted and a pure count of the same whether it was crumbling down or whether it was standing or --

THE WITNESS: Yes.

BY MS. FRANZETTI:

Q. I have another follow-up question. If I want to -- I was going to ask this hypothetically, but I'm not -- let me change it. With respect to the CAWS, if I don't want to put in the effort you put in to apply your index at least at the first go around and instead I use the QHEI, won't the QHEI give me a sense, for example, all the scores in the CAWS segments stay within a 12.0 or so scale range and we already went over the fact that they indicate poor habitat conditions generally in the CAWS, correct?

A. Yes.

Q. So can't I use the QHEI as kind of a screening tool even in the CAWS to just get a sense of is it excellent, good or poor habitat?

A. I think so. It does a couple things for you if you did that. First of all, you're getting out and you're seeing the system and just to get out and see it there's value. Secondly, you're going to identify things that are present or absent that you didn't know about before. So, in this example, going out and trying to apply the QHEI you'll note the absence of sinuosity and absence of pools and riffles and that will start you thinking along the lines of things you might want to measure further or evaluate further.

Q. Then I can if I so choose and I have the resources to come back and apply your index to try to get some differentiation within the core category of whether some of the areas aren't as poor as others for purposes of potentially creating two different use classifications instead of just one that says the whole area is poor, is that accurate?

A. Yes, you could do that.

Q. Let me still ask you 12a. Do you agree that when the QHEI is applied and its scoring conducted by adequately trained biologists it's capable of yielding consistent scores among

such biologists?

A. I would agree. Well --

Q. Assuming it's appropriate -- the area is appropriate for use of the QHEI?

A. Yes, that's what I was going to say.

Q. Moving onto B. Do you agree that when the QHEI is applied by adequately trained biologists, it's capable of yielding a reasonable estimate of habitat quality?

A. Yes, I would agree as long as it's applied to a system for which it's designed.

Q. Moving onto question 13. In the CAWS Habitat Study Report, Limnotech discusses the Illinois Index of Biological Integrity, also known as IBI, for fish and notes it has certain limitations namely that it was developed for wadable systems. Please explain why the fact that the Illinois IBI developed for wadable streams makes it less suitable for use in the CAWS.

A. The natural structure and function of large streams differs from small streams. Large meaning deep, boatable streams compared to small, wadable streams. So the methods that one would use are different. There are different

things you'd look for and that's why different protocols are developed and there are ample references out there in the scientific literature that will describe the need for non-wadable assessment protocols.

Q. Moving onto A. Is it correct that the Illinois IBI and the Ohio EPA boat IBI are different IBI indices?

A. Yes.

Q. Do you agree that the Ohio boat IBI is developed for rivers and not for wadable streams?

A. Yes.

Q. Moving onto 14. Assuming that sediment chemistry was not -- let me not assume. Let me ask that as a separate question. Was sediment chemistry included directly in the CAWS habitat progression equation?

A. Yes. We included measuring and I think I discussed this a little bit this morning. So just in brief --

Q. Yes.

A. We did want to represent -- recognizing the contamination of sediments in the

system we wanted to represent that somehow in our valuation of habitat factors. So we compared sediment contamination to the macroinvertebrate data to try to discern which containments seemed to be most closely correlated with macroinvertebrate condition assuming that would be an indirect measure of how they effect fish as well.

Q. Right. That's how you did it and I think that was the point we were trying to understand and I thought it did start to become clearer this morning. You didn't use the metric of sediment chemistry in your habitat regression equation?

A. Yes, we did.

Q. You did?

A. Yes. There were three variables reflecting sediment contaminant condition that went into the mix of all possible habitat variables. They ultimately weren't contained in the final analysis, but when we did the final regression they had been eliminated for various reasons as described in the report, but we did put them in along with all the other things we used as

possible habitat descriptors.

MR. ANDES: Do you want to explain which ones those were and why they were eliminated?

THE WITNESS: The three we selected were total chromium, total PCB's --

MR. ANDES: Chromium?

THE WITNESS: Cadmium. Sorry. Total cadmium, total PCB's and a variable called simultaneously extracted metals, SEM's, which is a measure of the bioavailable metals in sediments and we selected those because those were the three that were most strongly correlated with the macroinvertebrate data and with the number of different metrics of macroinvertebrates.

So they seem to be popping up a lot and had strong correlations because -- I don't know how many chemicals, but literally dozens, possibly even hundreds, of chemicals that have been measured and we simply -- we didn't think it would be practical to put them all in the pot for the analysis. So we wanted to discern the most important ones.

BY MS. FRANZETTI:

Q. And the macroinvertebrates metric was identified as a more important one then sediment contamination, is that right, because it gets carried through to the final analysis?

A. No.

Q. No?

A. Okay.

Q. You can tell I'm struggling with this issue.

A. Yeah. The macroinvertebrate data did not -- we only compared the macroinvertebrates data to the sediment chemistry data to try to determine which sediment chemicals were impacting the food chain the most.

We didn't have macroinvertebrate data compared to fish and we didn't have macroinvertebrate data compared to habitat. We wanted to get sediment contaminants as a habitat variable into our analysis.

So the only thing we used macroinvertebrate data for was to try to discern which sediment containments we should put into the mix as habitat variables to try to figure out if

they were effecting aquatic life the way other habitat variables were.

MR. ANDES: Am I correct that the -- so the sediment counts you looked at were ones that were well correlated with macroinvertebrate conditions?

THE WITNESS: Yes.

MS. WILLIAMS: I think Mr. Andes was going to ask you to explain when in the process they were eliminated? Can we finish that thought?

MR. ANDES: Sure. Go ahead.

THE WITNESS: That, I would have to look up. Wait. It's right here. I happen to have it right here. So total cadmium and total PCB's were eliminated during the principal components analysis.

MR. ANDES: Explain that, please.

THE WITNESS: The principal components analysis was a method we used to discern which variables, which habitat variables exhibited the greatest degree of variation across the system because ultimately we wanted to do this multiple linear regression. We knew that for

us -- to be able to get statistically significant results we needed what we called strong gradients. We needed variables that were well differentiated or as differentiated as possible across the system.

If everything is the same, you just can't get a good statistical analysis. So we wanted to try to figure out what was a variable. So while these things were variable and correlated with macroinvertebrates, it turns out that across the system compared to other things they just weren't that varied. So that's the principal components analysis.

And the simultaneously extracted metals was eliminated because it was strongly correlated with vertical wall banks and strongly correlated variables wouldn't work in the multiple linear regression either. It's very important to get statistically significant results in the regression analysis that the variables at least be numerically independent.

So if you have two variables that are really strongly correlated, then the statistical confidence in the analysis drops. So

that -- and there were other variables that were like that that were removed because of their correlation to their other variables, but that's why they were screened out.

MS. WILLIAMS: So all of them were screened out before they were compared to combined fish metrics, is that correct?

THE WITNESS: Yes.

MS. WILLIAMS: Then, can you explain for us which macroinvertebrate it was that correlated with the sediment contamination you looked at? I'm just trying to trick you.

THE WITNESS: I can say it wasn't in any one macroinvertebrate metric, but I think I would have to look that up and provide that answer because there were a lot of metrics and these chemicals were correlated to several different ones. So I'd have to go through the attachment in Appendix B and kind of make the list.

MS. WILLIAMS: So would we be able to make that list ourselves?

THE WITNESS: You should be able to do that. There should be correlation tables. I'm pretty sure. I'm going by memory now, but we

could provide that. It would be relatively straight forward to do that.

MS. WILLIAMS: Thank you.

BY MS. FRANZETTI:

Q. I'm going to skip to question 16 and I know this morning you gave testimony which included examples of what types of structures were included in the terms manmade structures. My question 16 is a little narrower, but staying with regard to manmade structures. I also have trouble with that term. Let me just stick with manmade structures. Can you give me some examples of the types of manmade structures that were determined to have a detrimental impact on aquatic life as part of your habitat study?

A. We didn't evaluate the impacts of specific structures on aquatic life. We just grouped three types into a category and then assessed that category against fish. So the three types were bridge abutments, dolphins and piers. So the presence of all of those or some of those as a group was discussed.

Q. And I think you touched on A this morning, but I'm going to err on the side of

inclusion in asking it. Does the CAWS habitat index with respect to the manmade structures factor attempt to quantify the various manmade structures located within a given segment of the CAWS to which the index was applied?

A. The variable we used for manmade structures was a count of the number of manmade structures in a sampling reach.

Q. So just how many existed within that 400 meter range?

A. Yes, and it had nothing to do with size.

Q. So would it be correct -- and I'm just paraphrasing a little, changing the remainder of it. So you didn't consider differences in size of the various manmade structures within a given location just how many there were there?

A. That's right.

Q. Moving onto 17. At page 57 of the CAWS Habitat Study Report, there's a finding that fish metrics are positively correlated to dissolved oxygen, but dissolved oxygen is a poorer predictor of fish metrics. Please explain further what this finding means including what the phrase

positively correlated means?

A. The phrase positively correlated means that in many cases as the DO metric increased, depending which one you were looking at, as it increased, the quality of fish condition also increased, but those relationships were found to be relatively weak because the R squared values were low and in many cases not even statistically significant.

Q. So that DO has a positive -- you found that DO has a positive effect on fish, but not much of one in the CAWS?

A. Yes.

Q. All right. Moving onto 18. In Appendix C of the Habitat Evaluation Report, Public Comment 284, and on pages two to three of your pre-filed testimony you consider the relationships between fish and water quality, particularly dissolved oxygen. Is it correct that the Limnotech study determined that dissolved oxygen was a much poorer predictor of the quality of the fish community than was habitat?

A. Yes.

Q. Do you agree that in the CAWS

habitat is a much more important factor to the quality of the fish community than is dissolved oxygen?

A. Yes.

Q. I'm skipping 19 and going to 20. At page 57 of the report in the third bullet, it stated, quote, some fish metrics are positively correlated to temperature, but more poorly than with dissolved oxygen. Relatively few fish metrics show statistically significant correlation to observed temperature data, end quote. Would you please explain in more detail the meaning of this finding and the data on which it is based?

A. The finding is based on regression analysis of fish data with temperature data from the CAWS collected between 2001 and 2007. Those were data from the District's CDOM stations and we calculated metrics from those data including the 24 hour antecedent temperature, the 48 hour antecedent average temperature, the percent of time temperature exceeded the proposed standard, the percent of time temperature exceeded the proposed standard by more than two degrees. And, for those metrics, we found in general the

regression to fish data were -- had very low R squared values and based on that concluded that temperature was a poor predictor of fish data.

Q. Let me just jump -- I'm going to skip down to D. What is the significance of the finding that relatively few fish metrics showed statistically significant correlations to observe temperature data?

A. Our conclusion was that very little of the variability in the CAWS fish data is explained by temperature variation.

MR. ETTINGER: Can I just inquire where did you find the temperature violations in the system?

MR. ANDES: The temperature violations?

MR. ETTINGER: Which were the sites in which there were temperature violations?

THE WITNESS: I don't recall the specific sites.

MR. ETTINGER: So do you know of any of them that would be anywhere other than -- that would be any of them other than Midwest Generation's plants?

MS. FRANZETTI: Objection to the question. Inaccurate. Facts assumed.

MR. ETTINGER: Do you know of any of them?

THE WITNESS: We can go back and look at our data and I can tell you, but I can't tell you from memory.

MR. ETTINGER: Do you know if there are any heat sources other than the Midwest Generation power plants?

THE WITNESS: Off the top of my head, I couldn't tell you.

MR. ETTINGER: Thank you.

BY MS. FRANZETTI:

Q. Just for clarity of the record. When we're talking about violations, are we talking about of the proposed standards or the existing standards?

MR. ETTINGER: The document says proposed standards.

MS. FRANZETTI: That's how you were using it. It just wasn't clear in the question.

BY MS. FRANZETTI:

Q. Moving onto 21. At page 57 of the

CAWS Habitat Evaluation Report, the third bullet goes onto state, quote, applying the proposed water quality standards for temperature for the 2001 to 2007 CDOM datasets does not suggest that attainment of these proposed standards is a good indicator of fish health. Please explain this finding in more detail.

A. It just means when we compared the fish metrics to the percent of time temperature exceeded the proposed standard that none of those fish metrics we looked at had a statistically significant correlation with the percent of time the proposed standards were exceeded.

Q. With regard to temperature, is it correct that the Limnotech study found that temperature in the CAWS rarely exceeded the current secondary contact water quality standards?

A. Yes. In the data we evaluated, the proposed temperature standard wasn't exceeded at most stations.

MR. ETTINGER: Wait a minute. Your question was to the current standard. So there were violations of the current standard that you found?

THE WITNESS: No. I apologize.

BY MS. FRANZETTI:

Q. For example, there is a --

A. I thought it was referring to the proposed. I'm sorry. I apologize. I misread your pre-filed question and I thought it was referring to -- the line of questioning had been dealing with proposed.

MS. FRANZETTI: Actually, I didn't think you did because I thought I was rare.

THE WITNESS: I would have to go back and look at the data to answer that. I can't say right now. I misread it.

BY MS. FRANZETTI:

Q. That's okay.

A. I apologize. I misread it.

Q. It's okay, Mr. Bell. The data is in the record. I was just trying to get a summary statement of somebody who studied it all in that 2001 to 2007 time period.

MR. ETTINGER: Did we look at anything different from what we talked about earlier this morning is percentage of time that the site is in violation versus fish metrics? We

didn't look what the fish metrics were at the time it was in violation?

THE WITNESS: That's right. There's nothing that can be said about the occurrence of violation at the time. I can't say anything about the occurrence of violation or the kinds of samples were taken.

MR. ETTINGER: You don't know whether there were good fish or bad fish at any given site at the actual time of the violation?

THE WITNESS: No.

MR. ETTINGER: Thank you.

BY MS. FRANZETTI:

Q. Moving onto 22. Regarding the data contained in Table 3-1 in Appendix C, I think you did testify this morning that Limnotech compares the 12 fish metrics with the percent of the time the daily maximum temperature exceeded the maximum proposed water quality standards -- temperature standards in the 12 month period proceeding each fish sampling event, correct?

A. Yes.

Q. Did it find that in none of the cases was the correlation significant?

A. Yes.

Q. Is it also correct that Limnotech found that there was not a significant relationship between the combined fish metric and testimony?

A. Yes.

Q. Moving onto 23. Regarding the data contained in Table 3-2 in Appendix C, does this information present Limnotech's comparison of the fish metrics and the percent of time the daily maximum temperature exceeded the maximum proposed water quality temperature standard by greater than two degrees Celsius within a regulatory period?

A. Yes.

Q. Did Limnotech's comparison of this data also fail to find any statistically significant relationships?

A. Yes.

Q. Question 24. Table's 3-3 and 3-4 of Appendix C, do these two tables present Limnotech's comparison of the 12 fish metrics and the 24 hour and 48 hour average antecedent temperature respectfully?

A. Yes.

Q. In these comparisons, is it correct that you found statistically significant relationships with three metrics and the combined fish metric?

A. Yes.

Q. For the three metrics where a statistically significant relationship was found, is it correct, though, that the R squared values were low ranging from 0.04 to 0.21?

A. Yes.

Q. Is it also correct that based on these low R squared values Limnotech concluded that, quote, low R squared values suggest relatively weak relationships?

A. Yes.

Q. Is it true that the 24 hour and 48 hour average antecedent temperatures, at most, explained only about 20 percent of the variability in any of the fish metrics and usually much less and that for most fish metrics these temperatures did not even show a statistically significant relationship?

A. Yes.

Q. Moving to 25. Based on the various

analyses that Limnotech conducted, and I'm going to slightly modify this question based on your testimony, do you agree that temperature was not a strong indicator of fish health in the CAWS?

A. Yes.

MS. WILLIAMS: May I ask a follow up?

THE WITNESS: Yes.

MS. WILLIAMS: Do you agree, Mr. Bell, that in the areas with the best temperature, the highest compliance, lowest temperatures you had the highest quality fish, highest fish metric values?

THE WITNESS: I can't answer that off the top my head. I'd have to go back and look at the fish data.

MS. WILLIAMS: I think we went over this a little bit last time, but I was hoping you'd remember. We could refer back to we talked about Attachment C.

MS. TIPSORD: Appendix C to what, Ms. Williams?

MR. ANDES: If we can borrow that again, I'd appreciate it.

MS. WILLIAMS: Do you have it?

MS. TIPSORD: What page are you on, Ms. Williams?

MS. WILLIAMS: C1.

THE WITNESS: Got it.

MS. WILLIAMS: I'm looking at -- why don't we start with percent top carnivores by weight versus percent time daily max exceeded. That would be the right-hand column, the second box down. Do you see that.

THE WITNESS: Yes.

MS. WILLIAMS: Do you agree that, again, the best fish metric value occurred within the best temperature data on the far left with -- the lowest temperature data had the highest fish metric value?

THE WITNESS: Yes, the highest metric in that chart occurs at zero percent.

BY MS. FRANZETTI:

Q. What is that metric measuring?

A. Percent top carnivores. It's the percentage of fish in a particular sample that would be classified as top carnivores.

Q. Let's try the one below. Illinois

ratio of non-tolerant coarse mineral substrate spawners versus percent time daily max exceeded previous 12 months. Would you agree that you had the highest ratio of non-tolerant spawners in the lowest temperatures?

THE WITNESS: Yes, at zero percent.

MS. WILLIAMS: Thank you.

BY MS. FRANZETTI:

Q. Do those answers in any way change your testimony in response to my questions regarding the significance of testimony?

A. No.

Q. Why not?

A. Because they're still -- there's still no statistically significant relationship between these data. The occurrence of higher scoring fish metric at a place where a few temperature metrics are low or lowest doesn't necessarily mean that's a condition that can be applied to the whole system.

I mean, the data are what the data are, but I don't think it changes the fact that there's not a statistically significant relationship and I still would say that it's not a

limiting factor for fish based on the data we've analyzed.

Q. Thank you. I think I'm on question 26. Based on the various regression analyses performed by Limnotech, did you find that attainment of the water quality standards proposed in this UAA rulemaking is not a good indicator of fish health?

A. Yes.

Q. It is your expert opinion that the fish community in the CAWS will not improve measurably if the proposed water quality standards are adopted?

A. Yes, based on the data we've analyzed.

Q. Question 27. At page 57 of the CAWS Habitat Evaluation Report, Section 3.3.3, concludes with the statement, quote, while no definitive statement can be made about causation from regression analysis, the weak correlation between fish metrics and dissolved oxygen indicates that incremental improvements in water quality alone may have at best a small benefit to fish if all other conditions effecting fish in the

system remain unchanged, end quote.

Does this statement mean that because of the habitat conditions in the CAWS and other stressors besides water quality, improving just the water quality without addressing these other stressors is not going to result in a significant improvement in the aquatic activity?

A. Yes.

MR. ETTINGER: By water quality here, you did not include the turbidity measure?

THE WITNESS: Actually -- and I think I made reference this morning to this. We did subsequent to our report do an additional classification or regression tree or CART analysis in which we used not just dissolved oxygen and temperature, but we added turbidity, chloride and ammonia and none of the analysis -- the analysis didn't change.

BY MS. FRANZETTI:

Q. I'm just going to ask a piece of 28 that I think was not already answered. At pages 63 to -- hang on a second. I don't think I need to read that intro. Let me just jump to C, 28C. At page 64 of the report, it stated that, quote,

based on these correlation analyses, three sediment chemical parameters were chosen for use in the habitat evaluation. Cadmium concentration, total PCB concentration and concentration of simultaneously extracted metals, which is a measure of the bioavailability of heavy metals in sediments. The three factors actually you just mentioned a few minutes ago. Why were those three sediment parameters selected for use in the habitat evaluation?

A. As I said previously, they were selected because those were the three contaminant measures that were most strongly and frequently associated with macroinvertebrate data and that's the list of correlations that we were going to provide in answer to one of the State's questions.

Q. Okay. Moving onto -- I think 29 has been covered. Thirty, at page 65 and in several other sections of the report relating to habitat conditions references are made to the, quote, 1999, end quote, article. Please provide a copy of this article for introduction into the record of this rulemaking. Is your counsel going to do that?

A. Counsel is now fishing for that in his box of records.

MS. FRANZETTI: Could counsel keep fishing so he can cover the next question if he has it?

MR. ANDES: Yes. The first document Chapter 10 Stream Habitat Management, Ronald J. Orth and Woody J. White in a book called Inland Fisheries Management in North America, second edition.

MS. TIPSORD: If there is no objection, we will enter Inland Fisheries Management in North America second edition edited by Christopher C. Kohler Chapter 10 as Exhibit 455. Seeing none, it's Exhibit 455.

(Document marked as IEPA Exhibit No. 455 for identification.)

MS. FRANZETTI: Thank you, Mr. Andes.

BY MS. FRANZETTI:

Q. Moving onto question 31. At page 81 of the CAWS Habitat Evaluation Report in Table 4-7 entitled, quote, habitat limitations in the CAWS related to hydrology (after Bunn and Arthington

2002), end quote. The Bunn and Arthington 2002 article is cited in support of several of the statements in Table 4-7 regarding the habitat limitations in the CAWS related to hydrology. Please provide a copy of this article for introduction into the record and please explain the meaning of the parenthetical (after Bunn and Arthington 2002)?

MR. ANDES: The name of the document is Basic Principles and Ecological Consequences of Altered Flow Regimes for Aquatic Biodiversity.

MS. TIPSORD: If there's no objection, we will enter the Bunn and Arthington article as Exhibit 456. Seeing none, it's Exhibit 456.

(Document marked as IEPA Exhibit No. 456 for identification.)

BY THE WITNESS:

A. You asked about the parenthetical citation after Bunn and Arthington?

BY MS. FRANZETTI:

Q. It's the inclusion of the word after. I'm sorry. I'm not familiar with that and

I'm not sure what that means.

A. What we meant was several of the things that are in that table were paraphrased from their findings. So we didn't directly quote or copy the table, but the content of the table was extracted. We wanted to credit them with that.

Q. I see. Okay. Thank you. I didn't know that's how that term is used.

A. That's how we used it.

Q. Moving to subpart A of 31. In Table 4-7 regarding the section on flow, it states that, quote, Bunn and Arthington 2002 cite flow as the major determinant of physical habitat and biotic composition in river echo systems, end quote.

Can you explain further what the Bunn and Arthington paper found with respect to the influence of flow on physical habitat and biotic composition?

A. Yes, I've got some quotes from that article that I think reflect what was intended here. I'd like to read those.

Q. Okay.

A. On page 493 is the statement, quote,

the shape and size of river channels, the distribution of riffles in pool habitats, and the stability of the substrate are all largely determined by the interaction between the flow regime and local geology and landform. Two, on page 494, this complex interaction between flows and physical habitat is a major determinant of the distribution, abundance and diversity of stream and river organisms.

On page 494, quote, the most commonly cited abiotic determinants of aquatic macrophyte assemblage structure are all flow related structures. On page 495, quote, physical disturbance from floods and droughts is thought to be a major determinant of the spatial and temporal dynamics of benthic communities and streams and on page 495, quote, many fish species display a preference for particular types of habitat such as pools, riffles and backwater areas and the intention here was to point out just the importance of flow regime in natural systems.

Q. Okay. Moving onto B. Also in Table 4-7 regarding the section on flow regime, it states that Bunn and Arthington 2002 states that

species whose life history strategies have evolved with defined flow regimes may experience recruitment failure in managed systems. These altered systems promote the establishment, spread and persistence of exotic and introduced species, end quote. Please explain further the meaning and basis of these conclusions.

A. There's a table two in that paper that I think lists some of the life history responses that are referenced by the quote. The point is, again, that flow regime is an important factor in establishing and determining biotic community in natural systems and where the flow regime is absent or highly disturbed or manipulated by human activity that there's a detrimental effect as concluded by these authors.

Q. That table two is at page 497 of the paper, Mr. Bell, that you're referring to. Did you keep a copy of it there?

A. We reproduced the copy of paper and I have a copy of the paper.

Q. Check 497 just so I can --

A. That's right.

Q. And that table specifies what some

of the specific flow variables are that are the basis of this statement?

A. That's right. And we don't mean to imply that all these effects are present in the CAWS, but simply that in natural systems the observation has been by these researchers that the altered flow regime can have a detrimental effect in various ways on fish.

MR. ETTINGER: Are we doing anything more than reading this report and putting it into the record here? I'm just asking. Seriously, I'm not trying to insult you. I'm just asking are we reading the paper here and discussing that which is fine?

MR. ANDES: It was cited in his testimony.

MR. ETTINGER: And you are citing. Do you have independent knowledge of those facts or is this something you thought was something good to cite?

THE WITNESS: I think that's the case. It's a citation, a technical citation.

MR. ETTINGER: I guess I ask further as to this report then before we leave the report

do you have independent knowledge of the influence of modified temperature regimes on life history patterns?

THE WITNESS: No. Independent knowledge?

MR. ETTINGER: Yes.

THE WITNESS: Meaning have I personally studied? No.

MR. ETTINGER: Then you wouldn't disagree that modified thermal patterns and day length cues have been shown not only to disrupt insect emergent patterns, but also to reduce population success?

THE WITNESS: In natural systems, I wouldn't disagree with that.

BY MS. FRANZETTI:

Q. Question C. Do you agree that a flow regime of a waterbody is important to the health and quality of the fish community?

A. Yes, in natural systems.

Q. Why do you add natural systems there?

A. Because we're talking about the CAWS here today and I don't have any -- we were unable

to draw any strong conclusions about flow in the system from the data we had. So I want to make sure I am clear about what I'm saying.

MR. ANDES: Let me follow up. If one were to assume for a moment that basically all the system has the same flow regime which is completely managed, the fact that it is a completely managed artificially created system is important to the nature of the fish community, correct?

THE WITNESS: Yes, I would expect that to be the case although we don't have data to corroborate that, but yes.

MR. ANDES: Variability between reaches in terms of flow regime did not come out as a significant factor?

THE WITNESS: No, it did not.

BY MS. FRANZETTI:

Q. Is that really what you're saying when you say you don't have adequate data? You were trying to use flow or flow regimes to determine does that make a difference within the CAWS to why some segments may be a little better, less poor than other segments, correct?

A. That's what we were trying to determine. We were trying to determine whether flow was an important habitat variable to fish in the CAWS.

MR. ANDES: To explain differences between reaches in the CAWS?

THE WITNESS: Correct.

MS. WILLIAMS: You used a model for that, right?

THE WITNESS: That's right.

MS. WILLIAMS: Which model?

THE WITNESS: It was the DUFLOW Model by Dr. Melching.

BY MS. FRANZETTI:

Q. Actually, I understand that you're qualifying your opinion that the flow regime of a waterbody, you know, is important to the health and community of the fish community, health and quality of the fish community to those in natural systems, but, in fact, your study really didn't study whether the flow regime here was the -- at least one of the fundamental contributors to all these segments not scoring very well objectively in terms of quality of habitat?

A. We attempted to determine that, but all we had to use were model data or model results.

MR. ANDES: Let me clarify. You weren't looking at it in terms of this waterbody relative to other waterbodies outside the system?

THE WITNESS: No.

BY MS. FRANZETTI:

Q. That's what I'm getting at.

A. No, we weren't doing that.

Q. Now, I understand. Thank you. I think D has been asked. I'm going to jump to E. Is it correct then that flow or flow regime -- let me change that based on your testimony. Is it correct that flow or flow regime is potentially another adverse condition that's present in certain of the CAWS segments, but which your scoring system doesn't account for?

A. Yes.

Q. Question 32. At page 119 of the CAWS Habitat Evaluation Report immediately below Figure 6.6 that's entitled Comparison of the CAWS Habitat Regression Model With 2008 Fish Data, it states, quote, as shown in Figure 6-6, the six

variable habitat regression model developed using 2001 to 2002 fish data shows a relatively good fit with the 2008 fish data. Why is that important?

A. The 2008 fish data was used as a validation dataset for us. The regression is a type of environmental model and it's typical to try to validate these models with independent datasets and that's what we did here. That dataset from 2008 only had 20 data pairs, which is a very small number and we were still able to demonstrate an R squared of 0.29, which for that quality of data, I believe, is good.

Q. The same paragraph goes onto state the R squared value of 0.29 (P equals 0.014) indicates that there is good and statistically significant correlation (98.6 percent confidence) between the habitat regression model and the 2008 fish data. Why is that important?

A. Again, R squared of 0.29 per dataset of only 20 pairs is quite a good result to get and we felt that that was a validation that we were on the right track.

Q. In the next paragraph the last sentence it states, quote, the regression fits the

long term averages with an R squared of 0.51 indicating that the six habitat variables in the regression equation explain more than 50 percent of the variability in fish data over long periods, end quote.

Are those the same six habitat variables that you've been -- you've testified to earlier?

A. Yes.

Q. Does this statement mean that these six habitat variables are the ones that have the greatest impact on the quality of the fish community in the CAWS?

A. I'd say these are the six habitat variables that explain most of the variability in the fish data that we evaluated. So, in that sense, the answer would be yes.

Q. Moving onto question 33. At page 120 of the CAWS Habitat Evaluation Report, Section 6.4 entitled Relative Importance of Physical Habitat in the CAWS, it is stated, quote, as previously discussed, the regression analysis shows that physical habitat can explain 48 percent of the fish data collected from 2001 to 2007, end

quote.

You state in your pre-filed testimony at page two that, quote, multiple linear regression shows that the dominant habitat variables identified in the study had an R squared of 0.48 with fish, indicating that these habitat variables explained as much as 48 percent or about half of the variability in the fish data, end quote.

Please clarify what you mean by these statements with regard to why they clearly support your finding that physical habitat is more important to fish than dissolved oxygen?

A. What we meant by that statement as pointed out in the quote the R squared of the regression between habitat and fish data was 0.48 and that's a significantly larger number than the regression between the DO variables and fish that we found which were two -- 0.02 to 0.27.

Q. I think I'm going to skip 34. Give me just a moment. Skipping 34. I think I'm going to ask 35. As you also discussed on page three of your pre-filed testimony and at page 123 of the CAWS Habitat Evaluation Report regarding Figure

6-9 comparison of regression residual with percent of time dissolved oxygen less than five mg/L. It is stated that, quote, DO alone can explain 27 percent of the variability in the same seven years of fish data. This indicates that physical habitat is relatively more important in understanding fisheries in the CAWS than water quality, end quote. Is this conclusion based on the finding that, quote, physical habitat can explain 48 percent of the fish data as compared with dissolved oxygen explaining only 27 percent?

A. Yes.

Q. Can it be inferred from these results that if one improves the dissolved oxygen levels in these waters from what they are today, there's not going to be a significant change in the fish community because the physical habitat remains unchanged?

A. I would say that based on our analysis there is no reason to expect that improving dissolved oxygen in the CAWS will result in a higher fish community across the CAWS.

Q. Moving to B. You state on page three of your pre-filed testimony that Limnotech

tested various measures of dissolved oxygen and found that the strongest relationship between any of them and the combined fish metric had an R squared value of 0.27 with the other measures of dissolved oxygen having R squared values ranging from only 0.02 to 0.08. So does that mean that the strongest correlation between DO and the fish data was 27 percent and the other DO measures tested were substantially less significant at two to eight percent?

A. Yes.

Q. And which measure of dissolved oxygen resulted in explaining 27 percent of the variability in the seven years of fish data?

A. That would be the percent of time between June and September that dissolved oxygen was less than five mg/L, which had the R squared of 0.27 with the combined fish metric.

MS. WILLIAMS: Isn't it correct, Mr. Bell, that none of the habitat metrics alone accounted for as much variability as that one DO metric did alone?

THE WITNESS: That's correct.

MS. WILLIAMS: Thank you.

MR. ANDES: Would you explain further?

THE WITNESS: As we discussed during the last hearings, along the same lines of questioning, that it's my opinion that consideration of a single independent habitat variable would be appropriate. So you can't draw very much meaning from the regression of a single habitat variable in fisheries because you have to consider the interplay of those variables.

BY MS. FRANZETTI:

Q. Moving onto question 36. At page 124 of the CAWS Habitat Study Report, at the end of Section 6.4.2, it is stated that, quote, this result indicates that including DO with the habitat variables improve the amount of fish data variability explained by the regression by about four percent over physical habitat alone. What is the significance of this finding?

A. The finding illustrates that across the CAWS as a whole habitat and dissolved oxygen combined explain only a little more variability in fish than habitat alone does.

Q. Does this also support the

conclusion that based on the findings of the Limnotech Habitat Evaluation Study, physical habitat has a far greater effect on the quality of the fish community in the CAWS than does the existing levels of dissolved oxygen in the CAWS?

A. Yes.

Q. Moving to 37. With regard to trying to explain the causes of the fish data variability, it appears from the content of Appendix C to the report that temperature was another metric that was studied to see to what extent it explained the fish data variability in the CAWS, correct?

A. Yes.

Q. Did you conclude that temperature played even less of a role in explaining the variability of the fish data than did dissolved oxygen?

A. Yes.

Q. Moving to 38. In Section 8.1 on page 141 of the CAWS Habitat Evaluation Report, there is the finding that based on statistical comparison of key physical habitat variables and DO metrics habitat is much more important to fish

than dissolved oxygen. Based on the statistical comparison of key physical habitat variables in temperature, is it also correct that the results show that habitat is much more important to fish than temperature?

A. Yes.

Q. Is it correct that the statistical comparison results would rank temperature in the CAWS as relatively less important to the quality of the fish community than either habitat or dissolved oxygen?

A. Yes.

Q. Question 39. On page ten of your pre-filed testimony, you state that, quote, two habitat variables; maximum channel depth and percent overhanging vegetation were the most important factors in describing fish data from the CAWS, end quote. Also in the CAWS Habitat Study Report the first finding at the bottom of page 124 states, quote, the two most important physical habitat variables in the CAWS that are positively correlated with fish are the amount of macrophyte cover and the quantity of areas that act as off channel bays to provide refuge from the main

channel, end quote.

Do these statements mean that these two habitat characteristics; maximum channel depth and percent overhanging vegetation have the greatest positive effect on the quality of the fish community in the CAWS?

A. No.

Q. Would you clarify what I'm misunderstanding there?

A. Yes. These two statements refer to two different analyses we performed. The first statement you quoted refers to the CART analysis and the second refers to the multiple linear regression analysis.

Q. So can I stop you for a second? On page ten of your pre-filed testimony, that refers to the two habitat variables; maximum channel depth and percent overhanging vegetation. That's referring to the CART analysis?

A. That's right.

Q. Which is different from what you were referring to at the bottom of page 124 where you cite to the other two physical habitat variables, right?

A. That's right. That refers to the multiple linear regression analysis.

Q. Keep going. I just want to make sure we all understood.

A. Just to underscore the distinction. The CART analysis which was the limiting factor analysis, showed that the two most important habitat variables for fish in the CAWS were channel depth and overhanging vegetation. Channel depth has a negative effect on the combined fish metric in the CAWS. So as it increases, the combined fish metric goes down. Percent overhanging vegetation has the opposite effect. As it increases, the fish metric gets better so they have a different effect and the reference to the multiple linear regression means that off channel bays and macrophyte cover are the two variables that were positively correlated with the combined fish metric. So out of the six variables in the regression model, those two have a positive effect as they increase. The rest have a negative effect as they increase.

Q. I'm going to skip over A and B. I think you've covered that. On C, in question 39,

what is meant by the, quote, quantity of areas that act as off channel bays? For example, does this mean the aerial extent of the areas and/or the number of the areas? So similar to how you explained manmade structures that you were just counting the number, not how big, not the extent of them within a study location? Can you explain how you dealt with off channel bays?

A. Yes, this refers to the number of those areas that are larger than five square meters. So it's a count, but it's a count of the areas that are greater in aerial extent than five square meters.

Q. If you know, why was five square meters used as kind of the litmus test for whether that got counted or not?

A. Just going back. My memory we had to -- we wanted to pick a size that was large enough to distinguish it from what we call bank pocket areas, which were smaller indentations in the shoreline, but not so large that they were never present. So this seemed to be an appropriate size. So there's nothing magical about it. It's just based on the context we were

doing it in. It was large enough to be substantially counted as present, but not so large that we would never find it and not so small it would get mixed up with other variables.

MS. BARKLEY: Mary Barkley with Prairie Rivers Network. I wonder if less than five square meters or greater than five square meters of aquatic use were of biological significance?

THE WITNESS: No.

BY MS. FRANZETTI:

Q. Question 40. The second finding at 125 of the CAWS Habitat Evaluation Report states, quote, the four most important physical habitat variables in the CAWS that are negatively correlated with fish are the maximum depth of the channel, the amount of vertical wall banks, the amount of riprap banks and the number of manmade structures.

You know what, I think you've pretty much answered this, not related to these variables, but I think we all understand how you used the term negatively correlated versus positively correlated.

So I'm moving onto 41. Is Table 7-7 on page 139 of the CAWS Habitat Evaluation Report accurately described as a summary of the CAWS habitat index scores for the major reaches in the CAWS?

A. Yes.

Q. So does Table 7-7 provide a summary view of the relative differences in physical habitat in the CAWS and, again, summary views?

A. Yes.

Q. Is it correct to conclude that based on the habitat index scores presented in Table 7-7, the Chicago Sanitary and Ship Canal and the South Branch Chicago River have the lowest quality of habitat for fish among the major reaches in the CAWS?

A. Yes.

MS. TIPSORD: Before you start on question 42, why don't we go ahead and take another break. I was hoping to get through yours.

MS. FRANZETTI: I know. I was thinking the same. I don't mind. I could use a break.

(Whereupon, a break was taken after which the following proceedings were had.)

MS. TIPSORD: Are we ready to go back on the record? Ms. Franzetti, whenever you're ready.

MS. FRANZETTI: Thank you.

BY MS. FRANZETTI:

Q. I'm going to skip 42. Let's go to 43. Regarding page five of your pre-filed testimony and your discussion of the channelization of the CAWS, why is the creation of shipping channels so detrimental to fish life?

A. The potential impacts of shipping on aquatic life are discussed in Section 4.2.2 of the Habitat Evaluation Report and include habitat loss and denaturization of the flow regime through things we've talked about in the CAWS such as straightening and deepening and bank modification and floodplain disconnection, substrate removal through drudges and vegetation removing through dredges.

There can be direct impacts on fish although we did not measure these in the

CAWS. Things like propellor and vessel impacts and physiological effects from wakes, sheer stresses from the passing vessels and that sort of thing and finally increase suspended sediment likely as a detrimental effect.

Q. Question 44. On page six of your pre-filed testimony, you stated, quote, in rivers and streams, connection to the floodplain is not only important for the system's hydrology, but is important for aquatic biota. For fish, floodplains can provide seasonal habitat diversity as well as a source of organic and inorganic material required by various organisms and various life stages, end quote. What do you mean by connection to the floodplain?

A. In this context, what I mean is a hydrologic connection between the channel of a river or stream and its floodplain. It can either be a temporary or permanent connection which allows the exchange of water and organisms and nutrients.

Q. On pages six to seven of your testimony, you state that, quote, floodplains never existed. For the 75 percent of the CAWS

that were excavated where channels did not previously exist such as the Cal-Sag Channel and the Chicago Sanitary and Ship Canal, why didn't floodplains exist?

A. For the portion of the CAWS that were constructed from where channels didn't previously exist, the floodplains didn't exist because you can't have a floodplain without a stream or a river.

Q. Okay. On page seven of your testimony, of your pre-filed testimony, you state that, quote, in the CAWS reaches that were once natural waterways or partially so, channelization has eliminated floodplain connectivity almost entirely, end quote. Please explain how channelization eliminates floodplain connectivity?

A. Channelization includes the steepening of banks and the deepening of the channels. Sometimes with the widening of the channels with the specific intent of containing the flows that occur. So preventing flows from exceeding the banks. So once that happens, if it's a successful, that connection to what may previously have been a floodplain is cutoff.

Q. On page ten of your pre-filed testimony, you state that, quote, the absence of floodplain and floodplain connectivity in the CAWS is for the most part an irrevocable condition. Please explain why.

A. To restore floodplains or implement new floodplains where they didn't exist previously, it would require large areas of what are today mostly developed land along the channels to be cleared to allow the flooding to occur and it would also require some of the removal of the things in the channel that have been put in place to facilitate their function for navigation and flood conveyance and storm water conveyance. So it seems to me impracticable to do that on any large scale in an urban setting.

Q. Question 45. On page seven of your pre-filed testimony, you state that, quote, the CAWS habitat study found that channel depth -- you know what, I'm going to change this because I really was just trying to understand what strongly negatively correlated with fish condition means. So when you've talked about negative correlation -- when you add this strongly negative

correlation, what is the difference?

A. Strong refers to higher R squared value.

Q. Higher R squared value?

A. Yes.

Q. Showing a negative effect on some?

A. The higher R squared value would show a stronger relationship. It could be a positive or a negative.

Q. Right. I'm trying to say with strongly negative?

A. Yes.

Q. But did you have any numerical kind of cutoff for where you feel it's really strongly correlated on R squared values?

A. Relative comparison for the most part.

Q. Moving to 46. On page six of your pre-filed testimony, you state the CAWS Habitat Evaluation Report, quote, found that sediment contamination was statistically correlated to poor invertebrate condition, do you think you've answered that question?

A. I think I have.

Q. I think you have, too. I'm going to skip that. Forty-seven. On page seven of your pre-filed testimony, you state that, quote, CAWS reaches with high commercial navigations were found to have a statistically significant poorer fisheries condition than those reaches without high commercial navigation. Is this Chicago Sanitary and Ship Canal one of the reaches with high commercial navigation?

A. Yes.

Q. And did you have a basis for determining if commercial navigation usage was high as you used that term?

A. The business for this was the use of commodity tonnage data from the Corps of Engineers which had been subsequently processed by the Great Lakes Fishery Commission.

Q. So it was based on looking at the Corps of Engineers data?

A. Yes.

Q. Page 48 -- question 48. On page three of your pre-filed testimony, you discuss the finding that there is a limited potential for physical habitat improvement in the CAWS. You

discuss the effect that, quote, reach wide improvement of the primary habitat impairment that can be improved would result in habitat index score increases between 0 and 13 points, end quote.

What do you mean by, quote, reach wide improvement of the primary habitat impairments, end quote?

A. The phrase reach wide improvement of the primary habitat impairments mean the habitat attributes that were identified in the habitat index over entire reaches of the CAWS such as the entire Chicago Sanitary and Ship Canal.

Q. Moving to question 49. On page 13 of your pre-filed testimony regarding the habitat improvement report, you discuss the fact that some of the Limnotech assumptions regarding habitat improvement potential may not be realistic and you give the example of the estimates that proposed improvements would increase the habitat index score from 34 to 47, a 38 percent increase for the South Branch Chicago River and that this is largely predicated on the assumption that half of the vertical side walls can be removed and

improved, which may not be feasible.

Please explain further what the assumption is regarding removal and improvement of the vertical side wall of the South Branch of the Chicago River entailed and what is the improvement you're contemplating there?

A. The improvement -- there's a conceptual example of what that might look like given in the Habitat Improvement Report, but it includes the removal of the vertical structure at the bank such as sheet piling and then excavating the bank back from there to create a stable slope, stabilization of that slope to prevent subsequent erosion and then some type of vegetation addition. So planting of the bank to create -- in an effort to create something that resembles a more natural bank condition.

Q. Are you aware of any similar projects in scope and size being done?

A. Not on this scale, no. Not on this scale.

Q. Move onto the next question, 50. Referring to page 14 of your pre-filed testimony, is it correct that the CAWS habitat index

Limnotech developed does not account for all of the stressors for the fish community that exist in the CAWS?

A. Yes.

Q. It is correct that the fish community stressors that are not accounted for in the CAWS habitat index include effects of navigation, sediment contamination and flow variability?

A. Yes.

Q. Do you agree that all three of these exist in the South Branch of the Chicago River?

A. Yes.

Q. Do all of them exist in the Chicago Sanitary and Ship Canal?

A. Yes.

Q. Moving onto 51. On Page 15 of your pre-filed testimony, you state first a cluster analysis of the fish data used in the study (attachment four) indicates that a dominant fish community occurs throughout the CAWS suggesting a degree of stability in the fish community. In light of this, it is unlikely that the small increases in habitat scores discussed here would

likely result in significant change in fish community (i.e., new species or significant change in relative proportion of existing species), end quote.

Please explain what you mean by the phrases, quote, dominant fish community, end quote, and, quote, stability in the fish community?

A. The phrase dominant fish community as we used it in this context refers to the most commonly observed group of fish species in the cluster analysis, which was observed at every station in the CAWS and it includes large mouth bass, common carp, and a number of minnow and sunfish species. The phrase stability of the fish community refers to the fact that all trophic levels are represented in this dominant fish community.

Q. So the fact that the fish species cover three trophic levels indicates stability in the fish community?

A. I don't know that the number is three, but, yeah, the trophic levels that you would typically expect to see.

Q. Okay. Question 52. Referring to page five of attachment four to your pre-filed testimony, it states, quote, one cluster comprised the majority of the most abundant fish species including large mouth bass, blue gill, common carp and a number of minnow and sunfish species. This group was observed at every station in the CAWS. For this evaluation, that cluster will be referred to as the, quote, dominant fish community. Is this the description of the fish species that makeup the, quote, dominant fish community in the CAWS that you were referring to in your pre-filed testimony?

A. Yes.

Q. Referring to page five of attachment four to your pre-filed testimony, specifically with respect to table one on that page, you state, quote, an evaluation of the direction of the trophic levels (food chain links) represented within the clusters indicates that the dominant community has the most complete representation from all trophic levels while other clusters primarily consist of fewer components of the food web.

This suggests that the dominant community represents a relatively complete fish community in the sense that its members occupy most trophic levels. The other clusters lack the components such as prey bait to exist as independent communities, end quote.

Please explain the significance of the statement that, quote, this suggests that the dominant community represents a relatively complete fish community in the sense that its members occupy most trophic levels. In other words, why is it significant that the dominant fish community members occupy most trophic levels?

A. It's significant because the presence of the -- the fact that trophic levels are all represented is an indicator that the community is self-sustaining, if you will, where as if some were absent it might indicate that an unstable condition, a transient condition in the fish community, that might not be there next year.

MR. ANDES: If I can follow up on that. When you talk about a relatively complete fish community is representing various trophic levels, are you saying anything in terms of having

both tolerant and intolerant species? Does it have to have tolerant and intolerant to be complete or is that a different issue?

THE WITNESS: No. This just refers to the trophic levels.

MR. ANDES: In terms of tolerance, what do you generally see here in this particular fish community?

THE WITNESS: These tend to be more tolerant.

MR. ANDES: So they're generally tolerant, but they're still a complete community in terms of having several different trophic levels, is that correct?

THE WITNESS: Yes.

MS. WILLIAMS: Can I ask a follow up? Does the list of dominant species we're discussing also include some intermediate species?

THE WITNESS: I don't know. I'd have to look.

MS. WILLIAMS: Where would you look? Explain where you would look to determine that.

THE WITNESS: I'd have to look at the list, first of all, and I don't have the

complete list in front of me and then there's a table that we use to classify species in terms of tolerant, intolerant and intermediately tolerant so I would cross reference.

MS. WILLIAMS: So you didn't look at tolerant, intolerant and intermediately intolerant?

THE WITNESS: Right. So we'd have to cross reference the list in the dominant fish community with that tolerance table and then you could determine that. So I don't recall.

MS. WILLIAMS: Is it possible that this dominant community is composed of tolerant and intermediately tolerant species?

THE WITNESS: It's possible. I'd have to check.

MS. WILLIAMS: Thank you.

BY MS. FRANZETTI:

Q. Question 54. I'm not going to read the whole intro and just get to the question. Does the data collected in your study support the conclusion that the substrate plays an important role in determining the nature of the fish community that can be expected to be present in a

given waterbody?

A. I would say the results of CART analysis support that, yes -- I'm sorry. The cluster analysis.

Q. Can you elaborate just a little bit further on why the results of the cluster analysis support that?

A. There is -- again, I don't have the memo in front of me, but there was a table in there that related the observed fish clusters to their substrate preferences and I think that's what this quote refers to. Let me just read it to myself.

Q. Sure.

A. So the quote that you didn't read has to do with the fact that there was a cluster of rock bass, small mouth bass that have a preference for coarse substrate and they're less frequent or hardly found at all actually in the CAWS so when you look at the dominant clusters that were identified in the CAWS they seem to be clusters that are associated with substrate that is found in the CAWS.

Q. Moving onto question 55. On page

six of attachment four to your pre-filed testimony you state, quote, the distribution of pollution tolerances among the clusters indicates that all, but one of the clusters are dominated by tolerant species, end quote.

For the clusters that were dominated by tolerant species, what does this say about the general quality of the fish community in the areas of the CAWS where these clusters were found?

A. It simply means that the observed fish clusters were dominated by tolerant species.

Q. Would you say that's not a very good quality of fish community?

A. I would say it's not surprising.

Q. I guess I'm just looking for on the scheme of relative -- will --

MR. ANDES: When we say they're tolerant, what are they tolerant of?

MS. FRANZETTI: Right.

THE WITNESS: The answer to that is they're tolerant because they're classified as tolerant.

MR. ANDES: What are they

tolerating?

THE WITNESS: Typically, poor water quality.

MR. ANDES: Poor habitat quality?

MR. GIRARD: How do you know poor water quality when you see it?

THE WITNESS: The assignment of tolerance was made by using -- by referring to other studies and those other studies classify the tolerance of these species according to the tolerance of their pollution. So that's all I'm saying is that when we use their tolerance assignments by implication, the tolerance is based on that and all we're observing here is that most of the fish community or fish clusters we observed are dominated by these tolerant -- pollution tolerant species.

MR. ETTINGER: Are rock bass pollution tolerant?

THE WITNESS: I don't believe so.

MR. ANDES: Are they observed frequently in this area?

THE WITNESS: No.

BY MS. FRANZETTI:

Q. Were the clusters found in the South Branch of the Chicago River and in the Chicago Sanitary and Ship Canal dominated by tolerant species?

A. Yes.

MS. FRANZETTI: Give me just a moment.

BY MS. FRANZETTI:

Q. There's a question I have for Dr. Mackey that I think based on your testimony may be more suitably directed at you.

A. Okay.

Q. Did you consider as part of your work in developing this CAWS Specific Habitat Index, did you consider the Ohio EPA use classification system?

A. No.

Q. So you didn't do any work to look at whether or not Ohio's use classification system might contain appropriate use classifications for the CAWS?

A. No.

Q. Okay. That wasn't a trick question.

I was curious as to whether or not that had been looked at and, if rejected, why?

MS. FRANZETTI: Thank you, Mr. Bell. I don't have any further questions.

MS. TIPSORD: Any other questions for Mr. Bell at this time?

MS. BARKLEY: I would just like to ask a few clarifying questions. I think, Mr. Bell, you testified earlier that the 12 fish metrics and fish sampling stations were not the same places that dissolved oxygen and temperature were taken, is that correct?

THE WITNESS: Yes.

MS. BARKLEY: So is it clear in the record at which point fish sampling points were done and at which point dissolved oxygen temperature sampling was done? Is it clear? Is it going to be clear in the record the distance and other influences that might be -- might impact those fish communities between the water quality sampling station and the biological sampling stations?

THE WITNESS: I think it's Appendix C to the Habitat Evaluation Report

addresses that. There should be a table in there that lists the fish sampling stations and describes which CDOM stations we paired to those fish sampling stations and I think there's also -- in fact, I'm fairly certain there's also a map in there that shows all of the fish sampling stations and all of the CDOM stations. So it should be pretty easy to put them together so you can see how close or how far they were.

MS. BARKLEY: Is there a reason that dissolved oxygen and temperature profiles were not taken at the time you collected fish?

THE WITNESS: First of all, we did not collect all of the fish. The District collected most of the fish samples in the area between 2001 and 2007. I can't answer why they didn't do profiles. When we did our 2008 sampling to supplement the sampling for validation, we didn't do profiling because it wouldn't match the historical data. So we wanted to get a dataset that was reflective historically. So we relied in 2008 on the CDOM data as well.

MR. ANDES: The 2001 to 2007 data was that all collected before this rulemaking

started?

THE WITNESS: Yes.

MS. BARKLEY: Was any water quality data collected at the fish sampling stations that the District has established?

MS. TIPSORD: Ms. Barkley, you're going to have to speak up.

MS. BARKLEY: Sorry. Was there any water quality data collected at the time that the fish samples -- fish sampling was done?

THE WITNESS: I would have to go back and look at the record to see what was collected at the same time as the fish sampling. There are certain water quality measures that are collected at the same locations as the fish sampling stations, but off the top of my head I don't recall what the District's practice is in sampling water quality at the time of fish sampling.

MS. BARKLEY: Thank you.

MS. TIPSORD: Anything else for, Mr. Bell? Thank you very much, Mr. Bell. We appreciate your testimony.

MS. BARKLEY: Thank you.

MS. TIPSORD: Let's move onto Dr. Mackey. While we're switching around, I understand that there's going to be -- IEPA is going to defer so are we starting with Prairie Rivers or where are we going? If none of the participants have an objection, that's fine. We can start with Citgo if that's okay with everyone. Then, we'll start with Citgo.

(Whereupon, a break was taken after which the following proceedings were had.)

MS. TIPSORD: Are we ready? We'll have Dr. Mackey sworn in.

WHEREUPON:

SCUDDER MACKEY

called as a witness herein, having been first duly sworn, deposeth and saith as follows:

MS. TIPSORD: If we can have a copy of his testimony. If there is no objection, we will mark the pre-filed testimony. It was actually filed February 2nd, 2001, and I want -- I'm going to be doing that with witnesses from the District who have testified more than once so it's clear with what we're talking about. If there's

no objection, we will enter Dr. Mackey -- Scudder D. Mackey's testimony filed February 2nd, 2001, as Exhibit 457.

MR. ANDES: 2011.

MS. TIPSORD: Yes. 2011. Thank you.

MR. ANDES: We haven't been going that long.

THE WITNESS: It feels like it.

MS. TIPSORD: It's Monday. Seeing none, it's entered as Exhibit 457.

(Document marked as IEPA Exhibit No. 457 for identification.)

MS. TIPSORD: Whenever you're ready.

E X A M I N A T I O N

BY MR. TESHER

Q. Good morning, Dr. Mackey. My name is Ariel Tesher. I'm here on behalf of the Lemont Refinery. I have a few questions that we pre-filed for you. I don't think this will take very long. We'll start with the first one. Based on your education and training, do you support discouraging or preventing evasive species from entering Lake Michigan?

A. Yes, I support discouraging or preventing evasive species from entering Lake Michigan.

Q. Why is that?

A. They could do irreputable harm to the Great Lakes Fishery and to the Great Lakes ecosystem.

Q. To the best of your knowledge, does the electric fish barrier prevent invasive species from entering Lake Michigan?

A. I would say it's designed to do so, but it may not be a hundred percent effective. Let's hope that it is.

Q. It is partially effective?

A. It's hard to say. The effectiveness evaluation is ongoing with the US Army Corps of Engineers.

Q. Okay. Based on what you know, would you favor maintaining the electric fish barrier?

A. Yes.

Q. Why is that?

A. Again, I think it's at least a short term temporary way to prevent damage to the Upper Great Lakes or to the Great Lakes Fishery and to

the Great Lakes ecosystem. I understand that there are several ongoing efforts that are exploring the feasibility of a hydrologic, permanent separation of the two bases and the electric field barrier provides us a bit of time in order to get that analysis done and move forward with whatever decisions are made.

Q. Would you consider the electric fish barrier a physical habitat characteristic that is also a limiting stressor on the Chicago Area Waterways? I'm referring to page four of your testimony where you talk about fiscal habitat characteristics?

A. Yes. I believe I would consider it a physical habitat characteristic. The caveat that I have is as long as the barrier remains operational. We are putting electric current in the water. It is going to act in essence a physical barrier to the migration of fish up or down the CAWS.

Q. And, Dr. Mackey, do you know what is the current plan for when the barrier is taken out of operation? What is done in those periods of time?

A. Could you -- taken out of operation are you talking about maintenance?

Q. Yes.

A. It's been a while since I have had an update on that, but I do understand that the barriers do temporarily have to be maintained. I believe barrier 2B is operational at this time and barrier 2A I believe was down and it may still be down for maintenance work, but I believe it's a six to eight month schedule for maintenance.

Q. When all of them are taken down, do you know how the Army Corps prevented fish from coming past it?

A. It's my understanding that the design of the system is as such that they will be taking down one barrier while the other ones remain operational. In other words, that's the reason we have barrier 2A and 2B and then as a backup we have the barrier one which is just a bit upstream from 2A and 2B.

Q. Are you aware of the use of rotenone when barrier pathogens have been taken out of operation?

A. Yes.

Q. Why is rotenone used?

A. In that case, there was concern about actual barrier 2A and 2B were not operational and there was maintenance that had to be done on barrier one and the Corps of Engineers and the State of Illinois and other partners decided to rotenone a 5.5 mile reach of the CAWS. At that time, we did not believe that the leading edge of Asian carp had reached that location and this was a precautionary measure to basically if there were any fish there to eliminate them or move them downstream below the Lockport Lock and Dam. That would give us a window of opportunity to perform the maintenance work and then bring barrier one back online.

Q. Back to the pre-filed questions number five for those people keeping score. It is your testimony on 11 in addition to the electric barrier, the other physical characteristics in the area of the electric barrier are unfavorable to aquatic life or is it your testimony --

A. Yes, the physical characteristics in the vicinity of the aquatic dispersal barrier are very similar to other areas within the Chicago

Sanitary and Ship Canal and those characteristics include vertical channel walls, composed of limestone and bedrock, a rectangular channel morphology. In other words, there's no shallow littoral areas, relatively steep walls.

Relatively uniform deep water across the channel. The flows are fairly moderate except during major storm events and the flows are in part regulated primarily bedrock and some localized silt muck, mineral substrates. There's an absence of coarse substrates in that area. Limited bank edge and in stream habitat structures. Virtually, no overhanging vegetation or trees in that area. It's an area of fairly intense navigation and there's no connection to a floodplain. Virtually, no riparian.

Q. Thank you. In addition to those physical aspects, does the existence of the electric barrier make the stretch of the Ship Canal even less hospitable to aquatic life?

A. I'd say certainly within the reach that is directly effected by the electric field that is produced by the dispersal barrier, I would say yes. I don't think there's too many organisms

that would want to live in a pulsing, electric field.

Q. Okay. That would be the RNA as designated by the report?

A. Yes.

Q. Given the existence of an electric fish barrier, do you recommend and support of having a protected area around the barrier to protect from the boating and others the might drive in the Ship Canal?

MS. WILLIAMS: I object. Clearly reactional use it has nothing on aquatic life so it's not a fair question.

MS. TIPSORD: I lost the last bit, Deb.

MS. WILLIAMS: I'm sorry. It's purely a recreational use, not aquatic life use so it's not appropriate for sub docket C.

MS. TIPSORD: Do you have a response, Mr. Tesher?

MR. TESHER: Others who would interact with the Ship Canal would include people that would fish at the aquatic life.

MS. WILLIAMS: Again, fishing is a

recreational use activity not an aquatic life use.

MS. FRANZETTI: If the agency is concerned about Dr. Mackey's response and the Board finds it inappropriate, that's fine. We'll deal with it.

MS. TIPSORD: I think it's recreational use. I agree.

MS. FRANZETTI: All right.

BY MR. TESHER:

Q. I have some other questions that probably get at the same area. Dr. Mackey, do you think the Board should recognize the existence of an electric fish barrier and discouragement of species entering Lake Michigan as and the use of the waters in which the electric barrier is located?

A. Could you clarify the question by what you mean by use of the waters?

Q. Sure. This rulemaking is concerned with the use of the water. We have a reference to the recreational uses, aquatic life uses. So my question to you is given what we've talked about with the protection from invasive species should the application of invasive species as formed by

the electric fish barrier be recognized as a use of the water? Is that one use of the water is looked to in the area of the electric barrier?

A. I really haven't thought about it or have an opinion on that. I think the electric field barrier in itself is in place. It's operational. Hopefully, it's a hundred percent effective and until we come up with a more permanent solution to the problem, I think the electric field barrier is what we have. I don't know if that requires a special designation in terms of use.

Q. Would you say that's how the waters are being used right now, one use of the water right now?

A. Certainly, it's being used for navigation purposes. I mean, we have commodities and shipping moving up and down through that reach of the waterway. Certainly, it's being used for the conveyance of waste water and storm water because the waters are moving through. So I still say there are multiple functional uses of that waterway.

Q. Absolutely. My only question is is

one of those uses to keep invasive species from entering Lake Michigan and the Great Lakes?

A. In the location of the electric field barrier, I would say yes.

Q. Would you believe -- this is perhaps repetitive of the earlier question. Do you believe the area of the electric fish barrier is capable of supporting any significant, aquatic life?

A. You're talking about significant aquatic life. I suspect there may be some macroinvertebrates that may be living in the soft sediments.

Again, I'm not sure how happy they would be subjected to a pulsing electric field. I don't believe that fish are going to be familiarly comfortable within the electric field as designed to compel fish.

MR. TESHER: That's all I have for you, Dr. Mackey.

MS. TIPSORD: With that, we'll move to Prairie Rivers. Albert?

E X A M I N A T I O N

BY MR. ETTINGER

Q. Did you work directly on the Limnotech study?

A. No, I did not.

Q. Would it be accurate to say, though, that a lot of your testimony is based on your interpretation of the Limnotech studies?

A. No. Which testimony are you speaking of?

Q. The testimony of Scudder D. Mackey in support of the new aquatic life use designation.

MR. ANDES: This testimony as opposed to his earlier testimony in the matter or both?

MR. ETTINGER: I think this is the one that was filed in February. Yes, I'm just talking about this one today. I can't go back that far in the past. All I'm really trying to do is cut us off of a lot of questions here today so I don't go over the whole Limnotech study with you.

BY MR. ETTINGER:

Q. So is it safe to say if we ask Mr. Bell about the question of the Limnotech study that you're unlikely to be able to add anything to it that Mr. Bell didn't?

A. I would tend to agree with that.

Q. Thank you. You just knocked out a lot here. So you did not work on the Limnotech study, but I still have to ask question number one. To your knowledge, has the type of study done by Limnotech to assess habitat conditions in the CAWS been done in any other waterbody?

A. I would say that there have been numerous -- number one, there are a number of different types of habitat assessment protocols that have been developed by different states and by different organizations primarily focused on habitat assessment and certainly there are numerous studies if you look at the literature and reports from agencies and whatever.

So I would say from the habitat component, yes. The habitat assessment is -- it's a standard type of thing that's done these days in terms of trying to assess the relative health of

rivers and streams. The problem is that with respect to the CAWS is that most of these habitat assessment protocols are based on natural systems and we've already had this discussion I know with --

Q. That's why I'm specifically not trying to go over the same thing.

A. Right.

Q. You heard me ask the question of Mr. Bell. Do you know of studies other than what he has already discussed of this time?

A. Generally, they would be the same types of things that Mr. Bell has testified.

Q. Do you know of any such report that concluded that water quality was more important to the waterbody study than habitat conditions?

A. I can't answer that question. In other words, no, I don't know that.

MR. ANDES: Do you know of any that concluded the opposite?

THE WITNESS: Not really, but, again, the studies that we were talking about just a few seconds ago in the first question, those were primarily habitat assessments. They weren't

focused on water quality, per se. So those comparisons weren't made, but this is certainly the study we did, that Limnotech has done here of the CAWS, is certainly an example of the city that has shown that habitat is certainly limiting in the system.

BY MR. ETTINGER:

Q. I understand, but we've gone over that study. I'm just asking if there are other studies that you know of that Mr. Bell hasn't already brought to us and the answer to that question is no?

A. That's correct.

Q. Because I think we've been over question two and three with Mr. Bell quite thoroughly. I'm going to skip that. Four, are there forms of aquatic life that can be effected by low dissolved oxygen levels other than fish?

A. Yes.

Q. What are those?

A. Certainly, benthic organisms and macroinvertebrates. Those communities that live in the sediments are on the bottom.

MS. TIPSORD: Dr. Mackey, I'm sorry.

When you're talking, we can't hear you over here.

MR. ETTINGER: He's important. I'm just -- actually, he is the most important person. Did you want him to repeat the question?

MS. TIPSORD: No. That's okay. Just remember to keep your voice up.

THE WITNESS: Okay.

BY MR. ETTINGER:

Q. Then, number five. Are some species of juvenile fish more sensitive to low dissolved oxygen levels than adult fish of the species?

A. The answer to that is yes. But we've been looking at the literature and there are some studies that show juvenile -- some juvenile fish have similar tolerance levels as to the adults. So that's -- it's not -- it's a generalization, but it may not be completely correct.

Q. Reading my question six here and it's not one of my better exhibits of the English language so I'm going to try it anyway.

MR. ANDES: I'm not even going to go there.

BY THE WITNESS:

A. I had difficulty in answering this question.

BY MR. ETTINGER:

Q. Let me see if I can interpret this from Cincinnati into English. I guess what I meant to say here is from your knowledge of Midwest fish species, what is missing here in terms of waterbody? What would you -- what other than intolerant or moderate -- are there any fish that are missing other than ones that are intolerant or moderately intolerant obligate riffle dwellers --

MR. ANDES: Can I ask to clarify? Do you have a list of the species of fish in the Midwest that we're culling from?

MR. ETTINGER: We're culling from his entire knowledge of the universe as it focuses on the Midwest.

BY THE WITNESS:

A. Given that I'm a geologist primarily by training and specialize in habitat work, the answer to this is straight forward. I would defer this question to Jennifer Wasik who may have a

better ability to answer this question.

MR. ETTINGER: Poor Jennifer is not here to defend herself.

MR. ANDES: She is taking my place down in Springfield.

MS. ETTINGER: Wow. She is lucky.

MR. ANDES: She'll be here tomorrow.

MR. ETTINGER: Right.

BY MR. ETTINGER:

Q. I'm going to read your sentence on page four and then we'll just try to ask about that. Leave off my incoherent sentence. So what you wrote on page four of your pre-filed testimony is even though the shoreline habitat improvements recommended in the Habitat Improvement Report would benefit many of the species already found in the CAWS, it would not benefit populations of intolerant or moderately intolerant obligate riffle dwellers that require fast moving water and coarse substrates commonly found in natural channels and my question is, is there everything in the CAWS now other than tolerant or moderately intolerant riffle -- I'm sorry -- obligate riffle dwellers?

A. As I stated before, I can't answer that question because I don't know and, again, I would defer to Jennifer Wasik.

Q. Okay.

MR. ANDES: Let me follow up a little bit. If you can describe from a habitat perspective what your judgment is as far as if improvements were to be made in a habitat, which species would be benefitted by that versus which species would not be benefitted?

THE WITNESS: Of course, it would depend on the types of habitat improvements that you would make in the system. There was a discussion with Mr. Bell earlier today talking about the possibility of putting in riffle pool sequences somewhere in the CAWS. Certainly, that would conflict with the functional uses such as navigation and with conveyance of waste water or storm water, but if you could do that, it's conceivable that you might be able to attract some different fish that would use those types of habitats and the other important thing to remember, though, is that the riffle pool sequences and this ties in with this article, the

Bunn and Arthington article, natural flow regimes, when you do habitat restoration, if you want to do sustainable habitat restoration, you need to make sure that you design your restoration projects with the appropriate flows in mind.

If you were to throw some gravel in these areas to create pools and riffles and if you don't have the appropriate flows to maintain that type of habitat structure, you're going to get a lot of silt and a lot of interstitial spaces with silt in it.

So there has to be a lot more modeling work or design work when you're actually thinking about the types of habitat restoration projects that you would want to do here.

MR. ANDES: So if you don't change the fundamental aspects of the system in terms of steep channel walls, the flow, et cetera, and you try to do some things to modify habitat, are you saying you're not going to get much in terms of improvement of environment for the fish?

THE WITNESS: Yes, that's correct. There's several different factors you're going to have to consider. It's just not dumping gravel

into the river. You have to look at the flow regime. You have to look at the pattern and actually it's what we call the habitat diversity. It's a pattern of connectivity between different types of habitat that are really important when you think about restoration because, for example, just a pile of gravel sitting on the channel bed that's all it is.

Fish come -- and if fish come and they key in on that gravel and they spawn on that gravel, but there's no adjacent nursery habitat or no connection to the nursery habitat, those eggs will not survive once they emerge from the spawning beds because it's not connected to other types of habitat structure that are necessary for the organisms to basically grow through the different life stages to become adults. So it's just not about one type of habitat. It's about a habitat pattern and connectivity.

So I probably have gone a bit around your question, but I would say if you could put in the appropriate types of habitat structure and pattern that you might have a chance to bring

in some different types of species.

Q. Okay. We don't want to make too small of plans or too large of plans, but will make our variety of possibility. All I want to ask just to nail down these obligate riffle dwellers question here, reading that sentence by itself, it makes it seem like everything is present in the CAWS that we could expect there other than these obligate riffle dwellers, is that what you meant to say or you're not sure?

A. I would say I'm not sure and that was not the intent of this statement. The intent of the statement was to say that there are some fundamental habitat characteristics that are necessary for certain species to, let's say, reproduce and survive in the CAWS.

MR. ANDES: Does that mean if you keep the basic functional characteristics in the system you'll never get the tolerant species to flourish here?

THE WITNESS: The chances are very slim that that would occur here.

MR. ANDES: Thank you.

BY MR. ETTINGER:

Q. Good. We don't want to keep the basic functions of this system necessarily.

MR. ANDES: You'll have to define who we is.

MR. ETTINGER: Let's introduce a exhibit and ask about the preliminary feasibility of ecological separation of the Mississippi River and Great Lakes to prevent the transfer of aquatic species. I have two more copies of this that I made at great expense.

MS. FRANZETTI: Albert, how long is it?

MS. ETTINGER: It's about 104 pages.

MS. FRANZETTI: I would say I'll make some copies in my office. I have questions.

MS. WILLIAMS: Albert, can you be sure to put all the information in the record about the title and the date and everything so we can make sure we have it?

MR. ETTINGER: Along with the calendar I gave you earlier, I'm going to give you this.

MS. FRANZETTI: Albert, we're

hearing back here this is available electronically?

MR. ETTINGER: I suspect it is.

MS. FRANZETTI: Albert, do you want a copy back? I thought it was a more recent report.

MS. TIPSORD: If there's no objection, we will admit Great Lakes Fishery Commission 2008 Project Completion Report Preliminary Feasibility of Ecological Separation of the Mississippi River and the Great Lakes To Prevent The Transfer of Aquatic and Invasive Species by Joel Brammeier, Irwin Polls and Scudder Mackey, November 2008. We'll admit that as Exhibit 258 if there's no objection. Seeing none, it's Exhibit 458.

(Document marked as IEPA Exhibit No. 458 for identification.)

BY MR. ETTINGER:

Q. Okay. Ms. Tipsord stole my thunder. I was actually going to try to properly authenticate something for once, but are you the author of this report that was previously marked as Exhibit No. 458?

A. I am one of the coauthors, yes.

MR. ANDES: Are there particular sections of this report that you were responsible for?

THE WITNESS: Yes, I was responsible for the hydrology flow and navigation portions of this report.

BY MR. ETTINGER:

Q. Specifically, let's get down here in this -- are there any recommendations of this report that you want to walk away from now?

A. No, I don't think so.

Q. You haven't woken up and read this?

A. This was written in 2008 and we're both about the same age so we have issues.

Q. No. You must be much older than me. I am only 39. Is there anything that you've now looked over on this document and said, gee, Irwin Polls wrote that, I can't stand by this anymore?

MR. ANDES: Are you going to ask him to review -- he told you which parts he was responsible for? Are you asking him to confirm he has read every sentence in the report except certain ones?

MR. ETTINGER: I'm not asking him if he agrees with every sentence in the study. I'm asking him whether based on his study and preparation of your testimony today did you find anything in this that you would like to say you now decide you don't agree with?

BY THE WITNESS:

A. I would say that the one thing that I would state differently would be what was in your pre-filed question, which has to relate to the periodic discharges from combined sewers causing a decrease in the dissolved oxygen concentration and its potential impact on the fish community.

BY MR. ETTINGER:

Q. Did you author that?

A. No, I did not.

Q. Who did?

A. I believe that was Irwin Polls.

Q. In this report, you guys suggest the possibility of some fairly major changes to the system, is that correct?

A. That is correct.

Q. Such as shutting down the Chicago

Sanitary and Ship Canal is one of the things you consider or breaking navigation, just below or in the South Branch of the Chicago River. Is it correct that you considered those possibilities?

A. I wouldn't use the term shutting down the CAWS. The fundamental tenant of the study was to explore possible options for some sort of ecological separation of the Mississippi Basin from the Great Lakes Basin, particularly dealing with invasive species and one of the things that came out of the study was that we wanted to keep as much of the CAWS intact as possible just because it's the most practical and economically feasible thing to do.

We wanted to maintain as much commodities and navigation functions as possible. We want to maintain as much of the water conveyance, storm water, waste water conveyance functions as possible. So we look for options that minimized impacts to that primary functionality and yet still allow us to guarantee a hundred percent ecological separation between the two basins to prevent the transfer of invasive species.

Q. Again, first of all, I don't think I used the term shutdown the CAWS. I meant shutdown the interconnection and I think the specific things that you considered were things like shutting down navigation traffic through the Sanitary and Ship Canal or breaking the hydrological connection either in the Chicago River or in other locations, is that correct?

A. I don't believe we ever discussed or at least seriously considered anything in the sand -- Ship Canal, per se, because that is a primary navigation route very heavily used by barge traffic. A lot of commodities moving through that portion of the system. In general, most places where we were looking at possible if you want to call it hydrologic separation is one way you could do this. We're close to the lake as possible. So it would minimize the impacts on the internal components of the system.

Q. You did consider, though, bringing the north side sewage treatment plant up to Great Lakes standards for its discharge?

A. Yes, we had four or five different scenarios. That was one scenario that was

considered.

Q. Did any of these big picture plans -- were they considered in any way in your habitat evaluation or in the Limnotech habitat evaluation, to your knowledge?

A. Certainly, to my knowledge, in terms of the Limnotech study, I was not part of that study directly. So I don't know what they took into account or didn't take into account in terms of the feasibility of these types of changes to the system.

In terms of the habitat assessment work I did with the side scan sonar, it wasn't even on my radar screen. I was focused primarily on what was in the channels, what was in the different waterway segments and I really wasn't thinking so much about, well, where would you put a structure or if flows were changed how would this might impact that. It wasn't really part of my -- what I was doing.

Q. So things were on your sonar?

MR. ANDES: I object to that characterization.

BY MR. ETTINGER:

Q. You were at no time in your studies asked to contemplate as part of your testimony major changes to the system?

A. Not with respect to this feasibility study in terms of the Asian carp and invasive species.

Q. With respect to your testimony to the Board today, were you asked to contemplate any major feasibility? Just with regard to your testimony, were you at any time asked to consider any major changes to the system as an approach to any of these issues?

A. No.

Q. I'm going to go to my pre-filed testimony ten. On page ten of your testimony, you state that electrofishing samples in a relatively small volume of water estimated one to two million cubic feet over a short period of time (hours). What are the implications of this?

A. When I was speaking about the electrofishing work in my pre-filed testimony, that was with respect to comparing the volume of water that was sampled using an electrofishing technique versus the volume of water and the time

period that was actually sampled by the rotenone event that occurred on the CAWS, the 5.5 miles of the CAWS that was treated with rotenone to basically kill all the fish within that reach.

So that comparison or actually the point was is that you cannot compare the results, the sampling results from those two because they are sampling completely different volumes of water over different periods of time and the results are not directly comparable.

Q. How much do you know about electrofishing?

A. I have used electrofishing equipment, but I would not consider myself to be an expert on electrofishing.

Q. I'm going to ask my questions and if you feel like you don't know how to answer them I don't know is also a good answer. Does electrofishing uniformly catch all age classes of fish?

A. If you're assuming that age classes are related to size, the answer is no.

Q. How does electrofishing differ as to size?

A. It has to do with the spacing between the lines of force in the electric field. So, generally, for electrofishing -- for electrofishing larger fish are more, let's say, deeply effected by the electro fields because you have more lines of force crossing their body. Small fish are not nearly as effectively brought to the surface because there may be only one or two lines of force or none depending on the spacing of the electrodes and also the voltages and pulsing.

Q. And does electrofishing catch fish equally at various depth levels in the waterbody?

A. Not necessarily. Generally as you increase your distance away from the anodes, the electric current is attenuated and so it becomes less effective. I believe Mr. Bell and I would agree with his answer indicated that the depth -- effective depth for electrofishing is between three to four meters or about twelve feet and that's what we see in the literature.

Q. Does it differ -- is there a DC versus AC electrofishing?

A. Yes, I understand that there is.

Q. Do you know what they did at the Water Reclamation District?

A. I don't know. I would defer to Jennifer Wasik. She is more familiar with the electrofishing techniques at the District.

MR. ETTINGER: Poor Jennifer. You better schedule an extra day.

BY MR. ETTINGER:

Q. Let's ask one more electrofishing question. To your knowledge, is electrofishing done during circumstances in which there are effects from combined sewer overflows in the system?

A. I don't know. Again, I would defer to Jennifer Wasik.

Q. Okay. You mentioned on page 11 that many of the catfish found in the Chicago Sanitary and Ship Canal could have been from spawning in the Lower Des Plaines River. Could catfish spawn in other waters that are physically connected to the portions of the CAWS?

A. It's certainly possible, but I don't know.

Q. Do you think -- when you say the

Lower Des Plaines River, you're speaking of the area below the Brandon Road Lock and Dam?

A. Yes.

Q. So you think that it's possible that the catfish that were found in the Chicago Sanitary and Ship Canal got past the dam?

A. It's possible or through the locks.

Q. And you think -- could they get past the electric barrier?

A. No. It depends on the size of fish, but I suspect that they cannot pass through the electric field barrier.

Q. So if we find catfish above the electric barrier, presumably they are from some place within the system?

A. If you found them above the barrier, yes. That's highly probable.

MR. ETTINGER: That's all the questions I have.

MS. LIU: Mr. Ettinger, did you want to ask Dr. Mackey your orange question?

MR. ETTINGER: We're all dying to hear about the orange water. Thank you very much, Alisa. That's very important. Why is that

picture orange is the Limnotech report?

THE WITNESS: For those of you who weren't here this morning, there was an interesting discussion with Mr. Bell.

MR. ETTINGER: It was fascinating.

THE WITNESS: In the -- first of all, let's take a step back. I collected side scan sonar data along several reaches of the CAWS side scans and an acoustic tool that we use to map the bottom of the channel. We can see features on the bottom and also look at substrates and other types of habitat structures and in the report there is an image, an aerial photograph, where it's actually a side scan mosaic. It's where the side scan line has been geo referenced, put into proper geographic space and it's actually been laid right on top of the photograph.

So you can see what is on the channel bed and then you can also see the features, the adjacent features, the channel banks and whatever other types of anthropogenic features there are along the canal and the question was Albert wasn't sure why it was sort of a bright orangeish red color and I'm not sure it printed

out all that well, but the equipment I used is an L3 Klein Sonar. It's a digital sonar.

And Klein -- the color there is called Klein gold and there is a technical reason for that color. There's almost an entire color path and actually old side scan sonar used to be black and white and used to be inverted because that's the way it would be printed on the old, wet paper charts, but the Klein gold color they did a series of experiments and they found that the human eye that that particular color and shading actually accentuates the contrast and the detail that you can see.

So that's the color I typically use for most of my side scan work because it makes it much more -- you can see the features much more clearly and particularly if you're interpreting the data and trying to build habitat polygons or substrate polygons that color I find, at least for my eyes, very, very useful.

The only caveat I would say is that my wife has told me my color sense is horrible, especially when it comes to decorating, but I'm using the Klein color scheme.

MR. ETTINGER: If we have to, Dr. Mackey, go do another report, we'll have the Committee look at the different colors.

THE WITNESS: Yes.

MR. ETTINGER: I thank you very much.

MS. TIPSORD: With that, let's adjourn for the day and we'll start again in the morning.

STATE OF ILLINOIS)
) SS.
COUNTY OF COOK)

I, Steven Brickey, Certified Shorthand Reporter, do hereby certify that I reported in shorthand the proceedings had at the trial aforesaid, and that the foregoing is a true, complete and correct transcript of the proceedings of said trial as appears from my stenographic notes so taken and transcribed under my personal direction.

Witness my official signature in and for Cook County, Illinois, on this 26th day of May, A.D., 2010.

Steven Brickey

STEVEN BRICKEY, CSR
8 West Monroe Street
Suite 2007
Chicago, Illinois 60603
Phone: (312) 419-9292
CSR No. 084-004675

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