STATE OF CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD

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PUBLIC HEARING
REGARDING WATER RIGHT APPLICATIONS FOR THE
DELTA WETLANDS PROJECT
PROPOSED BY DELTA WETLANDS PROPERTIES
FOR WATER STORAGE ON WEBB TRACT, BACON ISLAND,
BOULDIN ISLAND, AND HOLLAND TRACT
IN CONTRA COSTA AND SAN JOAQUIN COUNTIES

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HELD AT

901 P STREET
SACRAMENTO, CALIFORNIA
WEDNESDAY, JULY 30, 1997
9:00 A.M.

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Reported by: MARY GALLAGHER, CSR #10749

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WEDNESDAY, JULY 30, 1997, 9:00 A.M.

SACRAMENTO, CALIFORNIA

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HEARING OFFICER STUBCHAER: The Delta Wetlands Water Rights Hearing will reconvene. We'll continue with the cross-examination of the Fish and Game panel by Delta Wetlands.

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CROSS-EXAMINATION OF THE DEPARTMENT OF FISH AND GAME

BY DELTA WETLANDS PROPERTIES

BY JOSEPH NELSON

MR. NELSON: While Ms. Slomski is setting up, let me inform, Mr. Stubchaer, that we received late last night E-mail from Fish and Game, which we appreciate. We know they worked fairly late to get information to us. It's being decoded and we're -- Mr. Vogel, who isn't here right now, he's actually back at the office looking over that data.

So, assuming -- hoping that we won't have any cross questions, that we can deal with that data solely in rebuttal from here on out unless Mr. Vogel calls us and asks -- that there are some issues that he has. I do -- Mr. Wernette was also kind enough to talk to me a little bit about the percentages on pages 54 and 55 after the hearing yesterday. And I do have some questions

based upon what he explained to me how those numbers were derived.

And to make it a little easier I made up an overhead that goes through -- what does -- it's labeled Delta Wetlands DW 37, which I believe is the next one in the list. And what it does is it quotes the percentages that we were -- we had the question about on the top with respect to pages 54 and 55. And then the lower section starting with DFG derived these percentages from the data on Table 5 as follows is the explanation that Mr. Wernette gave to me last night:

Couple of things, Table DW 5 is the table that we've had up on the overhead several times and we've been discussing. And he took -- he informed me that he took those numbers directly from that table. I just want to have Mr. Wernette state on the record that is correct discussion of what he and I discussed last night, or a correction description.

MR. WERNETTE: Of our discussion last night?

MR. NELSON: Yes.

MR. WERNETTE: Yes, it is.

MR. NELSON: And can we -- well, we'll get to the two stars there as we go through it. Patty, could you, please, put up Table 5. Looking at this -- those percentages, what you informed you did is you took --

looking at the upper corner of Table 5 the winter-run diversion index diversion effects --

MR. NOMELLINI: I think we ought to be marking this.

MS. LEIDIGH: Is this from the BO?

MR. NELSON: This is from the DW-5, Table 5. This is the same exhibit we've been using for the last day.

MR. NOMELLINI: What about the prior exhibit?

HEARING OFFICER STUBCHAER: That was DW-37. It was marked and it was on the exhibit.

MR. SUTTON: Do you have copies?

MR. NELSON: Yes, we have copies that are in the box.

MS. LEIDIGH: Could the copies be distributed?

MR. NELSON: Yes.

HEARING OFFICER STUBCHAER: Mr. Nomellini, excuse me, it's a new exhibit, but it is marked for identification.

MR. NOMELLINI: Okay. And that was the prior one that was the subject of discussion with Mr. Wernette?

HEARING OFFICER STUBCHAER: Yes.

MR. NOMELLINI: Thank you.

MR. NELSON: Okay. Mr. Wernette, since we can follow both on paper with Exhibit DW-37 and this overhead of Table 5 from DW-5, as you informed me was what you did

was to get the first -- just for example, for the winter-run diversion, effects were reduced to up to the 60 percent figure.

What you did was you took the .85 from the DW BA column and subtracted it from the .33 from the DFG column. And then divided it back against -- that value back against the DW BA column to get a percentage. And you stated it was about 61 and you rounded it off to about 60 percent.

Is that correct?

MR. WERNETTE: That's correct.

MR. NELSON: So you didn't compare the reductions to the no-project conditions. Instead, you took the percentage of a percentage from .85 to .33; is that correct?

MR. WERNETTE: That's correct. We compared it with the proposed project as it was described in the EIR.

MR. NELSON: So isn't it true, though, when you're looking at the diversion index and division effects what you're actually -- what these .85, .64, and .33 are actually doing is adding to what the no-project condition is.

So when -- if you took the actual value wouldn't it be 17 point -- excuse me -- 18.59 for that DW BA?

MR. WERNETTE: That's correct. The no-project

information is already subtracted out. So that the -- what the numbers under these other three columns to the right of the Delta Wetlands BA are the differences between with project and base conditions.

MR. NELSON: And aren't each of these, actually, just less than one percent of a change from the no-project condition in each case?

MR. WERNETTE: Well, in the case of the -- when it is a one-percentage change it reflects about a five-percent increase over the no-project condition when you're just looking at those average numbers. When you look at Delta Wetlands BA of about .5 it represents approximately about a 4 to 5 increase over the no-project.

MR. NELSON: Isn't it -- I'm -- I'm confused. The 17.74 is a percentage. The 0.85 is a percentage value of increase in the no-project condition. So isn't it true that the increase is actually 0.85 from 17.75?

MR. WERNETTE: Well, instead of being in percentages, you described it, it's not a percent increase. It's just an absolute change in the index value of .85.

HEARING OFFICER STUBCHAER: What --

MR. WERNETTE: Those indices are values that, you know, they don't actually have any unit value to them.

So this is just showing the absolute difference in the values. Then we'd have to develop another chart if you wanted to see the percent change.

MR. NELSON: Are those index values percent index entrainment?

MR. WERNETTE: In a sense they're the percent of a hundred particles that end up being entrained in Delta diversions, other islands, and State and Federal Water Projects. So in a sense it's a percent of the hundred particles released. However, that's indicated by the parentheses, but in the sense it is an index that, you know, doesn't represent a percent change from the no-project, or a percent change with project.

MR. NELSON: Okay. I want to go down and clarify one thing with respect to number three on DW-37 which is referencing to your statement that Delta smelt diversion effects were reduced by up to 60 percent --

THE COURT REPORTER: I'm sorry. Mr. Nelson, could you start that over?

MR. NELSON: I'm sorry. Start the whole thing --

THE COURT REPORTER: Yes. The Delta --

HEARING OFFICER STUBCHAER: Slow down a little bit.

MR. NELSON: I want to discuss just real quickly clarify your columns with respect to number three on DW-37, which, when we discussed -- last night you stated

you took the -- so we're looking at the Delta smelt diversion index which I'll use Table 5 here. You stated you used the 0.24 column and the 0.05 -- or the DFG column when we spoke last night.

When I did the calculations last night the percentage came out differently, our percentage came out. The difference in that would have been 79 percent. You stated in the biological opinion that it's 60 percent. Could you explain why -- or what the differentiation, or what the problem there is?

MR. WERNETTE: Well, when I spoke to you last night I gave you a real off-the-top-of-my-head pretty simple explanation for how we developed our percentages. And in the case of the Delta smelt diversion index we -- what we ended up doing after, you know, more thought, the 79-percent reduction that you calculated -- and when we did it a couple months ago we believed that that probably overestimated the benefit of Fish and Game's own biological opinion.

Because one of the measures that we did not include in our reasonable and prudent measures is we did not include restrictions on diversions in the months of June and July in the biological opinion. And Delta smelt larvae are present in the month of June. And so the data that are presented on the far right-hand column under the

DFG column probably doesn't reflect the total -- you know, the actual true value.

So we -- we tried to inspect the data and actually look at those months where June contributed to diversion impacts and subtracted them out so that we actually came up with a number that was intermediate between the ESA column and the DFG column and used that. So that calculation was a little over 60 percent. And we rounded it off to 60 percent.

MR. NELSON: Can you remember exactly how you did that calculation with respect to what values you used?

MR. WERNETTE: I honestly can't remember other than the method we used where we -- you know, we obviously displayed the data that we received from Jones and Stokes in monthly increments so that we could actually look at those months where June contributed an impact and subtracted those and then re-averaged the impact.

MR. NELSON: Mr. Wernette, one final question. Looking at DW -- Exhibit DW-37, again, you also informed me that you actually didn't use the same two columns when calculating the winter-run discharge effects and the Delta smelt discharge effects.

Instead you used -- instead of using the B -- the BA column and the DFG column you instead this time used the BA column and the ESA column. Can you explain

why you shifted between those two calculations to different columns?

MR. WERNETTE: I'd be happy to. When we asked Jones and Stokes to model this, we asked the Board and Jones and Stokes to model this late last winter, we had a number of measures included in the operating assumptions. One of them was no diversions -- or no discharges from Bacon Island during the -- I can't remember -- January through June period, or through March period, excuse me. There were a three month period there where we did not -- where we asked them to model the operations to not allow any discharges for export during that time.

When we developed -- the Department finally decided on its biological opinion and selected the reasonable and prudent measures, it did not include that restriction. So we believe a fair assessment was -- since we weren't really having much of an effect on discharges was to use the proposed project as it's defined in the final operating criteria. So the percentages we calculated are, in fact, the same reductions that occur in the final operating criteria.

MR. NELSON: So is it -- isn't it true that the reason you used the ESA column in your discharge effects calculations and you changed, or modified your 0.05 value was because you didn't do an independent analysis of the

effects of the biological opinion terms?

MR. WERNETTE: The reason -- I'll answer that in two parts, if I can. The reason we didn't do the discharge analysis -- or we didn't have that data value to us was because we had just this one model run available to us to do the assessment. So, we in our judgments, we decided that we would not have any modification to what this model predicted as far as discharges in that center column under DW ESA.

And we used the modeling information as best we could to -- through inspection to modify that .05 number under the DFG column for diversion effects to reduce what we estimated originally -- or what this model at least estimated originally would be the effect.

MR. NELSON: Did you then view the March 25th analysis as an analysis that would be useful in analyzing the effects of your project under the biological opinion?

MR. WERNETTE: In my opinion I think it was very useful in assessing it. It wasn't a perfect assessment of our opinion, because we didn't have an opportunity to provide the more detailed specifications as modified. And sometimes it's a little hard to predict the exact outcome of that. So we did the best we could with the information we had.

MR. NELSON: Is the reason that you found it a useful tool was because the measures analyzed in the March 25th analysis are very similar to what it ended up in the biological opinion?

MR. WERNETTE: I don't think the that's the reason we found it useful. I think one of the reasons we found it useful was that at least in the electronic format we had the capability of seeing the data presented in a monthly format as opposed to an annual format. So that when the measures that Fish and Game has in its reasonable and prudent measures triggered we could easily see which months were effected and which ones weren't.

MR. NELSON: The measures analyzed in the March 25th memorandum aren't they substantially similar to the reasonable and prudent measures and the additional conservation measures that Fish and Game has proposed?

MR. WERNETTE: When you combine our reasonable and prudent measures with our additional conservation recommendations they're nearly identical. The only exception is that in our additional conservation recommendations that we make no recommendation with regards to discharges from Bacon Island in that January through March period.

MR. NELSON: Thank you. I have no further questions on this exhibit right now. I'd like to direct

my next questions to Mr. Sweetnam.

Mr. Sweetnam, in your testimony you stated that a five degree Celsius differential should be applied to the Delta Wetlands temperature plan, because of effects on Delta smelt from -- based upon a study that was conducted by Swanson and Chech; is that correct?

MR. SWEETNAM: That is correct?

MR. NELSON: Were you aware that the seven degree Celsius criteria that is in the Delta Wetlands temperature plan was suggested by Fish and Wildlife Service after they consulted with Dr. Swanson?

MR. SWEETNAM: They used the critical thermal maximum based on the study report?

MR. NELSON: I'm sorry, are you asking me a question, or -- my question to you was: Were you aware that Fish and Wildlife Service identified the seven degree Celsius temperature differential after consulting with Dr. Swanson?

MR. SWEETNAM: Yes.

MR. NELSON: You were aware of that?

MR. SWEETNAM: Not actually that they consulted with Dr. Swanson. They basically read the report. I'm not sure if they consulted with Dr. Swanson or not, or Dr. Chech.

MR. NELSON: Okay. Isn't -- are you also aware

that on page E9 of Mr. Wernette's testimony he cites to the same Swanson and Chech study that you cite for your proposition of 5 degrees Celsius. And he cites it for the proposition of the short-term temperatures differentials of 12 degrees Fahrenheit; 16 degrees Fahrenheit can incapacitate Delta smelt?

MR. SWEETNAM: I'm assuming so.

MS. MURRAY: Wait. Here's mine. Make sure they're the same.

MR. SWEETNAM: That's the same study. And if you read the next sentence it says: Longer duration exposure to water temperature increases of only 9 degrees Fahrenheit resulted in Delta smelt mortality. Based on these conclusions Fish and Game selected a maximum differential of five degrees Fahrenheit in order to of avoid impacts to Delta smelt and to reduce impacts to winter-run and spring-run.

MR. NELSON: Are you aware of the five -- are you aware of the five degrees Celsius mortality observation occurred, or was reported in the Swanson and Chech report?

MR. SWEETNAM: I'm absolutely aware of that. It's right here.

MR. NELSON: Isn't it true that the five degrees -- isn't it true that the five degrees Celsius observation

was an observation from a metabolic study and not the tolerance temperature study that Swanson and Chech were doing?

MR. SWEETNAM: I'm not sure if they identify which study that was from. I'm ready to put this into exhibit if you want.

MR. NELSON: My -- my question to you is: So you are not aware that the five degrees Celsius mortality observation occurred in the metabolic study portion of the report and not the temperature tolerance portion?

MS. MURRAY: I think that question has been asked and answered.

MR. SWEETNAM: I can answer again. I'm not sure. I -- I -- I don't think they identified which observation that was made in.

MS. MURRAY: And if he asks it a third time, I'm going to object, again.

MR. NELSON: I'm just going to ask on the record that he did review the report completely.

MR. SWEETNAM: I will basically state their results. Can I do that?

MS. MURRAY: Sure. He can ask the question three times.

MR. NELSON: Are you going to read the same results that you --

HEARING OFFICER STUBCHAER: Excuse me, gentlemen. One at a time, because the Court Reporter can't take down two conversations at once. So, resume.

MS. MURRAY: Go ahead, Dale.

MR. SWEETNAM: This is -- as cited in my DFG Exhibit 9 this is the report "Environmental Tolerances and Requirements of the Delta Smelt Hypomesus Transpacificus." It is a final report presented to the California Department of Water Resources dated July 20th, 1995.

"Our results suggest that regardless of acclimation temperature, life history stage, or season Delta smelt can be incapacitated by a short-term temperature increase of only seven to nine degrees Centigrade. Furthermore, longer duration exposure to elevated temperatures below the critical thermal maximum is almost certainly stressful and potentially lethal.

Mortality among Delta smelt acclimated to 12 degrees Centigrade and subsequently subjected to an acute 5 degrees Centigrade increase to 17 degrees Centigrade at temperature well within the critical thermal limits during routine metabolic experiments illustrated this phenomenon."

MR. NELSON: Thank you. Can I have one second, Mr. Stubchaer?

HEARING OFFICER STUBCHAER: Yes.

MR. NELSON: I have no more questions for Mr. Sweetnam. I'd like to turn to Dr. Rich. When were you retained by Fish and Game to analyze the Delta Wetlands Project with respect to temperature?

DR. RICH: As far as the contract it was April Fool's Day, April 1st.

MR. NELSON: So you never attended any of the joint consultation meetings in which temperature monitoring was discussed; is that correct?

DR. RICH: That's correct.

MR. NELSON: Did you ever contact Delta Wetlands, or Mr. Vogel, or Mr. Marine who developed the temperature plan to discuss it?

DR. RICH: No, I didn't.

MR. NELSON: In your testimony, your testimony primarily reviews the ranges of temperature that Fish and Game has selected as well as those that are in the NMFS's biological opinion. And you -- the Fish and Game biological opinion says -- has ranges in temperatures starting at 58 degrees then a threshold of 66, and a threshold of 75. The NMFS and the Fish and Wildlife's opinions include thresholds of 66 and 67.

Would you agree, then, that the -- that there is substantial agreement as to the upper two thresholds of

66 and -- between 75 and 77, that those are two critical thresholds for salmonids?

DR. RICH: No, I would not.

MR. NELSON: You would not agree that 66 and 67 even though you cite them as -- even though Fish and Game cites them as thresholds in which changes should occur?

DR. RICH: First of all you made several statements that weren't true. So if you could start over. The first thing is I didn't just discuss ranges in my testimony. I went into a great deal of discussion on sublethal impacts as well as a long list in a table in the back of all the various studies that have been done on chinook salmon and water temperatures. And in terms of thresholds, that are a lot of different thresholds depending on which study you want to look at.

MR. NELSON: Would you agree that Fish and Game and Delta Wetlands have both identified 66 degrees and 77 degrees as two thresholds that they agree on for changes in temperature plan criteria?

DR. RICH: Perhaps, if you've got a overhead that has a -- the two side-by-side.

MR. NELSON: I --

MR. STARR: We have one here. Would you like to look at it?

MR. NELSON: Yeah. Let me look at it to make

sure-- so I know what is on it.

MS. MURRAY: I think we made copies.

HEARING OFFICER STUBCHAER: We're off the record

(Off the record.)

HEARING OFFICER STUBCHAER: Back on the record.

MS. MURRAY: This is what we prepared yesterday when we did not -- believing their summary not to be correct. Should we enter this as an exhibit, or --

HEARING OFFICER STUBCHAER: It needs to be identified.

MS. LEIDIGH: Yes.

MS. MURRAY: Okay. So our next number is 15?

MR. SUTTON: Next number is 15.

MR. NELSON: Dr. Rich, isn't it true that Fish and Game uses as a breakpoint 65; Delta Wetlands has a breakpoint at 66; and they both have a breakpoint of 77 Fahrenheit?

DR. RICH: Yeah, out of context. I mean there is a number minus 65 -- or less than 65 degrees Fahrenheit for Fish and Game. And there is a less than 66 degrees Fahrenheit that is on this -- on this overlay.

MR. NELSON: Okay. Now, in your testimony you -- and you just mentioned this -- actually not in your testimony. On page EA of Mr. Wernette's testimony Fish and Game -- or Mr. Wernette has asserted that at channel

temperatures above 58 degrees increases of more than one degree Fahrenheit may result in the adverse effects on salmonids.

And then he -- in support of that proposition he cites several studies. He says: Boles, 1982; Brett, 1952; Reedamir, 1980; and Zaugg an Adams, 1972. Are you familiar with those studies?

DR. RICH: Yeah. Actually, Boles is just a literature. It is not a study.

MR. NELSON: Is Reedamir a literature review as well?

DR. RICH: No. I don't think Gary's -- Dr. Reedamir's was a study.

MR. NELSON: You said you are familiar with those studies?

DR. RICH: Yeah.

MR. NELSON: Can you --

DR. RICH: Actually, wait a minute. Reedamir is -- if I can see the reference in the back, I think this also may be a review.

MS. MURRAY: The reference in the back of your direct testimony?

DR. RICH: In the back of the biological opinion, or in the back of Frank's testimony?

MS. MURRAY: I don't have it in the back of Frank's

testimony.

DR. RICH: Dr. Reedamir's it wasn't really a study. It was just a review article on environmental factors -- '73 or 1980?

MR. NELSON: 1980.

DR. RICH: Yeah. It's just some environmental factors. He wrote a review article on some of the factors that affect smoltification and early marine survival. So I think of those three Zaugg and Adams and Brett were the two studies, per se.

MR. NELSON: Okay. Can you tell me where in either Brett 1952, or Zaugg and Adams they specifically identify information that would support the proposition that an increase of more than one degrees Fahrenheit will result in adverse affects on salmonids?

DR. RICH: If I had the articles with me, perhaps, I could, I don't.

MR. NELSON: Are you generally familiar with the Brett study?

DR. RICH: Oh, yeah.

MR. NELSON: Do you -- do you -- isn't it true that the Brett study used acclimation -- had a stage study where he used several different ranges?

DR. RICH: Ranges of what?

MR. NELSON: Isn't it true that he acclimated the

salmon to several different temperatures?

DR. RICH: Yes, he did. He was looking at their upper -- basically, the upper thresholds of the upper incipient. He was also looking at the lower incipient. We also looked at the preferred, or what he considered to be optimal temperature.

MR. NELSON: Okay. Now, in this study Fish and Game decided for the proposition that an increase of more than one degrees Fahrenheit would be adverse to salmonids.

Isn't it true that the Brett had in his acclimation studies, he acclimated the fish -- he had several different stages. He had a stage from 8.8 degrees Celsius to 10.8 degrees Celsius for three weeks where he held those salmon for three weeks. And then he had a second one where he started them at the acclimation temperature of 8.8 degrees Celsius and raised it to 15 degrees Celsius and held those fish at three weeks. Are you familiar with those two stages?

DR. RICH: Yes, I am.

MR. NELSON: Isn't it also true that the third stage he used was he had a group that he had at the acclimation temperature of 8.8 degrees Celsius acclimated them to 15 degrees Celsius for one week and then raised it up to 23 Celsius for two weeks?

DR. RICH: Yes, that's true.
MR. NELSON: And, finally, didn't he also have a final group that the salmon were acclimated, first, to 8.8 degrees Celsius, then raised to 15 degrees Celsius for one week, then raised to 20 degrees Celsius for one week?
DR. RICH: If you say so. I don't remember the exact actual temperatures.
MR. NELSON: Isn't it true that the Brett 1952 study made the finding that they could acclimate salmon to those temperatures ranges without significant loss?
DR. RICH: In the situation where the fish are fed maximal rations at these rather high temperatures, this is true. It really has no bearing on the real word in terms of what goes on with the fish in the San Joaquin, or any of these other places. It gives us an upper threshold in a laboratory of what could happen if you want to kill your fish.
MR. NELSON: And the changes, the acclimation, the shifts in those temperature ranges were all above -- well above five degrees Fahrenheit, weren't they?
DR. RICH: For that particular studies, that's true. There are other studies such as Horsey (phonetic) which shows you can have little temperature increase also in a laboratory setting and you can kill 50 -- 50 percent

or more of your fish. It really depends on which study you're looking at. And you're looking at just one study for obvious reasons.

MR. NELSON: I'm looking for the fact that Fish and Game cited it at four and the proposition is one degrees Fahrenheit. So with respect to Zaugg and Adams, are you familiar with what temperature ranges they used in their study?

DR. RICH: I believe that was -- was a steelhead study.

MR. NELSON: Yes, it was a steelhead.

DR. RICH: And it's been a while since I looked at it.

MR. NELSON: All right. Okay. Well, since you haven't look at it in a while, I'm not going to ask you questions on it then. Are you aware that the thermal plan identifies a four degrees Fahrenheit acclimation temperature threshold in sense of an increase?

DR. RICH: I -- actually, I don't think it does. I think it's about 20 years old. And I think Mr. Rugg can answer that.

MR. RUGG: The thermal plan does include a four degree surface temperature rise. It also includes a lot of other things that are more relevant.

MR. NELSON: But it does include -- with respect to

an increase in channel receiving water --

MR. RUGG: Anyplace the surface temperature cannot exceed four degrees Fahrenheit as long as 25 percent of the cross-sectional area doesn't increase by more than one degree Fahrenheit.

MR. NELSON: And isn't it true that the four -- does the thermal plan state a duration for that measurement of the four degrees Fahrenheit?

MR. RUGG: No.

MR. NELSON: Do you know what duration is typically used for that measurement?

MR. RUGG: It's a maximum at the surface at anyplace in the receiving water. There's not a duration element to it.

MR. NELSON: Does the thermal plan direct -- doesn't it direct that appropriate averaging periods be used?

MR. RUGG: Not that I'm aware of.

MR. NELSON: Dr. Rich, are you aware that in the Delta daily variations in temperature can range regularly between zero to six degrees Fahrenheit in a single day and in certain times of the year up to ten and eleven degrees?

DR. RICH: I'm aware of that. I'm also -- none of us is aware whether that is good for the fish or not.

The fact that they're there, they can't get out of the area, and they have to basically live in an area that has a ten degree variation doesn't mean that they're comfortable, that they're not cold, that they're not stressed, it's not killing them.

MR. NELSON: But it is the natural conditions that occur in the Delta right now?

DR. RICH: Right now it is. And it's not what it used to be. Before the dam, when the fish went much further up the tribs than they do now, they could get out much faster long before the water temperatures got up to where they are now. So, basically, due to the dams and diversions and all the other things that are going on we've created an unnatural environment for the salmonid.

MR. NELSON: Are you aware of whether daily average temperatures vary in the Delta from day-to-day?

DR. RICH: From the limited amount of information that we have they appear to. One of the biggest problems is that we do not, for whatever reasons, the agencies, or whoever have not gone out and collected the kinds of water temperature information that we really need to be able to resolve a lot of these issues that I was talking about ten years ago, and nothing was changed.

MR. NELSON: Okay. Focusing on the duration of exposure for temperatures of varying increases in

temperature, isn't it true that most of the studies that are cited have had exposure periods of upwards to 30 days?

DR. RICH: I wouldn't say "most." I'd say some do, some don't. Some have six minutes, some have 24 hours, other ones have 48 hours.

MR. NELSON: Your Rich 1987 study had a 28 to 33 day exposure period.

DR. RICH: Yes, that's true.

MR. NELSON: You're familiar with the fact that Brett's exposure -- study had a one-month-plus exposure period?

DR. RICH: I believe so.

MR. NELSON: Are you familiar with -- I believe, Johnson and Brice is also cited by Fish and Game in several places. Are you aware that Johnson and Brice had a 1.5 to 6 exposure period for their studies?

DR. RICH: I'll have to take your word for it.

MR. NELSON: Okay. In your analysis you include temperature ranges for, I believe, egg to fry emergence in your analysis, in your appendix; is that true?

DR. RICH: It was egg, alevin and incubation. Yeah, depending on how long the fry were emerging.

MR. NELSON: Would you agree that's not an issue for Delta Wetlands Project since spawning does not occur

on the Delta Wetlands islands?

DR. RICH: No, actually, I don't agree with that. I don't agree, because the water temperatures that are suitable for the egg to fry are basically very little information -- let me back up here.

We have very little information on what is happening in terms of the incubating eggs and -- that the damage to the eggs and sperms and the migrating adults. And we have very little information on what happens to the very early fry stage, the ones that get wiped down out of the tributaries when we have big floods, or a lot of water that's coming down. Most, if not all, of the studies that we have on growth and that sort of thing is a function of temperature, they were done on what we call juveniles, which is the larger fish.

And since water temperature tolerances increases as you proceed from the egg to alevin to the early fry to the late fry to the juvenile, if we have information for one of those pieces that -- we don't have site-specific information, but if we have information for a piece to this that is relevant such as information for the pre-emergence for the early fry stage, or even the alevin which is very similar in terms of the studies to what you find for both eggs and alevin, then we need to give it --

MR. NELSON: Do eggs and alevin to fry emergence occur around the Delta Wetlands islands?

DR. RICH: I already said they do not. But I've also told you that the thermal requirements for those stages, they're -- are very similar to what we believe to be for the fry are relevant.

MR. NELSON: In the Fish and Game criteria they have cited a 58 degrees Fahrenheit as an upper optimal growth temperature. And I believe they cite your study for that. Does stress occur equally on both sides of the temperature that that upper optimal if -- whatever the temperature is, does stress occur equally on each side of that temperature?

DR. RICH: On each side of 58?

MR. NELSON: Yeah. Is it a curve, I guess, a parabolic curve? Would a 56 degrees Fahrenheit temperature have the same type of stress as 60 if you're using a 58 degrees optimum?

DR. RICH: It would depend on the study.

MR. NELSON: Can you tell me -- explain for each life stage what the primary performance factors that you used to evaluate were, that you used to determine when a stressful condition exists for salmonids?

DR. RICH: They were different for each of the life stages, but ultimately I think I discussed -- or I

basically listed all the various types of stressful and lethal and optimal temperatures that have been reported in the literature. And so depending on which life stage one wants to consider some of the stressful factors could be disease; there could be a decrease in growth rate; there could be a suppression of appetite; there could be swimming performance. I mean there's -- there's a long laundry list of stressful things that have been shown to happen at various water temperatures.

MR. NELSON: For juvenile out-migrating salmon could you identify the primary performance factors that you used?

DR. RICH: That was a -- there's really very, very little information about chinook smolt during the migration. And Dr. Craig Clark up in the Milo and some of his colleges have done some studies on looking at growth rate and metabolism as a function of water temperature in fish that are going through that process. So that was one of the factors that went into coming up with a range.

MR. NELSON: Can you identify any other factors that you used?

DR. RICH: Well, I think I just listed --

MR. NELSON: Just go -- you just said growth rate. I didn't hear any other factors.

DR. RICH: Actually, in that study I believe they talked about a -- some -- I don't remember. I don't recall.

MR. NELSON: Okay. Based on these factors of which you've only identified growth right now, but you stated that there are others, what is the threshold criterion you used to establish what a stressful condition would be?

DR. RICH: Aren't you just asking me the same question, again?

MR. NELSON: No. In the sense of percentage, can the threshold criterion, the threshold percentage change in one of those factors?

DR. RICH: There is no percentage. I think -- I think any physiologist would -- who understands this kind of study would realize that you get different numbers depending on which studies you're looking at.

And what I'm interested in is making sure that we have -- that we've got a Delta which is the equivalent, to me, as a salmon ghetto, we've got a really stressful situation out there. And so when I look at all the various water temperatures that result in stress, or optimal growth, or lethal, or whatever I'm inclined to look at the lower ends to see, you know, when did these problems begin in juveniles? What temperatures does

disease begin? What temperatures do we start having a reduction in growth?

On the studies on the American River that I did we found that at temperatures over 60 degrees we started getting a disease in the fish. And these were fishes that were at maximal ration. They were fed as much as they wanted all day long, which is not something that occurs in the fish in the wild.

So in answer to your question: There isn't a percentage. It is basically looking at -- there never will be, frankly. I mean it's something that physiologists will probably have to contend with forever, things like this, because you can't come up with a percentage. If we have site specific studies for this project I could probably give you a percentage, but we don't.

MR. NELSON: So you didn't -- are you stating that you would not use a percentage to identify what is significant and insignificant stress?

DR. RICH: I would. If there were a study and we were looking at different water temperatures and say the growth rate over time, and we would compare the growth rate for each one of these temperatures and run a statistical analysis -- and in the study on the American River the growth rate was significantly lower at

temperatures above 60 than it was at 60 and below. So in that context, yes, you want statistics on it.

MR. NELSON: What criteria would you use in that instance --

DR. RICH: I think --

MR. NELSON: -- to determine a significance?

DR. RICH: I think I just answered that, which was basically looking at a statistical analysis to determine whether there is a significant difference in the growth rate of the fish that you're looking at at a proximate water temperature.

MR. NELSON: What percentage? What would be significant? I mean you said you --

DR. RICH: Oh, okay. I mean look at the T less than equal to .01, or .05, those are both acceptable.

MR. NELSON: .01?

DR. RICH: Uh-huh.

MR. NELSON: Or .0 what?

DR. RICH: 05.

MR. NELSON: Let's go back to optimal growth temperatures. Isn't it true that other studies have identified higher upper optimal growth temperatures than 58 degrees?

DR. RICH: This is true. As I discussed in my testimony we've got lower and higher ranges for optimal

temperatures.

MR. NELSON: Isn't it -- haven't upper optimal temperatures been identified as high as 68 degrees Fahrenheit?

DR. RICH: What studies are you referring to?

MR. NELSON: I believe my notes here say Brett 1952 and Brett 1982.

DR. RICH: I don't think Brett 1952 did. He was just looking for tolerance. And the '82 study are you talking about the laboratory, or the estimates for the field?

MR. NELSON: I wouldn't be able to tell you.

DR. RICH: I would have to see the text to be able to say "yes" or "no" on that.

MR. NELSON: Okay. Are you aware of the temperature criteria in the State Board's salinity plan?

DR. RICH: I've looked at it, yeah.

MR. NELSON: Are you aware that the State Board in that plan set a temperature objective for Freeport in the Sacramento River for 66 degrees from January through March?

DR. RICH: Yes, I'm aware of that, too. And it exists.

MR. NELSON: Are you aware that the salinity plan -- actually, I want to finish my line of

questioning, Dr. Rich, here.

Are you aware that the Board's salinity plan also sets a temperature objective from April through June and September and November at Freeport and at Vernalis at 68 degrees Fahrenheit?

DR. RICH: I'm aware of that. And I also know when this came out there was a great deal of discussion on it. And when I saw it when it did come out I was quite perturbed at what had happened, because it's quite evident -- and I've been through this with many, many biologists at the State agency that it's quite evident that the temperatures that are in this plan are harmful to the salmonid.

MR. NELSON: Isn't it true that the only studies that you have identified in your literature review that have occurred since the salinity plan temperature objectives came out are a Marine 1992 article, which is a review -- synthetic review that focuses on reproductive performance on adult chinook salmon at varying temperature levels and a Johnson 1977 study on egg incubation and fry emergence?

DR. RICH: You may know better than I, I'm not sure what the years are so I can't really answer that.

MR. NELSON: Can you identify any study that has been issued since 1991 that addresses these issues that

you cite in your testimony?

DR. RICH: You mean for the Central Valley?

MR. NELSON: For the Central Valley that you cite in your testimony.

DR. RICH: I don't believe there has been.

MR. NELSON: Okay.

DR. RICH: Doesn't mean that there shouldn't be.

MR. NELSON: I have a couple of questions for Mr. Wernette who -- with respect to the temperature criteria. Can we put on the overhead -- actually, I don't think this overhead actually gives this information.

MS. MURRAY: This one?

MR. NELSON: Will you put it on the overhead?

MR. STARR: Which one?

MR. NELSON: The one you had.

MS. MURRAY: 15.

MR. NELSON: Isn't it true in the Fish and Game additional conservation measures addressing temperature that don't allow Delta Wetlands to increase the water temperature above 58 degrees. So if it's at, for example, it's at 57.5 degrees, Delta Wetlands can't cause an increase of more than .5 degrees, it can't cause it to go above 58 degrees?

MR. WERNETTE: That's correct.

MR. NELSON: Does that summary that's up here on the overhead reflect that?

MR. WERNETTE: It doesn't look like it does. The language that we have in our biological -- or the description of what we say is that --

MS. MURRAY: What page are you looking at?

MR. WERNETTE: I'm looking -- in our testimony on page 20. In that September through June period we -- the final phase, that did not fit on this overhead, was: And shall not cause receiving water temperatures to exceed 58 degrees Fahrenheit.

And our intent for doing that was we did identify what I would consider blocks of temperature regimes that would be -- at least from a -- from a very unsophisticated perspective, were conditions that were good and then fair and then poor in terms of these temperatures ranges.

And the idea that we went with was that if we have a range of temperatures that exist in the channel of below 58 degrees, that, we would consider good. We didn't want Delta Wetlands Project operations to shift channel temperatures in adjacent channels from the good to fair range.

So within that range we basically said, okay, we're lucky enough to have good conditions for salmon,

let's not allow the project itself, the operation of the Delta Wetlands Project to actually shift us into not just an increase in temperature but also shift us from one category in water temperatures to one that was significantly inferior.

MR. NELSON: So isn't it true, though, under that criteria there could be situations where Delta Wetlands, for example, could be at -- and this temperature "the no increase above the threshold" applies to 65 and -- the 65 criteria as well as, right?

MR. WERNETTE: That is correct.

MR. NELSON: Isn't it true then the Delta Wetlands -- the channel water could be sitting at 64.8 and then Delta Wetlands would be restricted to not creating a channel temperature increase of .2 degrees Fahrenheit?

MR. WERNETTE: The way the mathematics would work out, that is correct.

MR. NELSON: Thank you. I'd like to turn back to Dr. Rich with respect to dissolved oxygen. In your testimony you noted that dissolved oxygen levels also have daily variations; is that correct?

DR. RICH: That's correct.

MR. NELSON: Do they also have variations -- excuse me, first of all, were -- were you referring to

variations within a 24-hour day, or daily averages?
DR. RICH: Basically either one.
MR. NELSON: Okay. Do you know what the range of variations is for dissolved oxygen in the Delta?
DR. RICH: No, not off the top of my head.
MR. NELSON: In examining --
DR. RICH: I'm sure it varies, also.
MR. NELSON: In examining the dissolved oxygen criteria, did you look at dissolved oxygen levels data for the Delta?
DR. RICH: Yes. I reviewed some of the information that existed.
MR. NELSON: But you don't remember what those variations were in the data?
DR. RICH: There was quite a bit of information. I couldn't give you a nutshell capsule of it.
MR. NELSON: In your testimony you stated -- I think this might have actually been in your oral testimony. You stated on your opinion and belief that a higher minimum of dissolved oxygen objective should be applied to the channels adjacent to the Delta Wetlands islands based on new and more sophisticated understanding of sublethal effects of reduced DO levels on fishes.
On what specific information on sublethal effects of an incremental change of 5.0 milligrams per

liter and 6.0 milligrams per liter did you rely on for your recommendation?

DR. RICH: The information that I had for those conclusions was some laboratory information on different salmonid species. I believe that's in my direct testimony.

MR. NELSON: Did those studies directly specifically look at changes between 5.0 milligrams and 6.0 milligrams?

DR. RICH: Perhaps, not at that decimal point. I think one of them looked at between 5 and 6.3, something like that.

MR. NELSON: In your testimony you relied on dissolved oxygen studies -- dissolved oxygen concentrations studies citing Dandy, 1970; Dorfman and Whitworth, 1969; and Medale, 1987.

Are you familiar with those studies?

DR. RICH: Yeah.

MR. NELSON: Isn't it true that Dandy 1970 is a brook trout study?

DR. RICH: It's also a salmonid.

MR. NELSON: Isn't brook trout a non-anadromous non-native fish west of the Rockies?

DR. RICH: This is true, but normally when we look at dissolved oxygen criteria, since we do not have a lot

of information on physiological impacts, we are forced to look at other salmonid species. And we know generally that salmonids are probably the most intolerant of the various species that one would find in the Delta.

And so given the lack of site specific information, the terms of what a fish needs in terms of dissolved oxygen we do have to look at laboratories sometimes on other species as well.

MR. NELSON: Isn't it true that brook trout have very different life stages and habits from chinook salmon?

DR. RICH: This is true.

MR. NELSON: You also relied upon Dahlberg of 1968. Isn't it true that Dahlberg -- the Dahlberg 1968 study has to be viewed in the context that he was tracking three various variables: Dissolved oxygen, temperature, and CO2?

DR. RICH: I'm -- I'm -- I'm not sure I understand your question. You basically said those were the three things they were tracking and that's true.

MR. NELSON: Right.

DR. RICH: And what was your question?

MR. NELSON: Isn't it true that the results of those studies was general to the tracking of those three variables?

DR. RICH: Yes. And one of them happened to be dissolved oxygen, which was what I was interested in.

MR. NELSON: I'm curious whether they called out dissolved oxygen impact separately, or is it that they generally combined the three factors and made their conclusions on all three factors together?

DR. RICH: I don't recall.

MR. NELSON: That concludes my cross-examination.

HEARING OFFICER STUBCHAER: Okay. Thank you. Is there anyone else who wishes to cross-examine this panel other than staff? Okay. Staff.

MR. SUTTON: You go first.

MS. LEIDIGH: You go ahead and start.

HEARING OFFICER STUBCHAER: Mr. Sutton.

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CROSS-EXAMINATION OF THE DEPARTMENT OF FISH AND GAME

BY STAFF

MR. SUTTON: Mr. Wernette, good morning.

MR. WERNETTE: Good morning, Jim.

MR. SUTTON: You have proposed in your biological opinion that up to 20 percent of water diverted by Delta Wetlands be used for environmental purposes; is that correct?

MR. WERNETTE: That's correct.

MR. SUTTON: Would you envision this water being

held and released at a time of Fish and Game's desire, or preference, or recommendation to be used for environmental purposes?

MR. WERNETTE: Yes. I would envision that it would be with input from the Federal Fish and Wildlife agencies and EPA as well.

MR. SUTTON: Assuming that Delta Wetlands fills primarily in the fall and winter months and builds up this -- if you will, this bank account of water, when would you anticipate that this water would be used primarily during the year?

MR. WERNETTE: Probably in the March, April, and May period.

MR. SUTTON: And for what purposes would that be used?

MR. WERNETTE: Some of the reasons that it could be used were -- depending on information may be in the April/May period from the realtime program. There may be an opportunity to transport, or assist in the transport of larval Delta smelt westward into the rearing areas in Suisun Bay.

Another reason could be that there -- if that's not -- if that opportunity doesn't present itself, we anticipate that those releases could offset some of the existing adverse hydrodynamic effects that we continue to

be concerned about in the Central Delta.

A third thing could be to increase the Keywest flows that the people -- the calculation of westward flows that have been linked to, at least, an indicator of beneficial effects -- or beneficial effects of salmon rearing in and migrating through the Delta.

MR. SUTTON: Were you here to hear the testimony by the California Urban Water Agencies in regard to water quality, in particular, dissolved and total organic carbon?

MR. WERNETTE: Yes, I was.

MR. SUTTON: CUWA recommended that Delta Wetlands water not be allowed to be released if it has a higher TOC or DOC, whatever, than the ambient receiving water.

Are you familiar with that recommendation?

MR. WERNETTE: Yes, I am.

MR. SUTTON: Are you also familiar with the information that CUWA presented in one of their exhibits that suggests that dissolved, or total organic carbon is highest in the winter and declines to relatively low levels on average about four to five milligrams per liter during the spring and summer?

MR. WERNETTE: I -- I don't think I carefully paid attention during that part of the program.

MR. SUTTON: Are you familiar with the trend that

they showed on their graph?

MR. WERNETTE: Yes.

MR. SUTTON: Okay. Where I'm going with this is my question is this: Assuming that Delta Wetlands water has a higher dissolved, or total organic content than the receiving water at the time in which you wish to use it, is it Fish and Game's position that that water should be released, or should it not be released to be in consistency with the position of the California Urban Water Agencies? How would this water be used?

MR. WERNETTE: I -- I don't know that our department has developed a position on that specific question. The -- the -- if the -- I would assume that if the request that the Urban Water Agencies had made becomes a permit condition and, you know, the Department may be in a position and other Fish and Wildlife agencies may be in a position of having to identify a less optimal period for the release of that water, that could still provide fisheries benefits.

For instance, in the fall when there might be opportunities to improve conditions for yearling spring-run salmon, but the benefits wouldn't be as significant as they would be if we could release in March, April, and May. And I honestly don't know when you end up with that type of conflicting information

between one -- how the Board itself actually resolves that to ensure that there aren't conflicting permit conditions. So it's really tough for me to answer how it actually would occur other than the response I gave.

MR. SUTTON: If you were releasing -- if you were proposing to hold that water and release it into the fall months, at the same fall late-fall period when Delta Wetlands is filling, would this have an additional incremental impact on project?

MR. WERNETTE: Can I ask a clarifying question, Jim?

MR. SUTTON: Yeah.

MR. WERNETTE: Are you suggesting if we held the water late into the fall and not released it, yet, that that would -- you know, there wouldn't be an opportunity to store because the reservoir would be full?

MR. SUTTON: Or at least there would be up to 20 percent reservoir capacity that's already taken.

MR. WERNETTE: If they're -- by observation of the operation data suggests that there aren't very many opportunities to fill the reservoirs over a seven-month period in the months of October and November, for instance. But I would assume that if we had a significant part, significant percentage of the storage on the project environment water that it would affect

project yield in that year if they had the opportunity to fill in the month of November.

It's difficult to look at the model data to know what happens in December. For instance, if the operation of the model predicted that it could fill in November, that might have been their first opportunity to fill. That didn't mean there wasn't also water available in December. So the ultimate affect could be zero on terms of project diversion opportunities. In other words, an early wet fall may also translate into continued wet conditions through the month of December.

MR. SUTTON: But if they fill in December then according to your formula they have to donate an additional amount of water to environmental uses compared to filling in October and November; is that correct?

MR. WERNETTE: That's correct.

MR. SUTTON: Okay. On DFG Exhibit 15 where you've compared dissolved oxygen requirements for CESA versus Delta Wetlands, I call your attention to the last portion of the dissolved oxygen section there where it says:

DW shall not discharge for export water less than 6.0 milligrams per liter, or when receiving water is less than 5.0 milligrams per liter without notifying DFG and the Board."

What's the significance of the words "for export

there"?

MR. WERNETTE: The significance is that the operating criteria for Delta's dissolved oxygen would apply to the discharges for export only.

MR. SUTTON: So if that water was being released for environmental purposes it would be all right to release it at less than 6.0 milligrams per liter? I'm confused, because that term does not come up anywhere else.

MR. WERNETTE: Can you answer the question, again, please -- or ask the question, again, please?

MR. SUTTON: I can't answer the question, that's my problem. Nowhere else on this chart is there a distinction made between discharge of water for export as opposed to other purposes. In this one case it says DW shall not discharge for export water of less than the characteristics I just gave you. And I'm asking what's -- what's the reason for that distinction here?

MR. WERNETTE: Well, if I can -- if I can start by responding to your overall question about, you know, how discharges are dealt with in all of these water quality -- you know, water quality, for instance, in water temperature. We do have a separate criteria that addresses the releases of water, for instance, from the habitat islands that -- and you've described it that are

not on this chart that I can tell.

So we -- we release -- or, excuse me, we have different criteria that are in our biological opinion, at least in the additional conservation measures, that we recommend to address discharges from the habitat islands. And to the best of my knowledge, however, I don't recall whether we actually have any -- in the case of dissolved oxygen, whether we have any differentiation between the reservoir islands where we're releasing water for discharges versus export versus when it's being released for environmental uses, or being -- discharges from habitat islands.

MR. SUTTON: Would you anticipate a situation where you would want to release water of lower dissolved oxygen, or have an impact on the receiving water for lower than the criteria shown here, where you might want to release it for environmental purposes but not for export?

MR. WERNETTE: Your question is: Do I see a condition where the DO level may be below these criteria when we might want to release it for environmental purposes?

MR. SUTTON: Yes.

MR. WERNETTE: That is a possibility.

MR. SUTTON: Okay. Thank you. With regard to --

MS. MURRAY: Did anyone else have any opinion about that, or have you discussed that with any of your staff?

HEARING OFFICER STUBCHAER: Are you on the record?

MS. MURRAY: No.

MR. SUTTON: With regard to your discussion yesterday about topping off, you indicated that -- as I understand it that without getting into the details of water law, that you thought that since they're using -- Delta Wetlands is using water on the properties now for agricultural purposes under their riparian and senior water rights permit that, in essence, this could be transferred to a new use of topping off; is that correct?

MR. WERNETTE: That's correct.

MR. SUTTON: And in making your calculation about the effect of your biological opinion on the loss of yield to the project, is it your belief that with the topping off process, or procedure that essentially there would be relatively little impact on total yield?

MR. WERNETTE: If the -- if the Board conditions their water rights clearly fixed topping off criteria, the estimates are that we would -- that that measure would replace most or all of the evaporation losses, but only around a third or half of the yield effects of the measures that we have.

MR. SUTTON: On page 65 of the biological opinion

you say that the cost per acre foot should be the same --

MR. WERNETTE: That's correct.

MR. SUTTON: -- between the Federal and the State. But you're testifying here that part of the losses of your measures are not made up by the topping off procedure. Therefore, how can the -- assuming that the capital cost and O&M cost and everything else is the same, how can the costs be the same?

MR. WERNETTE: The reason that they're the same is that when Jones and Stokes performed the operation studies to estimate project yield, they didn't account for any topping off. So they ended up taking -- taking it into account all the evaporation losses that would occur from late spring through fall and in their operation modeling subtracted those out. So that the 154 acre feet is the bare number after evaporation losses with no make up.

So what -- what -- what I'm suggesting without going into a whole lot of detail, if the estimate, for instance, of evaporation is 27,000 acre feet during that time period, and our measures cause an additional reduction in project yield of 10,000 that when you average, or take a look at the topping off measures it may not totally offset the combination of those two

numbers.

So what we're suggesting in our biological opinion in the brief analysis that we did was that we'll -- we'll be able to do what Jones and Stokes did not in their modeling, which is provide some assurances that that topping off can occur and those evaporation losses can be replaced in some -- in some -- at least, in some part of the environmental water reductions.

MR. SUTTON: If you assume that water -- if the project when the Delta is in balance condition that there's no surplus water available for taking under the Applicant's permits, that that water is not available for topping off, what is the difference in project yield between the project as modeled using the Federal biological opinions and the Fish and Game's biological opinion?

MR. WERNETTE: It would be a reduction of about 13 percent. So if you multiply the 154 times 13 percent that would be the reduction.

MR. SUTTON: Okay.

MR. WERNETTE: So --

MR. SUTTON: Thank you. Ms. McKee, I can't even see you there, you've recommended additional screens be done on other unscreened diversions in the Delta?

MS. McKEE: Yes.

MR. SUTTON: And these would be -- let me rephrase that.

Without getting into the legal aspect of it, are you aware of any authority that the Board has to require such screens?

MS. McKEE: I'm not an expert on the Water Code, but I do believe that the Board, through mechanisms in terms of protecting beneficial uses during diversion of water, there's probably some nexus there. But, again, I'm not an attorney and an expert on the Water Code.

MR. SUTTON: Let me ask a general question.

MS. McKEE: Good.

MR. SUTTON: And this is to the panel, I'm done with that topic, thank you. Sorry to confuse you.

HEARING OFFICER STUBCHAER: Mr. Sutton, if you're through there, how much more do you have?

MR. SUTTON: I have about three questions.

HEARING OFFICER STUBCHAER: Just three questions.

HEARING OFFICER STUBCHAER: Okay.

MR. SUTTON: Do you want to take a break now?

HEARING OFFICER STUBCHAER: Sure. And if you want to think of more questions you wouldn't be pressed for time. Sure, let's do that. Let's take our morning break.

(Recess taken from 10:30 a.m. to 10:44 a.m.)

HEARING OFFICER STUBCHAER: We'll reconvene the hearing. Mr. Sutton, are you prepared to resume your cross-examination?

MR. SUTTON: I think so.

HEARING OFFICER STUBCHAER: Okay.

MR. SUTTON: Mr. -- Ms. McKee.

MS. McKEE: Mr. McKee --

MR. SUTTON: Maybe I'm not ready. Let me ask a follow-up question on the screening question I asked you.

MS. McKEE: Sure.

MR. SUTTON: If the screens you recommended are not installed, what is the additional incremental impact on the endangered species resulting from the Delta Wetlands operations, all other things being equal?

MS. McKEE: In Delta Wetlands and Mr. Shaul's testimony they provide an overall annual summary of the incremental increase in mortality index. But that is not a very informative way of providing the information on what are the remaining incremental impacts.

If I had a copy of the actual model output, I could answer your question more specifically. All I know from the testimony and the information provided to us is that there will be ultimately a remaining incremental mortality.

MR. SUTTON: But have you calculated -- is there

any way of calculating what effect the screens will have that you're proposing on that mortality?

MS. McKEE: Actually, yes, there would be. I would hope to -- even after this hearing is over, get a copy of the output modeling runs. And I would suggest that also that's still necessary to be done since much of the modeling was based on our draft biological opinion, reasonable and prudent measures, and conservation measures. And to clarify the record, it would be good to have the model runs done again for the final BO.

Then with that information on the mortality index plus looking at the hydraulic parameters we would be able to look at what are the remaining incremental impacts. And the Department has been working now for a couple years with the National Marine Fishery Service and the U.S. Fish and Wildlife Service on HCP that -- and this is actually essential to the whole effort to develop mitigation for impacts is how many screens and at what locations would be necessary to mitigate for certain levels of mortality?

And I think that would be a very good template to be used to develop the number of screens and locations that would be necessary to fully mitigate.

MR. SUTTON: Thank you. Ms. Rich -- Dr. Rich, in your Exhibit DFG 7 on pages 7 and 8 you use the term

"significant losses." Do you see that?
DR. RICH: Which item number?
MR. SUTTON: In reference to -- on page seven, the NMFS temperature and DO requirements.
DR. RICH: Yes. Okay.
MR. SUTTON: Okay. And I was wondering how are you defining significant losses there?
DR. RICH: Basically, a loss in terms of a high mortality, or a high amount of stress which would ultimately -- could ultimately result in more mortality down the line somewhere.
MR. SUTTON: Are you using significant in the statistical sense?
DR. RICH: Not in that sense, no.
MR. SUTTON: So you haven't done any statistical analysis to determine what the difference in losses would be between the Federal biological opinions and the California Department of Fish and Game's biological opinion; is that correct?
DR. RICH: That's correct.
MR. SUTTON: Thank you. Finally, if someone could put up Figure 12 --
MR. STARR: That was theirs.
MR. SUTTON: Oh.
MR. SUTTON: I believe out of CESA?

MR. STARR: I didn't make a copy of that.

MR. SUTTON: You didn't make a slide of it, okay. Regardless, let me ask a question about that and I'll throw it out to whoever can best respond to it.

The testimony that was given indicated that the zero line on that graph -- and I'm talking about the upper portion of that figure there, represents the no-project impacts. Is that correct?

MR. STARR: Yes.

MR. WERNETTE: That's correct, Jim.

MR. SUTTON: Okay. And the values above that line represent the incremental impacts of the Delta Wetlands Project with the Federal biological opinions. Is that correct?

MR. WERNETTE: Excuse me --

MR. SUTTON: The gray bars.

MR. WERNETTE: Say that, again, Jim.

MR. SUTTON: The gray bars represent the incremental impacts on winter-run salmon entrainment over and above the baseline, or no-project condition; is that correct?

MR. WERNETTE: That's correct.

MR. SUTTON: And my question is: What are -- what is -- how do you obtain a -- a negative impact value under the CESA requirements for March?

MR. WERNETTE: The reason for that is that in the question that I answered earlier with you, Jim, with regards to when we might advocate using the environmental water, we asked Jones and Stokes to assume that we would release a percentage of that water in the months of March, April, and May for the purposes of modeling. So that improvement represents the fact that during that year there was actually a net improvement in conditions attributable to the release of that environmental water.

MR. SUTTON: Thank you. That's all I have. Thank you.

HEARING OFFICER STUBCHAER: Anyone else, Mr. Canaday?

MS. LEIDIGH: I have a couple questions and then Mr. Canaday is going to have a bunch of questions.

HEARING OFFICER STUBCHAER: Okay. Ms. Leidigh.

MS. LEIDIGH: Mr. Wernette, in your biological opinion one of the reasonable and prudent alternatives, or measures involves payment of $75,000 a year by Delta Wetlands to the Department of Fish and Game for mitigation purposes.

If that is paid by Delta Wetlands to the Department of Fish and Game, assuming that the Board finds that it is able to put that kind of a permit term in the permit and so on, does the Department of Fish and

Game have a fund that is available to it from which it can use that money for any purpose? Is there already a fund that's been authorized by the Legislature for that purpose?

MR. WERNETTE: I don't have a complete understanding of the fiscal arrangements within our department to -- other than to say that the Department has a special deposit account that's been set up with the State Controller's Office that allows us to receive mitigation funds, other funding that are related to mitigation projects and oversight of conservation throughout the State that when that money comes into that account -- it's just one account at the Controller's Office.

And our Department has broken out sub-accounts so individual projects can be tracked separately within the Department. So that would be the likely mechanism to allow for that water -- that money to be received and also to be accounted for during the course of the year.

MS. LEIDIGH: Okay. And used for what? Are there specific things that it's capable of being used for?

MR. WERNETTE: It can be used, depending on the purposes of the receipt of the monies, for capital outlay, costs of purchasing lands. It could be used for capital outlay improvements, construction, and it also

can be used for, you know, operating expenses.

So it -- some of the monies we receive actually have very specific limits on what we can use it for. And if it's specified in the authorizing legislation, or in an agreement with a particular project component that would control how we would use that money. But once that money is in there if it doesn't have those restrictions those are the sort -- that's how we can spend it.

MS. LEIDIGH: Okay. I think that answers that question. My other question is: In your biological opinion you have a number of measures that you say are based on California Environmental Quality Act rather than the Endangered Species Act.

It appears to me that those are over and beyond the measures that you had for endangered species. Is there some reason why -- and it also appears to me that, and you can tell me if I'm wrong, that you believe that the CEQA requirements have a stricter standard than the CESA requirements.

MS. MURRAY: It's a little bit of a legal question.

MS. LEIDIGH: Well, I know. It's sort of a little mixed, but I'd like to have a answer to the best of his ability from his operating standpoint.

MR. WERNETTE: I'll do the best I can. The

criteria that we used for what qualified as a reasonable and prudent measure, we interpreted that criteria to be very -- very specific to -- obviously, to the listed species.

MS. LEIDIGH: Right.

MR. WERNETTE: And then we actually -- we had a fairly high standard from our Department's point of view as to what we could include as a reasonable and prudent measures. So when Barbara Brenner was describing, you know, how some things described in my first testimony, or provided on the terrestrial resources that some of those measures were moved from reasonable and prudent measures -- potential reasonable and prudent measures to conservation recommendations.

Those are the ones that did not meet that criteria, you know, from our Department's point of view as to what could qualify as a reasonable and prudent measure. In other words, necessary to reduce the adverse effects of take on those two species. So we made that as a first tier in terms of our decision process.

So the next question we asked ourselves was given our position on the project and the Delta and the aquatic resources in the Delta, do we believe that after we've done that are there still adverse effects -- significant adverse effects on aquatic resources? And we

concluded that from our view, there were. So, hence, those measures that we felt would reduce those impacts to less than significant levels ended up going into that second set of recommendations.

MS. LEIDIGH: Okay. Is there some reason why those measures were included in the biological opinion instead of being included in a separate document?

MR. WERNETTE: I honestly -- you know, I don't -- I don't know that there's a specific reason that a separate document wasn't prepared. I think we thought it would be useful to include in one package those -- a combination of measures that we felt under both CEQA and CESA, both, fell to the endangered species that we were dealing with was reasonable to include in the same package as long as we were very clear that, you know, one satisfied CESA; and the other one was not required under CESA.

MS. LEIDIGH: Okay. You said at one point during your testimony I believe that -- that there's a higher standard that's required by CEQA for mitigation. Did you say that?

MR. WERNETTE: I don't recall.

MS. LEIDIGH: Something like that?

MR. WERNETTE: Saying higher standard compared to something else --

MS. LEIDIGH: Compared to CESA so far as your

mitigation measures.

MR. WERNETTE: I don't recall.

MS. LEIDIGH: You had some mitigation measures in your -- additional measures that looked like they were a more stringent mitigation than -- than the CESA measures.

MR. WERNETTE: That is correct.

MS. LEIDIGH: Okay. And they were based on the Environmental Quality Act?

MR. WERNETTE: That is correct.

MS. LEIDIGH: Okay. At some point whether you -- you want to do it right now or some other time, I think, Ms. Murray, I'd like to have your legal analysis of why it is that the CEQA standards appear to be more stringent than the CESA standards.

MS. MURRAY: I don't think Frank said that. I think he said that first they looked at jeopardy and then they looked at take. And there were some residual effects which they then went and said, now to get these down to significant affects we have to do this. I don't believe he testified that there's a higher standard at CEQA than CESA.

I think he testified that the higher standard in CESA is jeopardy. But in my closing arguments I will address these levels, but I did want to clarify for the

record that I don't think he said that.

MS. LEIDIGH: Okay. I would like it if you would address this in your brief. I don't have anything else. I'll turn it over to Mr. Canaday.

HEARING OFFICER STUBCHAER: Okay. Mr. Canaday.

MR. CANADAY: My questions will go mainly to the terrestrial aspects of DO and some of the conditions in the biological opinion and then additional recommendations.

First of all just for clarification, the -- I'll ask Mr. Wernette this: You were the primary author of the biological opinion, Mr. Wernette?

MR. WERNETTE: Yes, I was.

MR. CANADAY: Okay. Is it your understanding that the recommendations and the findings in the CESA aspect of the biological opinion and the reasonable and prudent conditions, those are binding upon the lead agency? Is that your understanding?

MR. WERNETTE: There are -- I forget the exact language in CESA -- the sections of CESA that we're advising the Board. You know, our opinion to the Board is that we believe those are necessary to reduce the adverse effects of take. There are specific -- you know, the Board -- this is our opinion to the Board.

The Board doesn't blindly have to take those

recommendations. There are a specific language -- there's specific language in the code, which I actually am not going to be able to quote to you, that under specific conditions, you know, there are -- there are other findings that the Board can make.

MR. CANADAY: And the additional conservation recommendations, those -- as a follow-up to Ms. Leidigh, those were made with a CEQA understanding; is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: Were those recommendations made during the comment period to the Draft EIR?

MR. WERNETTE: We didn't make those specific recommendations. In other words, we didn't include our additional conservation measures as additional specific criteria in our comment letter to the Board on the Draft EIR.

MR. CANADAY: But you're making them now in the basis as -- either as an advocate, or responsible agency under CEQA as to those recommendations?

MR. WERNETTE: That's correct.

MR. CANADAY: One of the points of discussion over the last couple days there's been one particular difference between the Federal opinion and the Department's opinion. And that dealt with the

compensation for the 50 acres of impact due to siphon -- development of siphons and the pumps.

And there was some discussion, or questioning on what the difference was. And I'd like to ask you a question. The Department's position for the easement of 200 additional acres and the enhancement or restoration is to achieve no net loss; is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: And that's the difference between your recommendation and U.S. Wildlife Service is that the Department doesn't recognize the conservation easement of an existing habitat as achieving no net loss; is that correct?

MR. WERNETTE: That's correct. Can I ask you a quick question, Jim, about the 50 acres that you described? I don't remember us discussing that to be honest with you, but I do remember us talking about the 200 acres. There is an issue about the 50 acres that Fish and Wildlife Service is actually willing to accept construction impacts incorporated within the 200. NMFS and Fish and Game believes that -- once those actual impact acres are estimated and calculated that those will be mitigated separately.

MR. CANADAY: Okay. But the heart of my question is: There's a difference of how you weigh and measure no

net loss, or compensation?

MR. WERNETTE: Yes, I understand.

MR. CANADAY: Okay. I'm going to be referring to pages in the Department's biological opinion which is, I believe, Department Fish and Game's Exhibit 11. And first I would take you to page 37 which is the start of the findings by the Department. And I'll read slowly for the Court Reporter:

Based on the best available scientific information -- and I'm reading at the bottom of the page, the Department of Fish and Game finds that the project described in this biological opinion -- and this is the Delta Wetlands Project, including the habitat and management plan and the measures in the attached Federal biological opinion would not jeopardize the continued existence of the greater sandhill crane and the Swainson's hawk, or result in construction or adverse modification of the habitat essential to the continued existence of these species.

Having read that, I would like to take us to page 46 which is 7.0 which the header is "Management Measures and Monitoring of Sandhill Cranes and Swainson's Hawk." And the term that's in this particular -- under this heading under 7.1 is that -- and I'll read slowly:

Monitoring of sandhill cranes and Swainson's

hawks shall be conducted prior to the development of the habitat islands, or habitat management lands on Bouldin Island and Holland Tract and annually for five years after habitat is -- development is completed.

And I don't -- I don't know of any controversy there that I'm aware of. What I'm interested in is the following sentence:

A specific monitoring plan shall be developed for these species and provided to the Department of Fish and Game for review and written acceptance prior to the close of the hearing record in issuance of the Delta Wetlands water rights permits.

In the Habitat Management Plan, which is part of the -- HMP that's been referred to, and I'm not sure -- I don't believe it has a specific exhibit number. It's an appendix to the Draft Environmental Impact Report. And I'm not sure what that number is.

UNIDENTIFIED LADY: C3.

MR. CANADAY: Pardon?

UNIDENTIFIED LADY: C3 --

MR. CANADAY: I know what appendix it is. I'm trying to figure out what exhibit number is. It's a staff exhibit, or is it a Delta Wetlands Exhibit?

MR. SUTTON: No, it's ours.

MR. CANADAY: Let me read to you what was in that

Habitat Management Plan and I'll ask you a question.

To ensure compliance with the California Endangered Species Act the Department of Fish and Game may require that monitoring be performed to confirm that the project impacts on greater sandhill cranes and Swainson's hawks are adequately offset by compensation.

The Department, therefore, may require the use of habitat islands by greater sandhill cranes be monitored after the project construction to determine whether use levels are, at least, as high as these levels before the project construction; and to provide information on how these species use the island habitats.

And I'll skip to another paragraph. And this will be the part to the heart of my question:

Monitoring requirements, performance standards, and potential remedial measures for greater sandhill cranes and Swainson's hawks will be developed by the Fish and Game in consultation with Delta Wetlands.

By reading that it's my understanding that the Department was going to provide the monitoring plan and the requirements in the monitoring plan to Delta Wetlands. Is that the intent of the Department, or if there's -- if there's an inconsistency with the issues in the BO, or the habitat management?

MR. WERNETTE: I agree, Jim, that is an

inconsistency. The relationship that we had during the development of the HMP was -- was one where if those specific areas of the HMP where the Department maybe had the -- had a pretty good handle on the requirements that we might have specific species knowledge that we would -- we were working as a team. And people would be assigned tasks and work on them and bring them back to the team for review and adoption by the team. And the team included not just the consultants and the State Board's staff, but also Delta Wetlands.

So in the content of that teamwork relationship I think that we were really anticipated it, envisioned in that plan that the Department take the first crack at drafting something like that, and bring it back to the team obviously with concurrence from the entire team, especially Delta Wetlands who would end up paying for it and be conditioned to perform that monitoring. I think that was what we envisioned at that time.

MR. CANADAY: In lieu of the condition that's in the biological opinion, would it be preferable for the Department to develop that plan and bring it to Delta Wetlands at a later date?

MR. WERNETTE: It, certainly, would seem like a reasonable approach. The way I would read the biological opinion it seems the people who would be out of

compliance would be us.

MR. CANADAY: That's part of my question.

MS. MURRAY: Well, no.

MR. CANADAY: Well, my question would be: If, in fact, there is a slight inconsistency here in common sense, or maybe the better sense would say that it ought to be the Department to make the first attempt at that, would it be -- is it -- is it -- can that be changed, or modified?

MR. WERNETTE: Well, I think, you know, I would -- I can't answer that question specifically. It would require our Director's approval to do that. But it seems reasonable though that the language be clarified in terms of the format and who's going to perform the function of providing the first draft and the timing of that first draft would seem in order.

MR. CANADAY: Okay. Is that something that the Department is willing to pursue, the clarification and --

MR. WERNETTE: Yes.

MR. CANADAY: Thank you. Back with the biological opinion, again. On page 38 -- and this is just a clarification for myself. I'm reading under .3, it's the last sentence. It says:

The adverse impacts of the taking of these species incidental to the project will be minimized if

the measures specified in section, Roman numeral 9-B are fully implemented and adhered to.

That should be Roman numeral 9-A; is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: And there is no "B" within this particular document?

MR. WERNETTE: That's correct.

MR. CANADAY: I'm on page 44 now on .3.7 and this was part of the question that Ms. Leidigh had earlier on the $75,000. And I'll state the same premise: That if the Board found that it had the authority to do that and required that, your testimony earlier, or response to Ms. Leidigh was that there are various, different types of accounts that the Department has to handle -- to accept that funding and disburse that funding.

If it were found by the Board that that $75,000 had to be in a specific account earmarked for the Delta Wetlands Project and that that money could only be spent on tasks relative to the monitoring of the Delta Wetlands Project, the Department would not have a problem with that?

MR. WERNETTE: We would not.

MR. CANADAY: Okay. I'm on page 47 now. And I'm on .7.3. And the essence of this particular point

deals with surveys, again, for Swainson's hawk. And it requires that these pre-construction surveys -- and they use the term to identifying information or accounting for monitoring Swainson's hawks numbers. And you've used the language "located in the project area."

And my question to you is: What will be considered the project area? Is it the Sacramento/San Joaquin Delta? Is it within a particular radius within the Delta those particular project islands? What will be the burden of the Applicant as far as the area to be surveyed?

MR. WERNETTE: Our intent with this was to look at the how the project was described, or estimate of how it would be construct -- or a view of how it would be constructed. We would envision that if, for instance, if the levee was the component of construction underway, it would be the levee systems and the immediate vicinity of those levee systems, say, you know, a few hundred yards away from that levee. Same thing for the siphon stations and pump stations those would be defined as the construction site, or the project site. And the data would be specific to those locations.

MR. CANADAY: Okay. On page 51, .11, which deals with the Black Rail. And it talks about surveys that need to be conducted .11.1. Now, first the tidal

influenced shore land margins with tules, cattails, and other types of vegetation. Is that -- when you're talking about tidal influenced shore lands are you talking about the tidal of influenced shore lands immediately around the islands, or were you thinking of an area larger than the project area to the immediate island?

MR. WERNETTE: We're thinking of those locations on the habitat in the immediate vicinity of the islands.

MR. CANADAY: Okay. On page 52 carrying on to page 53, the biological opinion has identified particular conditions that the Board are required to undertake with this project. And a lot of these are in the form of a -- of monitoring, or providing instruction to the construction crew about endangered species.

Is this something -- it gets back to my question to the $75,000 and the position with the Department: Is that something that that person could do rather than requiring Board to allocate staff resources to do this for the project?

MR. WERNETTE: It is possible that that individual assigned could do that. It's -- it's typical that if this condition is made, the Board -- the Board could delegate that responsibility to the project, Delta Wetlands Project to ensure that that's accomplished.

MR. CANADAY: Okay.

MR. WERNETTE: And it -- there are situations, for instance, where we have contracts with the Department of Water Resouces for -- to assist them in the operation of maintenance, for instance, of the aqueduct where Fish and Game staff, actually on occasion, do perform these orientation meetings for DWR. Often they're actually with the environmental specialist with the DWR. So it wouldn't be unusual for us to do this.

MR. CANADAY: Thank you. Okay. I'm sure we could find Board staff that would like to be out on the project islands.

HEARING OFFICER STUBCHAER: Maybe even Board Members.

MR. CANADAY: Now, I'd like to talk about some of the -- on page 72 additional conservation measures. And I'll read the fist paragraph under that particular header, which is Roman numeral 11 entitled "Additional Conservation Measures."

Under CESA it is incumbant on all State agencies to seek to preserve endangered and threatened species. The following measures will not require pursuant to the Department of Fish and Game Code Sections 2090-2092 are recommended as additional conservation measures to be implemented, or imposed by the State Water Resources

Control Board in furtherance of the purpose of CESA. The biological basis for these recommendations will be provided in the water rights hearing.

And that will lead me to my question. And my area of interest is on page 75, .3.0, measures to reduce additional -- incidental take in the project service areas. And I'll paraphrase this term. It -- the term that's recommended under 3.0 is that Delta Wetlands will generate annual funds based on the amount of water that they divert. Is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: And the purpose of this particular --

MR. WERNETTE: Can I clarify something, Jim?

MR. CANADAY: Sure.

MR. WERNETTE: Actually, it's not so much the water that they divert, it's the amount that they export.

MR. CANADAY: Okay. That's one of my questions. And I'll clarify that one now. So, any water that the Delta Wetlands would divert and store for later environmental enhancement water, they would not be charged this particular fee --

MR. WERNETTE: That's correct.

MR. CANADAY: -- for that water?

MR. WERNETTE: That's correct.

MR. CANADAY: Okay. But stepping back, there is,

in fact, a fund that will be generated by the amount of water that Delta Wetlands would divert and would export, and by -- export either through the State Water Project, or the Federal project; is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: And the -- and would you briefly summarize the -- the purpose of how this money will be used, this particular fund?

MR. WERNETTE: Well, the fund would -- when the monies are collected would, in our view, be used to assist in the planning process -- for number of various reasons. One is to assist in the planning process in some cases that are already underway in communities south of the Delta that received State Water Project water, or CVP water.

To advance the conservation planning, the habitat conservation planning, or NCCP efforts that are currently underway so that those planning efforts successfully conclude and provide mechanisms to, you know, to allow for the protection of endangered species in the service areas. And in addition to that, you know, So that the developments that are proposed down there can move forward with some certainty.

If there were planning processes that have been completed, those all set up plans for implementation.

And some of these funds then could be used for actual implementation. In some cases there are identified Corp areas that are very critical that when funds became available they could go to the purchase of those Corp areas and may be used to leverage some of the funding that's being provided through the habitat conservation planning process there, depending where -- what service area is being affected.

MR. CANADAY: The point of my question is that you said within the service areas of where this water would be delivered. Aren't there -- and I'm not disputing the benefits that this money could be put to, generally, but the heart of my question is: Isn't this, in fact, a responsibility of Delta Wetlands if, in fact, there are service areas that are receiving water, whether it's State Project water, Federal Project water, and they have their own planning and permitting processes that they have these plans already underway, is it -- is it truly Delta Wetlands responsibility to make these plans come about? And the nexus being some impact that is attributable to Delta Wetlands? Is that what the Department believes is the responsibility of Delta Wetlands?

MR. WERNETTE: That -- I think it's an excellent question. It's within -- the Department has looked at

this issue, I think, for the most part that you made about, okay, who's responsible for the development of these plans? Who's responsible for the impacts that occur, the site specific impacts that occur?

And typically the burden of developing these plans and implementing the plans have fallen on developers who are proposing commercial, or residential development in the service areas. And, certainly, that's where the main motivation has been for the development of these plans and for the implementation of the plans.

The Department views it, however, that there are a number of factors that influence development, or change land use practices throughout California. It isn't just a developer who wants to develop a residential area. There are services that have to be provided to that.

So when you look at the share -- what we considered the shared responsibility, not the only responsibility, but the shared responsibility that people who -- or companies that provide power, transportation access, and water supplies that those together contribute to, or -- to the growth inducement in a particular location, but clearly, you know, that isn't just their responsibility.

So we view it as in our -- this specific recommendation as being a fair approach at describing

what this specific project's responsibility may be to contribute to the advancement of endangered species conservation in the service area.

MR. CANADAY: My final question --

HEARING OFFICER STUBCHAER: Mr. Canaday, could I follow on your last question?

MR. CANADAY: You are the boss. Any time you choose.

---oOo---

CROSS-EXAMINATION OF THE DEPARTMENT OF FISH AND GAME

BY THE BOARD

HEARING OFFICER STUBCHAER: If the water supply generated by Delta Wetlands is used to replace some of the water supply which was lost due to the Delta Accord, it's also used to firm up the supply rather than to increase the supply, average supply, where are the growth inducing impacts?

MR. WERNETTE: To the first part of your question whether this replaces supplies that were lost during the Delta Accord -- as a result of the Delta Accord, under that specific example it may be very difficult to identify net increase of available water supply that could be used to encourage development.

In the second case where water project supplies could be firmed up, there still is a potential that as

those supplies are firmed up people are more comfortable with allocating those supplies both for maybe more permanent crops types that could be of less value to wildlife, or firm up supply sufficiently that the local planning agencies are willing to allow a development to move forward that couldn't before.

So I think you bring up an excellent point that in this world where there was in the December '94 Accord an identified reduction in water supplies, that if this just brings us back some incremental amount toward that, under that specific example it may be difficult to identify any new water supplies that could encourage development.

HEARING OFFICER STUBCHAER: So would that consideration result in any modification of the recommendation?

MR. WERNETTE: Well, I think that -- I personally don't think it would. We don't know how this water will be used in the context of the '94 Accord, nor how it might be used in the context of other water supply advancements that occur under the CAL/FED Bay-Delta Program. And, you know, if a temporary, you know, retreat in terms of water supplies on the Accord, we actually hope that we firm those supplies up and actually improve supplies in the Bay-Delta Program.

So we're taking a longer term view, not just a view of what's going to happen between now and 1994 -- or what happened between now and 1994 and the next few years. We're taking a look into the future where this project's water supply benefits added to what CAL/FED is going to be doing, you know, adds a small increment of water supply.

HEARING OFFICER STUBCHAER: Mr. Canaday.

MR. CANADAY: My last question, Mr. Wernette. The mitigation, the habitat islands are -- restating the obvious, are developed because of the impacts of the reservoirs islands; is that correct?

MR. WERNETTE: That's correct.

MR. CANADAY: Therefore, in any future water rights permit should the Board approve a permit that a way needs to be developed that should any future successor to the reservoir islands, the responsibility for the habitat, or the restoration, or mitigation islands needs to be linked to that particular water right.

Is that the opinion of the Department?

MR. WERNETTE: It is our opinion that the continued management of those habitat islands needs to be assured in some manner, whether it is the person -- if the reservoir islands are transferred, whether it's that specific entity that manages the habitat islands, we

don't have an opinion on that. But we do an opinion that the habitat islands continue to be managed as long as the project is operated.

MR. CANADAY: Okay. Finally, yesterday we heard testimony from a representative of Caltrans. And one of their interests was the future potential opportunity to enlarge across Bouldin Island Highway 12. Do you remember -- were you here for that testimony?

MR. WERNETTE: Yes, I was.

MR. CANADAY: Is it -- would it be the Department's opinion that if, in fact, that 100-foot movement of, at least, a proposed habitat management plan could be made and that compensation for any acreage required by the HMP could be accomplished with the exclusion of this 100-foot buffer, the Department would not oppose that particular adjustment, would you agree with me?

MR. WERNETTE: I would agree with you, we would not oppose that judgment.

MR. CANADAY: Thank you.

HEARING OFFICER STUBCHAER: Thank you, Mr. Canaday. Mr. Cornelius?

MR. CORNELIUS: No.

HEARING OFFICER STUBCHAER: And, well, I only have one more question: How big is a giant guarder snake?

MR. WERNETTE: It's not as big as you might think.

I don't remember the specifics, but I think if it was, you know, between 20 and 30 inches it might be a trophy giant guarder snake.

MR. CORNELIUS: A trophy.

HEARING OFFICER STUBCHAER: Is that in diameter, or circumference? Okay. All right. That concludes the cross-examination. Do you have redirect --

MS. MURRAY: Yes, I do.

HEARING OFFICER STUBCHAER: -- Ms. Murray?

MS. MURRAY: Yes. First Frank. Was the M Salmon Model created by Jones and Stokes?

MR. WERNETTE: Yes, it was.

MS. MURRAY: Did DFG do anything more to the M Salmon Model rather than report monthly averages rather than annual averages?

MR. WERNETTE: We didn't do anything more than that. The only other thing we did was to take that data and in some cases rank those data. So in some cases develop information on percent changes that we had to calculate separately from that, but the actual output was as you described.

MS. MURRAY: Did DFG ask Mr. Shaul to provide monthly output rather than average annual?

MR. WERNETTE: Yes, we did.

MS. MURRAY: Did he?

MR. WERNETTE: No, he did not except in an electric format he did, because the modeling output comes out in that format. As far as providing it in a written form, or written reports, no.

MS. MURRAY: Is that why DFG generated the monthly output using Shaul's model?

MR. WERNETTE: Yes, it is.

MS. MURRAY: In your opinion was DFG's use of the Jones and Stokes output inappropriate?

MR. WERNETTE: It was not inappropriate.

MS. MURRAY: After the DO was completed on June 16th, was there time before the testimony was due for this hearing to have Jones and Stokes run another model run similar to that in Table 5 of DW-5?

MR. WERNETTE: No. There wasn't.

MS. MURRAY: One last question: Mr. Sutton asked you some questions regarding the amount of water that might be carried over the environmental water. Do you recall that?

MR. WERNETTE: Yes, I do.

MS. MURRAY: Isn't it part of the proposal that the environmental water be released in the same water year that it was taken?

MR. WERNETTE: That's correct. I think -- I think there were a couple of questions that I went over to on

with Mr. Sutton. And one of them was the hypothetical that he described where we might be limited -- where there might be some restrictions on the ability to release that environmental water.

And it really is a use-it or lose-it proposition. So that at the end of September and at the end of the water year if it hasn't been used for environmental purposes, we've lost control of that water, or the ability to request its release.

MS. MURRAY: Jim, question for you. The data that you E-mailed to Delta Wetlands last night, did all of that data originally come from Jones and Stokes?

MR. STARR: Yes.

MS. MURRAY: Thanks. That's all. Dale, Mr. Nelson asked you about this year's 20 millimeter survey and pointed out that last year's fall midwater trawl index is less than 239. Do you recall that?

MR. SWEETNAM: That is correct.

MS. MURRAY: And that -- he mentioned that, therefore, diversions for protections would be in place this year.

MR. SWEETNAM: Yes. Yes, he did.

MS. MURRAY: Okay.

MR. SWEETNAM: I'm looking for the pointer.

MS. MURRAY: Oh, the pointer. Jim, you have it.

Okay. Why do you think that Delta smelt might still be vulnerable?

MR. SWEETNAM: We're still in the same problem in that we go back to the last year's index, which was less than the 239. If you look on the table over here for 1996 is 128 --

HEARING OFFICER STUBCHAER: Identify.

MR. SWEETNAM: Excuse me. Fish and Game Exhibit 9, Figure 3 page 26. Where the 1996 data would be under the 239 protection level. So there was increased protections, basically, reducing the diversions from February through June.

The problem is that we're still -- you can leave that there. We're still basing our decision on last year's index, which I tried to show that there was still no relationship between -- between years. If you look at the 1990s, it was basically a one in two chance that you would be under 239. And if you look at all the years, it's basically a one in four chance, or one in five chance that you're going to have those protections invoked. But there's no direct relationship between years.

The other problem is that with the data that I showed for this year in the current -- in the environmental -- in the EIR/EIS Jones and Stokes assumes

that there's -- you can go ahead and put that up, that in the Central Delta -- this is Figure 5-10 from Delta Wetlands EIR/EIS, Appendix 2, again, maybe Appendix F2, that there's 16 percent of Delta smelt respond in the Central Delta.

This year we had an exception where it may be over 50 percent in the Central Delta which would greatly magnify the model run which, you know, this is out of the ordinary given that, but it may magnify and increase the amount of take both at the State and Federal water facilities and at the Delta Wetlands diversions.

MS. MURRAY: Okay. Is that it?

MR. SWEETNAM: Yes.

MS. MURRAY: Mr. Sweetnam, you were also asked a question about your criticism of the monitoring program and whether you attended a meeting regarding the proposed monitoring. Do you recall that?

MR. SWEETNAM: I did.

MS. MURRAY: Why don't you believe that the proposed monitoring program will work?

MR. SWEETNAM: The way the proposed monitoring is in the Delta Wetlands final operation -- final operating criteria is that it calls for a 50-percent reduction if Delta smelt are observed the day before. So within one day you are going to reduce diversions by 50 percent.

The problem is that that can't be done right now. We are monitoring North Bay aqueduct, a DWR diversion in the northern Delta. And we -- we take, basically, 72 hours to identify larval Delta smelt. It takes that long to take the sample, sort the sample, process the sample, identify all the larvae in there and then say whether there's Delta smelt present or not. It basically takes three days to do that process. And currently there are only two parties that are able to identify larval Delta smelt at this time. More can be taught how to identify larval smelt, but it's a long involved process.

It's a problem that also comes up in that if you reduce the amount of pumping by 50 percent, you may have already entrained those planktonic larvae which are moving with that body of larvae towards the facility and have a problem with that, at least, to indirect effects. That's it.

MS. MURRAY: That all?

MR. SWEETNAM: Yes.

MS. MURRAY: Okay. Debra.

MS. McKEE: Yes.

MS. MURRAY: You testified on direct -- or on cross, sorry, that juvenile winter-run primarily enter the Delta through the Delta Cross Channel and Georgiana

Slough. Do you recall that?

MS. McKEE: Yes, I do.

MS. MURRAY: Where else do juvenile Delta salmon enter the Delta?

MS. McKEE: We believe they can enter the Delta at Three Mile Slough and the Lower San Joaquin as well.

MS. MURRAY: You testified that we don't have a quantitative index for the number fish entering the Delta through the Lower San Joaquin River, or Georgiana Slough, and Three Mile Slough. Do you recall that?

MS. McKEE: Yes.

MS. MURRAY: Is it your opinion that Shaul's exclusion of these areas from his mortality model due to lack of index data is a valid reason to exclude those areas?

MS. McKEE: No.

MS. MURRAY: Is that why you did a more qualitative analysis in preparing your testimony?

MS. McKEE: Yes, it is.

MS. MURRAY: Does Shaul's mortality index address adult winter-run?

MS. McKEE: Not in terms of the mortality model, no.

MS. MURRAY: Okay. There was some discussion on averaging during direct testimony. What is your

understanding of how Delta Wetlands average annual impacts?

MS. McKEE: If I may use the talking point. Actually, it's one of their exhibits.

MS. MURRAY: Please, identify this.

MS. McKEE: This is Table 3B in Mr. Shaul's testimony, DW --

MS. MURRAY: 15.

MS. McKEE: -- 15. It's in several different exhibits.

MS. MURRAY: Is this also out of 5?

MS. McKEE: It's also out of 5.

MS. MURRAY: Table 3B to Delta Wetlands Exhibit 5.

MS. McKEE: One of the difficulties that we had in interpreting the data and what we did differently is we looked at the actual years that the project was in operation. If you'll look at these columns you'll notice that at the bottom these numbers are actual averages, including the years in which the project is not in operation.

And so it averages in all of these zeros. And as a result it gives you a very low overall average for the seven-year period of record, which we didn't find as a valid way of trying to represent the actual impacts to a biological organism for a given year. And what we

wanted to see was what was the range in terms of impacts in a given year.

So that is how we analyzed, for instance, we started to talk yesterday about my Table 4, how we look at monthly export changes. This is just a lotus spreadsheet printout with the exact same data. And it shows you when you have all of the years in operation, including the non-operational years you have all of these zero exports. Okay. The second picture.

HEARING OFFICER STUBCHAER: Should we identify that?

MS. MURRAY: Probably.

MS. McKEE: I guess we could.

MR. NELSON: Mr. Stubchaer, are we going to be provided copies?

MS. BRENNER: We've never seen those.

MS. MURRAY: Yes, we have copies.

HEARING OFFICER STUBCHAER: Are they two separate tables?

MS. LEIDIGH: No.

MS. MURRAY: It didn't all fit.

MR. SUTTON: DFG 16 and 17.

MS. MURRAY: All right.

MS. McKEE: They wouldn't all fit on the same one. So to the summary table where it shows the maximum, the

minimum, and the averages, shows pre-project conditions, condition as conditioned by the CESA biological opinion, maximum averages for the export values, and the actual percent change that occurred. You see these grand averages, you end up with a minimum value of zero percent change. A maximum of -- a maximum of 11.8 and an average of 1.4 percent change.

This is the exact same table only what we've done is we've taken out all of the years when the project was not in operation --

MS. MURRAY: And for identification we'll label this DFG 17.

MS. BRENNER: Do you have copies of that?

MS. MURRAY: Yes.

MR. STARR: Ready for the next one?

MS. McKEE: Yes. And as you can see you have different averages here as far as what is the maximum export rate, minimum average, and the same thing in terms of percent change under the biological opinion.

We felt that this approach was more valid. So what we did is we took what happens in seven years of operation without the project, we looked at what was the average, the maximum, and the minimum. Then we looked at what was the range in terms of changes under project operations, and we looked at what was the percent change

from pre-project conditions. This is, again, the exact same table, only what we've done is eliminated every year in which --

HEARING OFFICER STUBCHAER: Ms. Murray?

MS. MURRAY: And for the record this is DFG 18.

MS. LEIDIGH: We need copies of that.

MS. McKEE: I'm flashing my button here. This is exactly the same information only we removed all the years in which there was no operation to make it easier to view. And what's very important, that we would like to point out that hasn't been done in any of the analyses is we looked at what were the impacts occurring and in what type of a water year.

I think that this would be very informative to the Board that they look at this information in this manner, but it would show in April, which is a very critical month, that the majority of exports will be occurring in the dry and below normal years, in critical years. And, of course, those are years in which we would expect to have greater overall impacts to these species we've been speaking about.

So, on summary, what I would recommend is that a lot of data which we have been looking at has been averaged in a multitude of different ways in order to represent information. I think that taking a look at

what were the conditions in the pre-project operation and looking at the ranges of conditions specific to given months that would occur by water year type would really provide the Board the kind of information that they're going to need in order to finish assessing this project. And these are models that were performed for the Board.

Also, I think I spoke just a few minutes earlier that a model should probably be run to reflect the final CESA biological opinion, since there were some slight changes so that you could be confident that it's the best information available.

I hope that helps clarify exactly that information on how did we average our information.

MS. MURRAY: Debra, one last question: On direct you testified regarding the conservation recommendations and the Federal biological opinion. Do you recall that?

MS. McKEE: Yes, I do.

MS. MURRAY: Is it your understanding that the conservation recommendations in the Federal opinions are project specific?

MS. McKEE: Yes, they are.

MS. MURRAY: What is the basis for that understanding?

MS. McKEE: Under Federal EFA, I believe Section 2(c), defines exactly what conservation measures are and

their purpose. And I had the good fortune of speaking with Mr. Jim Monroe who is with the Army Corp of Engineers. And I went out on break and I asked him and he did clarify for the record that the Federal conservation measures are project specific.

MS. MURRAY: Okay. Alice --

MR. NELSON: Mr. Stubchaer, I would like to object to that question and the answer and say that Ms. Murray can simply provide and brief this issue as to what conservation measures and conservation recommendations provide in the ESA Federal Act and speak to it very clearly, instead of reporting a hearsay conversation from Mr. Monroe who is with the Army Corp of Engineers. It would be a lot more useful to have this issue briefed rather than to have these types of discussions going on as to what is and isn't in the --

HEARING OFFICER STUBCHAER: Is your objection just to the contact during the break, or to the previous discussion?

MR. NELSON: My objection is to the -- her assertion as to -- if she wants to rephrase it as: It is her understanding of what the conservation recommendations are, I would accept it then. But not as to a flat statement that that is what the ESA says.

MS. McKEE: I have no problem saying it's my

opinion. I admitted earlier that I'm not an attorney.

HEARING OFFICER STUBCHAER: That's fine.

MS. MURRAY: Alice, isn't it true that the Department of Fish and Game recommended temperature criteria that do not limit temperature increases to one degree less than 58, but allows up to a four degree increase not to exceed 58 degrees?

DR. RICH: That's correct.

MS. MURRAY: You mentioned in your cross-examination that there's very little information about adults with eggs travelling through the Delta. Is it your opinion that eggs are not affected by -- by temperature while travelling through the Delta --

DR. RICH: No.

MS. MURRAY: -- to adults?

DR. RICH: No, they are affected by any source of stress, whether it's thermal or any other kind of stress.

MS. MURRAY: That concludes redirect.

HEARING OFFICER STUBCHAER: All right. Is there going to be any recross-examination?

MS. BRENNER: Could we have a few minutes, Mr. Stubchaer?

HEARING OFFICER STUBCHAER: We'll do it after lunch.

MS. BRENNER: Thank you.

HEARING OFFICER STUBCHAER: We'll reconvene at ten minutes of 1:00.

(Luncheon recess.)

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WEDNESDAY, JULY 30, 1997, 12:53 P.M.

SACRAMENTO, CALIFORNIA

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HEARING OFFICER STUBCHAER: We'll reconvene the hearing. This is recross-examination of the redirect testimony by the Department of Fish and Game. And as a reminder recross is limited to the scope of the direct. Who's going to examine for Delta Wetlands?

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RECROSS-EXAMINATION OF DEPARTMENT OF FISH AND GAME

BY DELTA WETLANDS PROPERTIES

BY JOSEPH NELSON

MR. NELSON: I am. I have a couple questions for Ms. McKee. You were asked to explain why you used the ten years out of the ten worse years -- the highest impact years in your analysis rather than a full seven year analysis.

Isn't it true that Jones and Stokes looked at the effect of the --

MS. MURRAY: Excuse me, that was not part of redirect.

HEARING OFFICER STUBCHAER: There was testimony showing the ten years on redirect. There was an exhibit that went up there that showed the ten years. But the statement that you referred to, Mr. Nelson, I think was from the direct.

MR. NELSON: I will confine it to the table which she provided which is the averages of actual operating months in which she shows 19 years in which Delta Wetlands discharges for export in April. It's DFG 18.

Can you -- is it your testimony that these are the only years that should be analyzed when looking at the affects of the project in April?

DR. McKEE: It depends upon what parameter you're trying to evaluate. And the purpose of this overhead was to just show all of the years in which you were exporting in the month of April. There are other -- actually, yeah.

There are months also in this column when you are doing releases for outflow and there are other months which are not shown, because they weren't relevant, necessarily, to the export information that I was talking about. So obviously if you were going to look at the affect of release of outflow you'd need to look at all of the years in which you were making release for outflow.

However, when I looked at the data I did not use this number here which is the average only of the exports under pre-project conditions for the years you might predict you might do additional exports. I used the seven year record. And I was simply using this to show how -- depending on how you wanted to average your data

how you could have dramatic changes in your formula.

HEARING OFFICER STUBCHAER: I know we --

MR. NELSON: It is DFG 18.

HEARING OFFICER STUBCHAER: All right. Thank you.

Ms. McKee, is it your testimony that you don't need to look at all 70 years when analyzing discharge affects for the project in April?

DR. McKEE: No.

MR. NELSON: Did you -- does that table include what Delta Wetlands discharges would be under the final operations criteria?

DR. McKEE: This is under the terms of the State Biological Opinion.

MR. NELSON: Did you -- in preparing this chart did you consider what Delta Wetlands' discharges for export in April are under the final operation's criteria?

DR. McKEE: Yes. There is another set of data that was provided by the consultant to the Board, Jones and Stokes, which is the ESA table and it's exactly the same spreadsheet, but it just shows project affects under the final operations criteria.

MR. NELSON: Are you aware that out of 19 years that you noted that Delta Wetlands is discharging for export under the final operations criteria Delta Wetlands's discharges for export -- excuse me, under the

final operations criteria Delta Wetlands is discharges for export in 14 of those 19 years would be exactly the same as those discharges for export under the CESA Biological Opinion?

DR. McKEE: I don't have a table in front of me. So I would have to take your statement as true and correct, but I can't -- I can't say anything without seeing the tables side-by-side.

MR. NELSON: And when you -- you put in the water-year type in those months, right, in the CESA the middle column. Did you look in developing this chart and actually putting in the actual outflow for April in those years?

DR. McKEE: Warren Shaul created this data. All of this is just printing off a couple of columns. And all of this information was put in there by Jones and Stokes. I'm just printing off a couple of columns to show you.

MR. NELSON: And in analyzing the project over a seven-year period for the month of April, or any other month, in looking at the affects of the project is it necessary to look at other parameters such as outflow and other hydrologic conditions to determine what the actual affects are?

DR. McKEE: We looked at outflow, inflow, Old and Middle River flows, Q West, exports, percent of

Sacramento River diverted, percent East Side of channels diverted, all of the information that Jones and Stokes provided in this spreadsheet.

And, yes, we looked at all of them together. We did not just look at one parameter in isolation by itself. And we also looked at the relevant frequency of this project's operation both under terms of the State's Biological Opinion and the Federal Biological Opinion.

MR. NELSON: In -- in relation to the relative frequency when Delta Wetlands is actually diverting, or actually discharging, did you then compare that to the outflow and hydrologic conditions that exist when those operations are occurring? For example, in 1957 did you look at what the outflow was when those exports were occurring?

DR. McKEE: Yes.

MR. NELSON: Did you consider that an important parameter to look at instead of simply looking at the percent change in the actual exports that occurs?

DR. McKEE: I believe that the purpose of my testimony with these charts was to discuss averaging periods. And I was not discussing the relevancy of any given parameter to other parameters that I didn't present on this table at this time.

MR. NELSON: Is it your understanding that -- I

will go back then to my last question: Is it your understanding that Delta -- that -- I'm trying to format this the right way.

In developing the averages and looking at a 70-year period, do those averages, whether they are taken on a month-by-month basis, a year basis, or some other averaging period; isn't it true that they have to be taken into context of what other overall conditions exist?

DR. McKEE: Yes. I think that was the purpose of my pointing out that I believe that it would be more informative to the Board and to Mr. Stubchaer if this information was broken out also by water-year type to show when operations might occur.

And, certainly, when you look at things according to water-year type, you would be getting that flavor for what were the outflow conditions like relative to the changes in lower San Joaquin River flows, relative to the percent of Sacramento River inflow by water-year type. So, obviously, there might be a greater impact with a smaller change in one of these parameters if it's a dry year than with a larger change in a wet year.

MR. NELSON: Isn't it true that even given those parameters classifying the water-year type that water availability, outflows, and hydrologic conditions can

vary month-to-month even in a certain water year?

DR. McKEE: I would have to take your word for that. I'm not a hydrologist, but just as a human being I've seen that occur, just like the March miracle.

MR. NELSON: Thank you. I have no other questions.

HEARING OFFICER STUBCHAER: Okay. Anyone else other than staff?

Mr. Moss.

MR. MOSS: Richard Moss for PG&E. Mr. Stubchaer, if I could just go off the record for a moment.

MR. STUBCHAER: Yes.

(Off the record from 1:04 p.m. to 1:05 p.m.)

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RECROSS-EXAMINATION OF DEPARTMENT OF FISH AND GAME

BY PACIFIC GAS AND ELECTRIC

BY RICHARD MOSS

MR. MOSS: I have a few questions for Dale Sweetnam, please, on your favorite subject, Delta smelt. Is it your testimony, Mr. Sweetnam, that it is presently impossible to do accurate realtime monitoring for Delta smelt larvae?

MR. SWEETNAM: On a realtime basis for the larvae, yes. We are attempting to do realtime monitoring on adults, but it's very difficult. And we -- we are

attempting to do realtime monitoring for salmon as well. But for winter-run because they are so rare the chance of encountering a salmon in our very small net -- nets that we use are very rare. So the chances of detecting when Delta smelt, or winter-run salmon are in the estuary it's very difficult.

MR. MOSS: You may have in part answered this but: At what life stage, if any, of the Delta smelt is it possible to conduct realtime monitoring?

MR. SWEETNAM: I should probably back track, because we are attempting to use monitoring of larval Delta smelt to monitor diversions at North Bay Aqueduct. The problem is that you can't get that information on a realtime basis. It takes about 72 hours to process that information.

So it's not really a realtime monitoring. We've coined it as recent-time monitoring, because you can't process the data on a realtime basis to get it back to the operators to actually make changes in operations on a realtime basis. So -- and that's sort of like the context of how realtime monitoring is now in effect in the Delta.

MR. MOSS: Did you say that there were only two persons who can accurately identify Delta smelt larvae?

MR. SWEETNAM: Right. Actually, two parties.

MR. MOSS: Two parties?

MR. SWEETNAM: Basically, there is a consultant that we use for identification to confirm our identifications and we have staff people at Fish and Game.

MR. MOSS: I was going to say: Who are they and where are they located?

MR. SWEETNAM: Actually, one is on our staff. We have staff that's been trained in identification. And Mr. Johnson Wong, who's a consultant and actually is who PG&E uses.

MR. MOSS: I just wanted to see if we were talking about the same individuals.

MS. MURRAY: You're hiring the right guy.

MR. MOSS: Yes.

MR. SWEETNAM: And he charges about 80 to $90 a sample. So the cost of processing and identifying those fish if you are sampling 20 samples a day you can see how that may be a very lucrative business, very boring, too.

MR. MOSS: Given what you've said and what is known about the monitoring, do you think that the 72-hour minimum is about as low as it is going to go in terms of reporting the monitoring back with feedback to the operators?

MR. SWEETNAM: In terms of larval information, yes.

We are trying to get adult data within the same day, within 24 hours, but that has problems as well.

MR. MOSS: Is it correct in your -- in your redirect testimony that you gave the opinion that you think that the monitoring for Delta smelt as proposed in the Delta Wetlands Project is either unfeasible, or nonpractical, or what?

MR. SWEETNAM: Well, I was just -- the way I would express concern is the way it's written out, if you're adaptively managing to reduce exports within 24 hours it's not going to work. The proposal that Delta Wetlands has is that it's sort of open-ended. And we're still -- it's a preliminary stab at monitoring. So I think it's -- in the final wording it says that they will consult with Fish and Game and Fish and Wildlife Service to come up with a plan that's approved by everybody.

MR. MOSS: So that's a work in progress then?

MR. SWEETNAM: Correct.

MR. MOSS: Thank you.

HEARING OFFICER STUBCHAER: Okay. Anyone else? Staff?

Mr. Sutton.

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RECROS-EXAMINATION OF DEPARTMENT OF FISH AND GAME

BY STAFF

MR. SUTTON: Mr. Sweetnam, just for clarification you've discussed realtime versus recent time. And what is your definition of "realtime"?

MR. SWEETNAM: It's sort of a loose term. It's sort of one of those but -- I don't -- as significance it has a different meaning to different people. I was trying to come up with a good term. Meaningful may be another example.

There is a process that is going on currently in the Delta called realtime monitoring. Although, that information is trying to be presented to interested parties within 24 hours. So, in essence, it's semi-realtime as well. If you get it to the point of making decisions. We were considering in the naming of that project that realtime was within 24 hours. Trying to get the information to the people that would make the adaptive management change in operations like SWPRC within 24 hours. And we were using that as realtime.

MR. SUTTON: So, in essence, realtime is -- is whatever time it takes to turn the information around?

MR. SWEETNAM: Exactly.

MR. SUTTON: In the case of a --

MR. SWEETNAM: And it may be really long.

MR. SUTTON: Yeah. I was going to say in the case of a flow measurement it can be essentially instantaneous.

MR. SWEETNAM: Right.

MR. SUTTON: And in the case of Delta smelt larvae it's 72 hours is the functional realtime monitoring minimum that you have right now; is that correct?

MR. SWEETNAM: Right.

MR. SUTTON: Thank you. This is a more general question to anybody who can answer this. We've had a lot of testimony and exhibits here about different percentages and time of export and how much -- impacts and that sort of thing.

And earlier Mr. Wernette indicated when I asked him a question that in the absence of topping off there was about a 13-percent impact on the yield of the -- of the average annual 154,000 acre foot average annual yield of Delta Wetlands under the Federal BO's.

The question that I'm trying to get -- and maybe this isn't appropriate under redirect, but you might want to consider it, I think you talked about doing some rebuttal, but let me ask you and see is this:

We know what the impact is, or we have an estimate of what the impact is on project yield. What, on the other side of the coin, over the average -- over

the 70-year average annual hydrology and operations of the project, what is the average increase in protection, or conversely decrease in loss, whatever measurement you wish to use, for Delta smelt and winter-run salmon under the -- under the reasonable and prudent measures proposed in Fish and Games's BO? We've got half the equation, what's the other half?

MR. SWEETNAM: I'll take a stab, my first inclination for Delta smelt a 70-year average that would -- you would include the affects on the 70 generations of Delta smelt, because they only live one year. So in terms of the impact, it's hard to -- for Delta smelt to go through a 70-year average when it's only living one year. I mean, this is from a biological standpoint.

MR. SUTTON: But there -- if I may interrupt, but there is with the measure you propose there is presumably some measurable difference between the level of protection, or the amount of loss ascribed to Delta smelt under the Federal BO's versus Fish and Games' BO. And that's the number I'm trying to get.

MR. SWEETNAM: I think Frank has the answer for you.

MR. WERNETTE: The biological opinion has a couple of percentages that Mr. Nelson discussed this morning

with respect to diversion effects where the biological opinion reduces diversion effects by 50 percent for both winter-run and Delta smelt. And that's in comparison of the project as proposed in the Draft EIR.

When you look at the measures in the final operating criteria, they also reduce impact of diversions from the proposed project in the EIR. But in our calculations, those reductions are 25 percent from the base project for winter-run. And about 30 percent for Delta smelt. So that the reductions in terms of reduced impacts is about double what the reasonable and prudent measures of the biological opinion.

MR. SUTTON: Are those just the reasonable and prudent measures, or with the other conservation measures included?

MR. WERNETTE: With the reasonable and prudent measures.

MR. SUTTON: Only?

MR. WERNETTE: That's correct.

MR. SUTTON: Thank you.

HEARING OFFICER STUBCHAER: Is that it?

MR. SUTTON: Yes.

HEARING OFFICER STUBCHAER: Mr. Canaday?

MR. CANADAY: No questions, sir.

MR. STUBCHAER: Anyone else?

I just have a couple questions regarding these Delta smelt larvae, just mainly for my education and not to influence the decision.

How large are the Delta smelt larvae?

MR. SWEETNAM: They hatch at about five millimeters so about the size of a tic-tac.

HEARING OFFICER STUBCHAER: Can they swim?

MR. SWEETNAM: They -- they can swim, in essence, not very well. They're considered planktonic for the first two, or three months, or so.

HEARING OFFICER STUBCHAER: Is the North Bay aqueduct pumping plant at the end of kind of a dead-end slough?

MR. SWEETNAM: Right.

HEARING OFFICER STUBCHAER: So if they're in the slough what moves them out other than tidal action?

MR. SWEETNAM: Or exports move them up.

HEARING OFFICER STUBCHAER: Yeah. Yeah. If the pumping is stopped, will they be there for quite a while?

MR. SWEETNAM: They can be, yeah. And the current restriction for North Bay Aqueduct is that when we determine that there is presence of Delta smelt in the system, and it's a very strange calculation, because it's a weighed average between three stations. One is close to the pumps and one is farther away. And the one

farthest away gets weighed less. So it's sort of a weighed average of these stations.

They're restricted to 65 csf for a five-day period. So, in essence, we have five days to -- that their pumping is reduced. And in those periods we are additionally monitoring. So it keeps going that the five-day period stays on until there are no more Delta smelt present.

HEARING OFFICER STUBCHAER: So they're all pumped. Okay. Thank you. That concludes the recross-examination. Do you wish to offer exhibits?

MS. MURRAY: Yes. I wish to offer DFG Exhibits 1 through 18 into evidence.

HEARING OFFICER STUBCHAER: Okay. Any objections? Seeing none, they're accepted into evidence. Thank you for your participation.

MR. SUTTON: Excuse me, Mr. Stubchaer?

HEARING OFFICER STUBCHAER: Yes.

MR. SUTTON: For bookkeeping purposes, there's been several exhibits introduced by Delta Wetlands during cross-examination that have not been formally offered into evidence. Those would be Exhibits 34 -- Delta Wetlands 34, 35, 36, and 37. I would like to know if you want to get that taken care of now.

HEARING OFFICER STUBCHAER: Yes. Ms. Schneider, or

anyone, do you wish to offer them?

MS. BRENNER: Sure. Delta Wetlands would like to offer into evidence DW 34, which was Mr. Krasner's technical paper; DW 35 which was the comparison of the table, the State and Federal biological opinion; 36, DW 36 was the Lower Sacramento River Entrainment Index data set that Mr. Nelson used during his cross-examination. And DW-37 was Frank Wernette's interpretation of the percentages on table five that Mr. Nelson and Mr. Wernette discussed yesterday afternoon. We'd like to offer those into evidence.

HEARING OFFICER STUBCHAER: Are there any objections? Seeing none, they're accepted.

MR. SUTTON: Thank you.

HEARING OFFICER STUBCHAER: I think everyone is worn out. Okay. Next, we will have rebuttal testimony, and if we stick to the same order it will be Delta Wetlands first.

MS. SCHNEIDER: Mr. Stubchaer, may we sit here and bring up one witness at a time?

HEARING OFFICER STUBCHAER: Yes.

MS. SCHNEIDER: Thank you.

HEARING OFFICER STUBCHAER: How much time do you expect you'll need?

MS. SCHNEIDER: We have substantial rebuttal

testimony. We estimate that it will take between -- about three hours. I have two new witnesses for Delta Wetlands. Dr. Alex Horne and Doctor -- or Mr. Robert Korslin. For the record, that's spelled Horne, H-O-R-N-E; and Korslin is K-O-R-S-L-I-N.

And we need to have these two witnesses sworn in, because they were not here previously, and enter their resumes for the record as new exhibits -- introduce them as two new exhibits now before I start.

HEARING OFFICER STUBCHAER: Where are they? Are they in the audience?

MS. SCHNEIDER: They are in the audience, Dr. Horne and Mr. Korslin.

HEARING OFFICER STUBCHAER: Okay. I recognize -- yeah. Please, raise your right hand. You promise to tell the truth in these proceedings?

DR. HORNE: Yes.

MR. KORSLIN: Yes.

HEARING OFFICER STUBCHAER: Okay. The witnesses may be seated.

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REBUTTAL TESTIMONY

DELTA WETLANDS PROPERTIES

BY ANNE SCHNEIDER

MS. SCHNEIDER: The first resume is for Dr. Horne. We have copies for the Board and for the parties. That would be Exhibit -- Delta Wetlands 38. And the second is for Mr. Korslin. And we also have copies for the Board and parties. And that would be Delta Wetlands Exhibit 39.

I think to give you a sense of the rebuttal testimony, Mr. Stubchaer, the order that we intend to follow right now is to start with Dr. Brown who's with Jones and Stokes. And then when he's completed to proceed with Dr. Kavanaugh, Dr. List, Dr. Horne, Mr. Hultgren, Mr. Forkel, Mr. Korslin, Mr. Marine, and Mr. Vogel.

MR. MADDOW: Excuse me. Mr. Stubchaer, can I just ask Ms. Schneider to repeat that?

MS. SCHNEIDER: Certainly. The order will be Dr. Brown, Dr. Kavanaugh, Dr. List, Dr. Horne, Mr. Hultgren, Mr. Forkel, Mr. Korslin, and Mr. Marine, and Mr. Vogel. And so, Dr. Brown, would you come up here. We'll start with him.

Good afternoon, Dr. Brown.

DR. BROWN: Hello.

MS. SCHNEIDER: Testimony has suggested that export adjustments should be made by your DeltaSOS Model. That when they were made, they were unrealistic because most of those additional exports could not be made because of demand in storage limits.

Can you clarify your testimony and respond to that comment?

DR. BROWN: Yes. I'd like to refer to Figure 3A-5 from the Draft EIR/EIS. This is showing the monthly Delta outflow after the DeltaSOS Model has made the adjustments bringing the simulated exports up to full allowable exports.

I've already testified that this is done in order to protect senior water rights, and also protect the State and Federal operations. With this -- what I'm wanting to say along with this figure is that this figure of monthly Delta outflow in this case compared to that required under the 1995 Water Quality Control Plan objectives is, in essence, the entire analysis that all of the other subject areas follow after.

And so what we have been describing throughout the proceedings is whether water that is not required by the Water Quality Control Plan objectives would be allowable under the Delta Wetlands Project.

In the event that the adjustment to full exports

could not be made under actual operations because there is a storage limitation, or a demand limitation, that would mean that exports are less; and, therefore, outflows are more during that month being simulated. And that would, in essence, reduce the environmental affects that we are looking at.

So what I'm wanting to say here is that these adjustments, which are made in the SOS to full possible exports also assure that the maximum potential environmental affects have been analyzed. And so we are agreeing that in actual operations some of the exports simulated may not have actually occurred, because there's not location to put the water during that month.

MS. SCHNEIDER: Testimony suggested that the reduction in no-project Delta Wetlands agricultural diversions and possible new Delta Wetlands diversions to refill storage lost to evaporation were not properly simulated.

Can you review your modeling assumptions to clarify how you addressed these parameters?

DR. BROWN: Yes. As we have indicated, the Delta Wetlands islands cover about five percent of the Delta lowlands. And so the total consumptive use presently occurring in the Delta would be reduced by that amount of present diversions in consumptive use. But that then has

to be adjusted by the assumed use of water on the habitat islands.

The amount of consumptive use that the DeltaSOS Model has adjusted, or reduced is approximately 25,000 acre feet. And this reduced consumptive use and diversion in the SOS Model is first available for possibly increased export under the Water Quality Control Plan. And, indeed, it has been testified often that reduction in consumptive use is subsequently exported by the State or Federal projects. But in other months, if the export to inflow ratio is already controlling the maximum diversions to the State and Federal projects, then this reduced consumptive use would increase the Delta outflow.

Now, under the SOS modeling of this new water right application, in some of those months where there is additional water now in the Delta that is not being exported, sometimes the project under its reservoir diversion and storage operations would divert that water that, in essence, was given up from the present no-action condition, or no-project condition.

So this amount of allowable diversions under the assumed rules for project operation under the new water right is already included in the SOS simulation. And, for example, is already a part of the 154,000 acre feet a

year average export possibility that is simulated under the final operating criteria.

MS. SCHNEIDER: So, in other words, you have already simulated diversions as part of the 154,000 acre feet that would replace evaporative losses?

DR. BROWN: That's right. We might show just one example of it. We're just going to look at the top line. Is it just happens that in 1922 --

HEARING OFFICER STUBCHAER: Please identify.

DR. BROWN: Yes. This is Table 2C from the Delta Wetlands Exhibit 4, DW 4. And this is showing under the final operating criteria -- and as you recall project rules under the final operating criteria there are no diversions allowed in April or May.

You can see that in the end of March 1922 water year the project was full with 238,000 acre feet. Evaporation of 4,000 acre feet in April, 7,000 acre feet in May, and an additional 7 in June, would have left the reservoir islands at 220,000 acre feet.

But in June because the exports were already at capacity, the released water that's not being used for ag diversion is available for diversion under the reservoir operation criteria. And in June a diversion that allows the project to refill to full storage capacity is simulated.

Although this example occurs in 1922, it is not very often allowed under the new rules, that is the evaporation refill occurs in 1922, but does not occur in many of the years. So that's the end of my answer on that.

MS. SCHNEIDER: Looking then at June and July, what estimates did you use in your modeling of Delta Wetlands no-project diversions compared with diversions under the final operations criteria for June and July?

DR. BROWN: Okay. I'm referencing another table from the EIR. This time it's Table A1-8, it's also included in my testimony. This is the assumed month-by-month accounting of the different water use terms within the project islands under existing, or no-project conditions, and also under the habitat management.

And just to summarize, in June and July this is the evaporation in inches. In July it's approximately six inches, that will make it easy for us. Six inches or a half a foot distributed over the 20,000 acres under no-project is approximately -- sorry, I'm looking at the wrong numbers.

That is the evaporation. However, the actual diversions, the applied water gets to be almost a foot, because the assumption is that the irrigation efficiency,

the amount of water applied compared to that evaporating is relatively low in the lowlands. And so the assumption is that there is almost a full foot of water being put on to the 20,000 acres. So 20,000 acre feet in July.

Under the final operating criteria where these diversions to refill evaporative losses are simulated on occasion, the long-term average for both June and July is on the order of 2,000 acre feet.

So where the agricultural diversions right now are a little less in June, 15,000 acre feet, about three quarters of a foot and a full foot, or almost 20,000 acre feet in July, these months the diversions under the proposed project would be reduced to about 2,000 acre feet each.

MS. SCHNEIDER: Testimony suggested that the DeltaSOS Model was not accurate, because the effects of Delta Wetlands Project operations on upstream CVP and SWP reservoirs was not simulated using DWRSIM. Would you describe how your model simulated Delta Wetlands's operations to respond to those issues?

DR. BROWN: Yes. The DWRSIM Model which is the Department of Water Resources's simulation of the entire Central Valley area does not include an in-delta storage facility. And it does not, therefore, have rules for operating such a facility in conjunction with the

existing upstream reservoirs and Delta export pumps.

And so we could not do which -- could not use the same procedure which was used by Contra Costa, because Contra Costa's diversions from the Delta are a specified in -- input to the DWRSIM Model. And so once they reoperated under Los Vaqueros's revised operation they could rerun the DWRSIM Model inputting this different demand sequence.

Since an in-delta reservoir facility is not part of the DWRSIM Model we could not use the DWRSIM. And this is what required us to operate the Delta Wetlands as though it was an independent project operating only when the State and Federal facilities could not have taken the water for diversion and only when pumping capacity would not have already been used by the State and Federal facilities. So it is operated independently without interfering with the State and Federal projects.

MS. SCHNEIDER: There is also testimony suggesting that the Delta Wetlands Project is incompatible with the CAL/FED alternative solutions to existing issues. And that Delta Wetlands Project would not be operated in coordination with existing CVP and SWP facilities to satisfy the '95 plan objectives.

Given your modeling assumptions, including your daily operations investigations, can Delta Wetlands

operations be coordinated with existing and future Delta operations?

DR. BROWN: Yes. We think it can be. We have an appendix in the EIR, that's Appendix A-4, and it explores these issues related to the actual day-to-day operation of a facility if it is granted a water right, and how that operation on a day-to-day basis could be accomplished, again, without interfering with the State and Federal facilities, or their operations.

The CAL/FED OPS Group, which I guess most people know, has been operating with a series of monthly meetings for almost three years now, is one of the mechanisms that allows the project operators to explain what has been happening, and what is projected to happen. Fish and Wildlife agencies, of course, are present and voicing their concerns, and the results of the near-time monitoring.

And given such a precedent in recent time, the idea of adding in a new facility with its specific operational criteria, certainly, seems feasible. And this was assumed in the environmental analysis that this coordinated operation would, in fact, be accomplished.

MS. SCHNEIDER: In your various analyses, have you evaluated the water supply affect of Fish and Games's proposed measures for the Delta Wetlands Project?

DR. BROWN: As part of the consultation that was going on, we were asked by State Board staff to evaluate the effects of the proposed Fish and Game measures. Now, this was based on the March version of the Fish and Game proposals. And there are a few changes that have been made since then.

But based on -- with many of the same additional restrictions that are requested by the Fish and Game proposal, we simulated with the same DeltaSOS Model and the numbers are this: The final operating criteria was simulated to have an average diversion of 196,000 acre feet and an average export of 154,000 acre feet.

When we simulated the preliminary set of criteria -- this would be the March version of Fish and Games's criteria, this allowed for the same set of hydrologic conditions, diversions of 160,000 acre feet, exports of 106,000 acre feet, with approximately 18,000 acre feet going to Delta outflow under the various percentages that were in the Fish and Game's proposal for environmental water.

The 106,000 would, therefore, compare the Fish and Game a 106,000 acre feet per year of exports would compare to the 154 that is simulated under the Federal opinions of the final operating criteria.

MS. SCHNEIDER: Various testimony suggested that

Jones and Stokes's evaluations of Delta Wetlands hydrodynamic and salinity effects were incomplete and inaccurate and involved a series of models that were uncertain and unreliable.

In your opinion, are your assessment models and comparative results accurate and reliable?

DR. BROWN: Yes. I'm referring to Figure 3-1 out of the Draft EIR -- which rather than try to get all the details is simply a representation that there was a whole series of monthly assessment models that were previously available, or that were developed for this specific environmental assessment.

For example, the DeltaSOS that we've been talking about, the daily SOS which was used to evaluate the day-to-day operations that -- that would occur, or how would daily operations occur, the RNA Delta hydrodynamic and salinity model, the effect of Delta outflow, which is similar to the G Model developed by Contra Costa, the Delta DWQ, which is drainage water quality from the Delta agricultural areas compared to what the proposed project would discharge, a Water Treatment Plan Model of trihalomethane production developed for the Environmental Protection Agency, and the Delta Move Model, the name -- the monthly transport is just a -- was the Delta Move Model that we've had some

discussion of recently. All of these models are connected together in the assessment.

And my point here is that at every opportunity these model results are compared to available data, whether it be actual flow data such as day flow, the approximately 25 years of continuous electrical connotativity data from about 25 stations throughout the Delta, all of the MWQI channel data related to THM's, all of the Delta islands drainage investigations from ag drains, the demonstration wetland experiment, and then in the fisheries area actual fish abundance criteria.

So the -- the basic approach is to develop a series of connected models, but to test the models with the available field data at every opportunity. And we think this has provided a reliable assessment approach.

MS. SCHNEIDER: There was testimony that suggested that tidal mixing and transport processes in the south Delta channels were complex. And the effects of Delta Wetlands discharge were difficult to analyze.

Do you agree with that?

DR. BROWN: I certainly agree that the tidal flows and mixing exchanges in the Delta are complexed. But as CUWA Exhibit 8 demonstrates for us, they are not beyond our understanding.

MS. SCHNEIDER: Russ, you're referring to Figure 1

from CUWA Exhibit 8?

DR. BROWN: Yes, I am. This particular result is a simulation done for CUWA indicating how much of the Delta Wetlands discharge water would reach the various intakes for either Delta diversions, or Delta exports.

The flow conditions that were simulated here had a Delta Wetlands discharge of approximately 3500 and a an export -- total export including the Delta Wetlands discharge of something like 11,000. The percentage of Delta Wetlands discharge to the total export is approximately 30 percent.

The mitigation measures that we are suggesting for controlling the allowable effects of Delta Wetlands's discharge water on export water quality are confirmed by this detailed 15-minute simulation of tidal mixing and exchange.

They're confirmed in the sense that after a number of days the amount of Delta Wetlands discharge water reaching either the Tracy, or Clifton Court intake was approaching the 29 percent, which is the Delta Wetlands discharge flow that day.

This illustrates that a relatively simple method of using just the fraction of the total exports that's being contributed by the Delta Wetlands discharge provides a reliable and easily understood approach to

controlling the total concentration increase at the Delta, which would be a function of the mitigation standards that are placed on the water right permit by the Board.

And so although the details of tidal mixing and exchange are quite complex, the overall effect is quite easy to understand. And that -- in that the source of Delta Wetlands water reaching the export is approximately equal to the discharge volume compared to the total export volume during that time period.

MS. SCHNEIDER: Thank you. In a more general sense, how were specific results from the hydrodynamic models used in the water supply/water quality and fishery assessment models?

DR. BROWN: As the previous figure we had up, 3-1, indicated the results from the hydrodynamic model in a sense were summarized and included in many of the other models. The hydrodynamics gave us the -- sorry, the hydrodynamic models indicated what the different channel flow splits were. Once those were determined, the results from that model was included in the DeltaSOS Model, which then calculates the flows in the channels using those hydrodynamically determined flow splits.

The seawater intrusion effects, in addition, which were found during the hydrodynamic modeling were

included in the effected Delta outflow modeling as a relationship between salinity at some location and outflow. And those same outflow salinity relationships are included in the Delta DWQ to estimate the amount of seawater intrusion reaching the Delta lowlands in the export locations each month as a function of Delta outflow.

And then the Delta Move Model that's been described in the previous testimony, included the tidal exchanges that were calculated in the hydrodynamic model, those were included as exchanges in the monthly Box Model that we call Delta Move. So at every opportunity the results of the detail hydrodynamic model, the results of that modeling were included in the monthly assessment models that are used for each of the resource topics.

MS. SCHNEIDER: I have a question about Delta move. There's been discussions about Fish and Game's use of Mr. Shaul's Delta move data. Mr. Starr from Fish and Game said that he numerically combined the four boxes in the Delta Move Model.

Can you comment on Fish and Games use of Delta move data?

DR. BROWN: I can explain what the Delta Move Model does, which may help you understand what Fish and Game did.

MS. SCHNEIDER: This is a new exhibit before you start, Dr. Brown.

We would introduce it into evidence. We have copies for the Board and the parties. It would be Exhibit DW 40. Would you explain how you developed this model, this figure --

HEARING OFFICER STUBCHAER: Can you move that to the right so we can see that figure. Thank you.

MS. SCHNEIDER: Dr. Brown, could you briefly explain where the information came from to develop this figure?

DR. BROWN: Yes. These are monthly results from the Delta Move Model for the sequence of months from 1967, this will be water years, through 1991. This is the -- just to show the 25-year period. I want to start with trying to explain this with the Sacramento box.

The Sacramento River box which basically goes between Collinsville up to about the Cross Channel, it's that portion of the lower Sacramento River. At the beginning of each month that water is tagged and then the fate of that water during the subsequent month, or during that month is followed. And at the end of the month, the Move Model estimates how much of the water has been entrained in either ag diversions, or the State and Federal pumps, or Contra Costa's diversion, any of the

Delta diversions.

And you can see that during the irrigation season of -- we're just looking at the first year, 1967 approximately 25 percent, or .25 as a fraction of that water tagged at the beginning of the month in the Sacramento box has been diverted somewhere in the Delta. And the shaded is the results of the Sacramento box.

You can see that there are times when virtually none of the water beginning in that box will end up in a diversion. This is very likely the months or periods with a high outflow where there is essentially no opportunity for the water originating in the lower Sacramento River to be diverted anywhere in the Delta and it is moving downstream.

The San Joaquin box, which will be a little bit harder to see without colors, is the second line that's often approximately twice as high as the Sacramento, although, sometimes it's the same.

I'm just indicating that on a month-by-month basis there is large variations in how much of the water starting in the lower San Joaquin, and this box would be located between the mouth of the Mokelumne down to the confluence of the Sacramento, if that water is tagged at the beginning of each month and traced -- tracked through the month. And the fraction of that water that is

diverted somewhere in the Delta is plotted. And it is a line that fluctuates like the Sacramento and often is higher than the Sacramento, because the lower San Joaquin is closer and more vulnerable to the major diversion in the South Delta.

And I am also showing the Central Delta box. The Central Delta box is -- includes Franks Tract, all of Old River, Middle River, and all of the South Delta Channels, Grantline, and the Old River itself.

This water is very vulnerable during periods of high export. And often -- this is the high line, not the boxes. And often in the summer period with relatively low inflows on the San Joaquin, or Sacramento and relatively high exports, the percent of water that starts in the Central Delta at the beginning of the month that is entrained by the end of the month is relatively high, reaching maximums here of 90 percent.

And the fourth one is the Mokelumne River box. The inflow to that box is the Mokelumne River itself, but the majority of the water is coming through either Cross Channel, or Georgiana. So that box is all of the Mokelumne River channels up to the Cross Channel. And the boxes are showing that the percent of water starting there at the beginning of the month is sometimes the same as the Central Delta box. That is they're both

predominantly diverted. And sometimes it's less.

But these are the four different boxes that are tracked for the Delta smelt. In Warren Shaul's analysis he uses only the Mokelumne box entrainment on a month-by-month basis to combine with this the monthly timing of the winter-run population that's assumed to come up with his annual index.

So the Move Model, to summarize, is tracking the fate of water beginning in these four boxes in the Delta. And that is the end of my explanation. From here what the Fish and Game actually did with this, these four different time series of monthly fate of water beginning in these four boxes, I am not yet clear on.

And we'll do that last figure. I'm sure that figure was too much for all of us. This is simply a summary using the no-project case where we will have full exports going for the entire --

MS. LEIDIGH: Could you identify --

DR. BROWN: Sorry. This is Appendix A to Figure 3, Appendix A to the biologic assessment which is included in the Draft EIR/EIS documents, Figure 3 from Appendix A. This is simply a summary.

The four boxes that we were looking at, the Central Delta, if we just average for the entire period with full exports simulated we find that on average --

not taking into account the month-by-month pattern that was there, but just the averages, 80 percent of the water beginning in the Central Delta at the beginning of the month is diverted, or entrained by the end of the month.

For starting in the Mokelumne box the number is less, but still 60 percent on average of that water, without regard to which month we're tracking, is diverted or entrained.

Water beginning in the lower San Joaquin, since it has two boxes that it has to move through to get to the pumps and is often -- there is a flow at Antioch moving water out of that box towards the confluence and towards Suisun Bay, a much lower average entrainment, or diversion fraction. The lower Sacramento is lower still.

And for particles of water, or organisms vulnerable to the movement entrainment beginning at the confluence is less than five percent on average that makes it to a Delta diversion. So these are in a sense the summary of all of the water supply information on imports and exports combined with the hydrodynamic information on channel flows splits and tidal exchange mixing that gives us this fate, or tracking assessment that is used as the beginning of the fisheries's assessment and evaluation.

MS. SCHNEIDER: Of those boxes shown on that

figure, is one represented by the Cross Delta flow parameter?

DR. BROWN: Yes. The tracking of the Mokelumne River box is the results referred to by Mr. Shaul as the Cross Delta flow parameter.

MS. SCHNEIDER: Is there a basis for combining these boxes?

DR. BROWN: The proper way to combine information about these four boxes is to decide how much of your target species, that is the species that you are assessing originates in each of these boxes, and then of -- how much of the population originates in these boxes in each month.

And these are what Warren calls the distribution coefficients. The total abundance of a vulnerable population needs to be distributed by month and by box as to their point of origin. Then the results from the Move Model can be properly combined into an overall diversion, or entrainment index.

MS. SCHNEIDER: Okay. I'm going to move to ag drainage and export water quality issues. There's been testimony that has suggested that the export electrical connotativity and dissolved organic carbon is generally the result of agricultural drainage increasing the observed Sacramento River concentrations.

Is this an accurate description of the factors controlling Delta export water quality?

DR. BROWN: I don't believe it is. There are more sources of water. And, therefore, potential sources of both salinity and dissolved organic carbons than simply the Sacramento River. I want to refer to Figure C-4-4 from the Draft EIR documents.

This figure is illustrating results from the DWQ, the Delta Water Quality -- sorry, Drainage Water Quality Model that was used for the assessment of DOC, and linked to the T -- trihalomethane analysis.

These are the monthly observed connotativity values for the Sacramento River. And the line would be the assumed distribution that is based on a flow regression during low-flow periods. Even on the Sacramento, the observed connotativity is higher than during the periods of high flow when connotativity will be lower there is a range of between 100 and approximately 250 on the Sacramento River itself. That is the source quality of the Sacramento River varies as a function of flow.

And this can be included in the assessment modeling and is. There is similarly a -- and a much wider range of observed connotativity for the San Joaquin River. During periods of low inflow the connotativity on

the San Joaquin can be quite high. During high flow periods the connotativity on the San Joaquin here in units of .2, this is 200 microsiemens would compare to the quality on the Sacramento.

Only infrequently is the quality of the San Joaquin equal to the Sacramento, which means that in the assessment of export water quality it's quite important not to lose track of the quality on the San Joaquin and how much water on the San Joaquin is coming in. Coupled with the fact that the San Joaquin inflow is largely exported, that is almost always contributes fully to exports, the percentage of exports originating in the San Joaquin can be quite high.

And this is a second source of both connotativity, or salinity and dissolved organic carbon that must be considered in this assessment strategy. The third one is illustrating that for salinity there is a substantial source of salinity originating as what we call salinity intrusion. And this is a function of the Delta outflow.

And so to begin the analysis of how much additional salinity, or dissolve organic carbon has been added within the Delta, we first need to -- carefully need to account for these three inflows of salinity, or dissolved organic carbon represented on this diagram.

Because the agricultural drainage flows are not measured, the way that the Sacramento and San Joaquin flows are measured we're left with some uncertainty as to the magnitude of the drainage flow.

We have very good measurements of the drainage water quality in recent years as part of the municipal water quality investigation. But because we don't -- do not have actual measurements of drainage flows, those remain uncertain. However, if we have these estimates of the amount coming in on each of the rivers and the amount of salinity from seawater intrusion, we can use the model to estimate what the export DOC and export chloride would have been with just these river sources and without any ag drainage. And then compare that predicted export concentration to what is actually observed. The difference will represent the additional salinity, or DOC contributed by the unmeasured source, that is the drainage from the agricultural areas.

And so combining these four sources, and not just the two, the Sacramento is important. The San Joaquin is important. Seawater intrusion is important. The fourth unmeasured term can be determined by differences in comparison to the measured export concentrations, which we do have a good record of.

MS. SCHNEIDER: There's -- there's been testimony

that suggested that you relied solely on Delta Wetlands's experiments that you conducted and ignored the municipal water quality investigation stated.

Do you have a comment on that?

DR. BROWN: My comment is that that is not true. There is an entire appendix in the Draft EIR documents that describes and analyzes the municipal water quality measurements for the rivers and for the exports and goes through the analysis that I was just mentioning, comparing the inflow and export concentrations. There is a second appendix, C-2, that describes at the time that the analysis was done all available Delta island drainage information from the MWQI.

MS. SCHNEIDER: Okay.

DR. BROWN: So all available data from the other agencies was used along with the additional experimental results that were obtained that we've described previously. I'm wanting to refer to Figure C 5-9.

MS. SCHNEIDER: And that's from the EIR/EIS?

DR. BROWN: Yes. And this figure illustrates the the Delta DWQ model which was constructed, based on all available channel and inflowing data as well as the island drainage data to provide an estimate of the export water quality that was also observed as part of the MWQI Program. And this illustrates that process I was

mentioning.

All of the river inflows and the salinity intrusion plus the estimated agricultural drainage for the EC variable and also separately for the chloride variable are included. And these two graphs just show the DWQ prediction on a monthly basis of what the export chloride and what the export EC would have been if the model is accurate. And it's being compared to the measurements for these two salinity variables collected at the three diversion or export locations: Rock Slough, the DMC, and the Banks.

And although there are variations between the three export locations and there are certainly variations between the model results and the measured results, the range of values predicted in these high salinities would be from low Delta outflows in combination with possible ag drainage effects.

And so it is the combination of all available data comparatively checked against the model predictions. That is the basis for building this assessment framework.

HEARING OFFICER STUBCHAER: Could I ask a question on this? Is the seawater intrusion component have more of an affect on the chlorides relatively speaking than on the TDS? You don't have it up there, but --

DR. BROWN: Yes, it does. Because the ratio of the connotativity -- sorry, the ratio of chloride to connotativity is very distinct for each of the rivers and the seawater. The Sacramento has only a five-percent chloride in the connotativity. The San Joaquin has 15-percent chloride per connotativity. And seawater has 30-percent chloride per connotativity. So when seawater is affective, twice as much of an affect on chloride is simulated and observed.

HEARING OFFICER STUBCHAER: Thanks.

MS. SCHNEIDER: There was testimony that suggested that the peak biomass occurs in the late summer and corresponds to the maximum potential source loading of dissolved organic carbon.

Is that a correct statement?

DR. BROWN: No. The first half is true. The peak biomass of a bush, or a tree, or a Wetland plant occurs at the end of a growing season, near the end of the summer. But this is not when the peak source of dissolved organic carbon would occur.

I'm referring to Figure C 3-1, which is in the EIR and is the basic carbon cycle described for Delta agricultural, but it would apply to Delta Wetlands, that is to Wetlands within the Delta. So a plant -- this could be a tule marsh, or a corn plant is growing and

reaches peak biomass, sure enough, at the end of the summer. And then is harvested, in the case of corn, or falls over and decays in the case of tulles.

There is microbial activity that requires a connection to the oxygen source from the air that is working to degrade, or decay both the plant residue, I'll call it, and also may oxidize or decay some of the peat soil. The carbon moving through the microbial activities ends up either as dissolved organic carbon, or as CO_2, some of which dissolves in the water, most of which escapes after mineral reactions in the carbonate system back to the CO_2 in the atmosphere.

And only the dissolved carbonate, bicarbonate CO_2 and the dissolved organic carbon, which is the higher weight organic molecules still containing carbon are coming off the drainage water and there is a delay between the peak biomass and when the peak dissolved organic carbon is available.

And this is the -- in the experimental regime, but it was done for the project the decay of the vegetation and the oxidized peat as this area was flooded in the fall following the full year of growth and microbial activity in the peat soil.

In the vegetation experiment only three percent of this original organic carbon was observed as dissolved

organic carbon in the barrel test. And in the soil saturation test, which was a sample from the peat soils either at the surface, or down about two feet less than one percent, the measured numbers were a .1 for the Wetlands's soils and .2 percent, or two parts per thousand of the organic carbon measured in the peat soil was coming off as dissolved organic carbon.

These both indicate that a very small fraction of the peak biomass is available later in the season after microbial decay and in the dissolved organic carbon form.

MS. SCHNEIDER: Testimony suggested that Jones and Stokes's analysis of potential affects of Delta Wetlands's operations on export bromide and DOC levels are not correct. And that the EPA Water Treatment Plant Model estimates of THM were inaccurate because the affects of bromide on THM were not properly simulated.

Is that testimony correct?

DR. BROWN: I don't believe so. I'm referring to Figure C 5-10 from the Draft EIR, which is just like the figure we recently saw. These are results from the Delta Drainage Water Quality Assessment Model for the period '82 through '92 -- sorry, through '91, a 10-year period.

This is the model predictions with the historic inflows and exports simulating what the export bromide

concentration would be, which is directly related to the chloride concentration that was previously shown. The measurements for bromide only began in the MWIQ Program in 1990. And so in this graph there's only approximately two years of the measured bromide shown, again, for the three different export, or diversion locations.

And towards the end of '90 and into '91 both years with relatively low Delta outflow, the bromide concentrations increased in measurements and in simulations approaching one milligram of bromide. During periods of high Delta outflow, the bromide would -- is predicted to get as low as .1. So at the range of bromide predicted and measured is approximately .1 to 1.

And the dissolved organic carbon predictions which, again, are a function of the river inflows, the relative contribution of each of those inflows to the export as well as the ag drainage load of DOC from the Delta areas itself as predicted by the Delta DWQ Model in comparison to the observed measurements. And we can see that the Delta DWQ model gives a predicted range in the three to six or seven range.

The measurements at the export locations have been as low as two and also have been as high as seven. The correspondence of the organic dissolved carbon is not

as close as the salinity measurements are. Nevertheless, it is the precursors, the two important variables for disinfected by-products, bromide and dissolved organic carbon. And these have been simulated as the major assessment variables and these we feel are accurate especially in the comparative mode where the effects of the project would be compared to the no-project case to get an estimated project effect.

Now, the second half of the question related to: Was the proper model used to go from these precursors into a treatment plant that might be using Delta water and predicting the THM?

The EPA water treatment model was developed by Malcom-Pirnie Engineers and that was finished, I believe, in '91. The water quality review team, which is the Board's staff, the Corp, Metropolitan, Contra Costa, and the Department of Water Resources, the U.S.GS, and other agencies on occasion, suggested to the Board staff that these precursors were not enough.

That the affects at a treatment plant should also be simulated as a part of the EIR analysis. And so Malcom-Pirnie, the authors of the EPA Model were contacted and retained to create a version of the water treatment plant model that would work with this 25-year monthly estimate of export water quality. This work was

completed in November of 1992, the results of which went into the draft document at that time, and were circulated to the review committee.

During that next year, 1993, Metropolitan Water District and some of their contract -- or customer agencies, I'm not sure what they call them, some of the water districts operating the treatment plant retained Malcom-Pirnie to modify the basic prediction equations inside of this water treatment model to more accurately reflect the influence of bromide in Delta water on forming THM's. That report came out December of '93, one year after the work for this document was completed by Malcom-Pirnie.

I'm referring to a combination of -- this is from my testimony, which is identified at the bottom as DW 12. It is a combination of the text from page 28 and Table 1, because after the revised equation was produced by Malcom-Pirnie there was certainly discussion within the review committee, which was still meeting on a somewhat regular basis, of whether the evaluation done for the Draft EIR should now be redone since there was now a new equation.

And the evaluation at that time was that although the equation changes the influence of dissolved organic carbon and bromide on producing THM's, the

results would have been substantially the same as in the draft document. And so the modeling was not redone.

Here is a simple comparison, just to review, that evaluations done at the time that this new equation was produced, so this would be early '94, for a range of dissolve organic carbon between two and six, which is the possible range of dissolved organic carbon in Delta exports as indicated by the measurements shown in the previous diagram. And for a range of bromide in milligrams going from zero, which really cannot occur, perhaps .1 can, all the way up to the observed range and this would also correspond to be just above the chloride of 250, which is a part of the Water Quality Control Plan objectives. So a one milligram of bromide is certainly at the top end of what is assumed to occur in the Delta.

For a mean value of four dissolved organic carbon the revised equation says that trihalomethanes would range from 24 up to 97 at high bromide. The EPA model that was used in the draft document says that at low bromide there would have been 26.6 and it would have increased up to 38 at the high bromide.

Well, there is certainly a difference in the trihalomethanes that would be predicted under the no-project. The relevant comparison for this assessment is: What would a change in dissolved organic carbon do

to the trihalomethane? That is, the sensitivity of trihalomethanes to a change in dissolved organic carbon is the most important comparison.

And what the text indicates is that the revised equations, which are now emphasizing the affects of bromide reduce the change in trihalomethane simulated for a given change in dissolved organic carbon. As an example, for a 20-percent change in DOC, which is the suggested mitigation standard in the Draft EIR is the significance criteria for significant environmental affects during the month, the THM concentration will increase about 15 percent.

Whereas, in the EPA model, the one that we used to evaluate potential environmental affects, a change of DOC of 20 percent would have given a 25-percent change in trihalomethane. Restated, the sensitivity of the new equation to a change in dissolved organic carbon is reduced. The sensitivity of a change to bromide is increased.

If bromides would have increased because of project operation from .5 milligrams to .6, that is in the middle of the allowable range of bromide, the revised equation indicates that it would increase THM by 14 percent. Whereas, the previous equation, the one that's used in the National EPA Model, would have suggested an

increase of 4 percent.

Because this is an evaluation of the relative affects of the proposed project against the no-project case, the actual trihalomethane values are not as important as the change in trihalomethane predicted for a change in one of the precursors, which is being properly modeled in the Delta DWQ Assessment Model. And this is the analysis leading to the conclusion that the original modeling did not need to be redone.

I'm referring to one last figure, which is from the same appendix, C5, that fully describes the trihalomethane modeling that was done following recommendation by the review committee.

It has been testified that the trihalomethane predictions are the result of a whole pyramid of models starting with the water supply models of what the monthly flows in the Delta would be. Then the hydrodynamic model indicating what the movement of the rivers and the sources and the seawater intrusion and the mixing would have been. Then the Delta Water Quality Model, which estimated that adding to those river inflows the drainage, then this trihalomethane model. And so that the numbers coming out of this model are hopelessly unreliable, because they were the combination of four uncertain and now connected models.

Nevertheless, when we're all done we have eight actual observed trihalomethane values from the Penitencia treatment plant that have been simulated with the water treatment plant model using their actual treatment processes for the -- this one year where we have an overlap of our modeling and their measurements and all of the values are not exact. Again, the important thing for the assessment modeling is that the range of values and that the comparative change from a no-project to a project are still within the range that were actually measured.

And so my answer to the very short question long answer is that our estimates of the trihalomethane values, even though it was the last variable predicted after a sequence of models and even though there was, perhaps, an equation that did not fully account for the bromide affect still provide adequate and accurate information for this impact assessment.

MS. LEIDIGH: Dr. Brown, for the record, could you identify that last figure that was up on the screen?

DR. BROWN: It was Figure C5-14.

MS. LEIDIGH: Thank you.

DR. BROWN: From the EIR.

MS. SCHNEIDER: Thank you, Dr. Brown. That concludes our questions for Dr. Brown and next will be

Dr. Kavanaugh.

Good afternoon, Dr. Kavanaugh.

DR. KAVANAUGH: Good afternoon, Ms. Schneider.

MS. SCHNEIDER: Let's just start right in with CUWA Exhibit 6D. CUWA Exhibit 6D states that Delta Wetlands has not adequately addressed the affects of pore water circulation and bioturbation on rate of release of DOC from peat soil.

Did you address these mechanisms in your analysis as shown in your Table 5-5 of DW Exhibit 13 on page 51 of that exhibit?

DR. KAVANAUGH: Yes, I did.

MS. LEIDIGH: You have to speak directly into that, very close.

DR. KAVANAUGH: Am I close enough?

HEARING OFFICER STUBCHAER: Yes.

DR. KAVANAUGH: I felt if I'm any closer it's in my mouth. So, good. I -- I'm, of course, a little hesitant to put up any numbers in front of the Board after you just listened to quite a few numbers but, unfortunately, this is all about numbers. So if you'll bear with me I'll try to be succinct and direct on this issue.

It was stated in the CUWA Exhibit 6 -- which one is it, 6B that certain fundamental processes that accelerate the rate of release of dissolved organic

carbon from the sediments were not adequately addressed.

And what I wanted to point out, again, in my rebuttal is that in this table, and I'm referring to Table 5-5, Delta Wetlands 13, Exhibit 13, that I looked at diffusion from the sediments and vegetative biomass and algae, and these are the three -- three key components that would release DOC to the water column. And the key issue with respect to these mechanisms is the manner in which the quantity of DOC is released to the water column due to diffusion coming out of the sediments.

The processes that influence the rate of transfer of DOC out of the sediments into the water column are molecular diffusion, pore advection, bioturbation, and if you have the other -- is there another chart there? Do we have Exhibit 6B? 6B is in the CUWA Exhibits. And I can just quickly state that the direct wave action is the fourth mechanism that was reported.

Now, in this analysis you'll note that I have a value of low to high for release of -- from the sediments. And I've done that for all four of the islands, two of them, of course, reservoir islands and two of them habitat islands.

In order to estimate the amount of DOC that

could possibly be released from the sediments, I evaluated both literature sources, looked at the data from the EIR/EIS, and also undertook an independent analytical analysis and that's in my testimony. The particular quantities of -- with respect to each one of these mechanisms has been estimated in my testimony and you can review it.

The key point is that on page 126 of my testimony I stated that the estimated release from the sediments due to molecular diffusion alone was approximately one milligram of DOC per square meter per day. The three other processes that are mentioned in the CUWA exhibit: Direct wave action, pore water circulation, and bioturbation are processes that would initially accelerate the quantity of DOC that would be released from the sediments. These -- these are the three processes that have been noted.

And as stated in my testimony, there are no models available to accurately estimate the release of DOC from the sediments due to those processes. So the way in which I handled this -- and this is Exhibit 6B from CUWA Exhibit 8 -- 6, excuse me.

So the manner in which I addressed this question was to increase the rate of DOC release that would be expected, or possible from the sediments. And if you'll,

again, put up Table 5-5 -- actually it's -- thank you.

And in order to get these numbers here, I used the values of five milligrams DOC per square meter per day for the low-end value, and 25 milligrams per -- per milligrams of DOC per square meter per day to get the high value. And this is 5 to 25 times greater than the quantity of DOC that would be estimated to be released due to molecular diffusion. Now, I think that adequately addresses the other processes that were identified. That is to say, pore invection, bioturbation and wind mixing.

The literature states that in order to account for these processes you generally expect an increase in the rate of DOC from sediments ranging from three to ten times what you would observe due to molecular diffusion alone. And I have used 5 to 25 times greater in my analysis. And I believe that adequately and quantitatively addresses the uncertainties associated with the three processes that have been pointed out.

MS. SCHNEIDER: Dr. Kavanaugh, do you consider that your analysis, in general, is conservative? That is that your analysis overestimates the probable amount of DOC that would be released to the water column on average?

DR. KAVANAUGH: Yes, I believe it does. It's in the analysis. I made a series of assumptions and it's summarized in the first overhead. If you can see it

there, it says -- it says -- the title of this is "Conservative Basis for Diffusion Equations."

MS. SCHNEIDER: And that is a new exhibit, which we would introduce as Delta Wetlands Exhibit 41. We have copies for the Board and parties.

DR. KAVANAUGH: This table -- this chart, this new exhibit summarizes the key points that I'd like to stress to the Board why I believe that the analysis I undertook is conservative.

The first bulletin in this chart says "high values of rate of release from the soil." I just mentioned 5 to 25 times faster than molecular diffusion alone. Second bulletin says "total area of the islands contains peat soils." In other words, the assumption is that there is peat soils throughout the 11,000 acres of the two reservoir islands.

In fact, as we have heard from other testimony the islands do not contain peat soil throughout the islands. There's considerable aerial extent of soils that are either devoid of organic carbon, or significantly reduced. And so this is, I think, clearly a conservative assumption. That is to say, in areas where there is very little peat soil there would be, by definition, very little release of DOC.

And the third is that the water stored on the

islands for 365 days of the year, 12 months, as we've seen the average is 10 months. Sometimes lower periods of time, but on average 10 months. So, again, this is a conservative assumption.

The fourth bulletin the rate of diffusion is constant with time. This is a key point. I have assumed that the 5 to 25 milligrams of DOC per squared meter per day will be constant over 365 days. In fact, the rate of release would decrease with time as the easily removable DOC would be exhausted from the upper layers of the sediments. In all of the scientific studies of DOC release from sediments it decreases with time. And I have assumed it is constant with time.

Last but not least, I've assumed no losses due to photolysis which is the UV oxidation of organic matter which we know occurs. When it is oxidized it's often subject to bacterial degradation. And I have not accounted for that at all, all though I quantified it in my testimony and you're welcome to evaluate that. So all of these factors I think support the opinion that I have that this is a conservative estimate.

MS. SCHNEIDER: Dr. Kavanaugh, in CUWA Exhibit 5 Mr. Krasner completed a sensitivity analysis of the possible impacts of Delta Wetlands Project on DOC levels in the export waters. That's in Table 6-7 of CUWA

Exhibit 5.

In those tables Mr. Krasner selected values of 8, 16, and 32 milligrams per liter. He claims that you loaned him the 8 milligrams per liter level, and that that level was considered by you to be optimistic. Is that true?

DR. KAVANAUGH: The statement that the 8 milligrams per liter number is Mr. Krasner's opinion and is not mine. We did have a -- I thought a productive meeting with the CUWA representatives. And Mr. Krasner asked me what I thought was going to be the level of DOC in the reservoirs under the DW Project, Delta Wetlands Project. And I said that I thought it would be, at worse, up to 7 to 8 milligrams per liter.

MS. SCHNEIDER: So the 8 milligrams per liter is really your worse case scenario; is that correct?

DR. KAVANAUGH: Yes. That's correct.

MS. SCHNEIDER: And in regards to the selection of 32 milligrams per liter and 16 milligrams per liter, are those extremely high values of DOC likely to occur in a fully flooded reservoir island?

DR. KAVANAUGH: In my opinion, no. These are highly unlikely ranging on impossible at the 32 milligrams per liter level in my opinion. And I'd like to demonstrate that with a new exhibit. If you can put

the next chart up.

MS. SCHNEIDER: Mr. Stubchaer, this is labeled Table A, "Incremental Mass of DOC Discharge Based on Assumed Values of DOC in Milligrams Per Liter in Reservoir on an Annual Basis." And this would be Exhibit DW 42.

DR. KAVANAUGH: What I'd like to demonstrate to you -- to the Board with this table -- and I hope it's relatively comprehensible is -- is it probable that such levels, 32 and 16 milligrams per liter DOC could be occurring in a full reservoir? This is a reservoir now that has a 238,000 acre feet in it.

And if one assumes that the diverted -- the DOC in the diverted water is approximately 4 milligrams per liter and one looks at the increase 6, 8, 16, and 32 and, obviously, this gives you the incremental increase of the DOC in this third column, one can easily compute the quantity of DOC that would be represented by these assumed numbers, 6, 8, 16, and 32.

Now, as you can see that for an assumption of 6 milligrams per liter, which represents an increase of two, the actual amount of DOC, which is about 600,000 kilograms, is approximately equal to what I have estimated as a base condition and what is approximately equivalent to the projected condition.

In other words, under the base condition the amount of DOC released from these two islands now, Bacon and Webb, is approximately less than -- it's about 550,000 kilograms. So at 6 milligrams per liter you're about 23 percent higher than what is currently coming out of those two islands.

Then let's look at the opposite extreme 32 milligrams per liter. In this case, the quantity increase of DOC would be over 8 million kilograms, which represents a factor of 17 times the current release from the two islands. Now, if you put that in perspective across all the Delta Wetlands's lowlands, which is about 340,000 acres that would represent over 250 million kilograms of DOC from the Delta on a annual basis.

And as I pointed out in my testimony, the quantity of DOC that's currently being released in the agricultural drainage ranges between 12 and 24 million. So this is an order of magnitude greater than what's currently being released. And that's why I made the statement that in a full reservoir 32 milligrams per liter is really an impossible number. It would not happen.

Now, let's take a look at 16. 16 represents around three and a half million kilograms which is now seven times greater than the base condition. Six times

greater than what I have estimated in my most conservative estimate of the quantity of DOC that would be released from the two islands. Again, 16 is highly unlikely and not credible either. A factor of seven-fold increase relative to the current agricultural conditions is -- is highly unlikely.

So the most likely conclusion that I have drawn is that the increase, assuming four is somewhere between six to eight, most likely six, two milligrams per liter. So that is further support, I believe, for the fact that my eight milligrams per liter is a worse-case type scenario. That the 16 and 32 numbers used by Mr. Krasner and others is really not credible numbers with respect to a full reservoir.

MS. SCHNEIDER: I'd just like to clarify when you're talking about 250 million kilograms is that for just the Delta Wetlands islands, or is that the number for the entire Delta lowlands area?

DR. KAVANAUGH: That's for the entire lowlands area.

MS. SCHNEIDER: In CUWA Exhibit 6 Dr. Losee argues that the dissolved organic carbon concentration in the water on the reservoir islands could be as high as 30 milligrams per liter due to leaching of DOC from peat soils alone without accounting for vegetative biomass.

In your opinion is that analysis correct?

DR. KAVANAUGH: I think that the analysis that Dr. Losee undertook is an example of the kind of approaches that have been taken in analyzing this problem by some of the CUWA experts. And that is that they have evaluated a worse-case scenario, which when looked at closely is a very unrealistic scenario.

A new exhibit that I'd like to present to the Board looks at the Losee -- Losee analysis in the context of the parameters that he assumed and put into his equation.

MS. SCHNEIDER: We would introduce into evidence as Delta Wetlands Exhibit 43 a table identified as Table B. Can you put it up, Patty, Table B "Estimating the Maximum DOC Release from Sediments Using the Losee Model."

MS. SLOMSKI: I don't have it.

MS. BRENNER: You have it. It's the next one.

MS. SLOMSKI: "Estimating the Maximum DOC"?

MS. SCHNEIDER: Yes.

DR. KAVANAUGH: This one -- do you want to enter it?

MS. SCHNEIDER: Yes. I introduced it as Delta Wetlands Exhibit 43 and it's -- copies are being given to the Board and parties.

DR. KAVANAUGH: Now, for purpose of analysis what I

have just done here is summarized the model that Dr. Losee has used to estimate what he thinks would be a worse case, or likely -- I'm not sure of the words, I can't remember the words, likely increase in the DOC due to losses from the peat soil only.

His model shown up here -- and he used the following parameters: The depth of the sediment layer that would be completely mixed with the water column. Dr. Losee used half a foot. I am proposing three inches. The basis for that is that as noted in my testimony that mixing conditions in the reservoir islands are not likely to mix a very deep layer, on the order of a few centimeters. And the data are there to support that and so consequently I would reduce that to .25 feet.

The second parameter is the fraction of organic carbon. Dr. Losee used 10 percent .1. We have recently collected data that Mr. Holtgren has evaluated, the data showed that the organic carbon fraction on the reservoir islands is approximately 20 percent. Based on data indicating that there is 35 percent organic matter on the islands on average. And about 50 percent of that would be organic carbon.

The bulk density numbers are similar. The key parameter, however, is the fraction of organic carbon that would be converted to DOC. And you'll remember on

the cross-examination, perhaps, Dr. Losee agreed that his 20-percent value may be too high and felt that 2 percent might be a more reasonable number. In fact, the Deverel article that I quoted in my testimony suggests that only one percent of the peat soil organic carbon is available to be converted to DOC.

The data from Dr. Deverel is measurements in the Delta soils. The data that Dr. Losee used is from the Artic Ocean with -- in conditions that are, obviously, not similar to what we see in the Delta. But I have used in this analysis the 2 percent, or .02, which I think we agreed to in some informal negotiations that occurred during the cross-examination. The 20 feet of water is the same.

This gives a change in DOC according to Dr. Losee of 300 milligrams per liter and according to my analysis, only 30. The next key point and one that is very important is: How fast does this peat soil convert to DOC, instantaneously? These are slow processes. Dr. Losee assumed that the ten cycles would release all of this.

If you assume a filling and draining cycle of once a year, that would be ten years. And I did not see any data to support that assumption of ten cycles. One way to look at it is to ask the question: Well, how fast

does the peat get converted to DOC?

On the basis of a rate equation, that is the rate of decomposition, there are data available that indicate that this is a fairly slow process. If one looks at this as a rate constant of .001 per day, which is a reasonable way to approach this, one sees that 99.9 percent of the DOC would be converted into DOC in the water column within about 20 years. So a number of 20 is, I think, credible and justifiable and that gives you a number than of 1.5 milligrams per liter in the water column and not the number of 30.

Even if you accept the ten years, it's still only three. So somewhere between one and a half and three is the number that I think is more credible using the Dr. Losee model. And that happens to be consistent with the analysis that Dr. Brown has completed and also the analysis that I presented.

HEARING OFFICER STUBCHAER: Ms. Schneider, how many more questions of this witness, just for the purposes of scheduling the break?

MS. SCHNEIDER: Enough that we should have a break.

HEARING OFFICER STUBCHAER: Okay. We'll take the afternoon break.

(Recess taken from 2:45 p.m. to 2:59 p.m.)

HEARING OFFICER STUBCHAER: We're back on the record.

MS. SCHNEIDER: Dr. Kavanaugh, in CUWA Exhibit 5 Mr. Krasner presents an analysis of possible impacts of the Delta Wetlands Project on DOC --

DR. KAVANAUGH: I'm sorry. We're on the bottom of page four?

MS. SCHNEIDER: Let me start that question again. In CUWA Exhibit 5 Mr. Krasner presents an analysis of possible impacts of the Delta Wetlands Project on DOC in export water under a selected discharge scenario.

Does his analysis show that the Delta Wetlands Project will have a significant affect on DOC in export waters?

DR. KAVANAUGH: I'd like to extract some of the information from Mr. Krasner's exhibit, and enter that as a new exhibit to answer that question. This is Table C, the title of it is, "Impact of Delta Wetlands Project on Annual Averages in Support of DOC."

MS. SCHNEIDER: And that would be Delta Wetlands Exhibit 44.

DR. KAVANAUGH: In Mr. Krasner's analysis, which is in CUWA's Exhibit 5, he undertook an assessment of the DOC discharges on DOC levels in the export waters. And he covered a period of time of 17 months. This distorts

the analysis of the project, because it includes two Delta Wetlands diversion and discharge events.

A more appropriate assessment of his data is to look at a one-year evaluation, that is 12 or 13 months. And I've done so in this table, Table C. This Table C contains the data from Mr. Krasner's Exhibit Table 6, CUWA Exhibit 5. And it includes the first column with the months from May through April. It includes the base condition dissolved organic carbon at the Banks station. And you can see that the annual average is 3.43 milligrams per liter DOC.

I've also compared a number that I want to interject and bring to the Board's attention. And this is a number called the running monthly average, which in this case is a running average based on one -- on monthly averages. And you can see that in this database of 12 months average DOC, the DOC exceeds 4 milligrams per liter 4 out of the 12 months. But when one uses a running monthly average, which is going to be the basis for all compliance requirements in the Safe Drinking Water Act you can see the running average never exceeds 3.6.

HEARING OFFICER STUBCHAER: Question.

DR. KAVANAUGH: Yes.

HEARING OFFICER STUBCHAER: If you were to continue

that for another year would the second year start at the 3.43 and keep increasing eight-tenths?

DR. KAVANAUGH: It certainly could, Mr. Stubchaer. It -- depending upon what these numbers are.

HEARING OFFICER STUBCHAER: So then would a more appropriate time be two years instead of one year?

DR. KAVANAUGH: A longer record is most appropriate, yes, and two years would be better than one year. The important point about the running monthly averages, however, is it does tend to account for exceedances of the normal averages. In other words, it takes care of outliers.

HEARING OFFICER STUBCHAER: Wouldn't one expect the running monthly average to wind up -- you only have 11 values there. So if you hit the next value, wouldn't you expect it to wind up where it began?

DR. KAVANAUGH: I think it depends on what happens the next year.

HEARING OFFICER STUBCHAER: Is this -- is this a -- a particular year like a beginning year?

DR. KAVANAUGH: This is -- this is the start of the data that Mr. Krasner used and then he extended that on for another five months.

HEARING OFFICER STUBCHAER: So it hadn't quite reached some sort of equilibrium?

DR. KAVANAUGH: No, it hasn't reached an equilibrium. That's correct. Now, the main purpose of this chart -- and, of course, I raised the whole issue about this running monthly average and we'll come back to it, is to compare the annual averages, or the option of discharge off of the DW island if the DOC in the reservoir were to be 8 milligrams per liter.

And as you can see based on that if you look at the average these are essentially the same as a slight decrease, actually, in the average DOC, even discharging the DOC at eight milligrams per liter. When you even go up to the 16 milligrams per liter you see an increase on the annual average of only 0.08. You can see 9 of the 12 months of the year there's an actual benefit of the project, because of the removal of the agricultural drainage.

And it is during these three months of discharge when you do get impacts where the DOC in the export waters is increased relative to the historical values, if you assume that the numbers 8 and 16 are correct. And as I pointed out, I consider 8 to be the worse case in my analysis. So one should keep in mind these numbers, these numbers are highly unlikely.

MS. SCHNEIDER: In CUWA Exhibit 5-C Mr. Krasner summarizes Stage I and Stage II disinfectant disinfection

by-product rule. Is this a complete summary of the rule as you understand it?

DR. KAVANAUGH: Mr. Krasner used this to present a number of other issues related to the Stage I and Stage II disinfection by-product -- disinfection by-product rule. I put together another summary which I believe is more complete in that it includes the compliance requirements. That is to say how the Stage I rules will, in fact, be implemented and how utilities will be evaluated as to whether or not they are in compliance. This is a new table, D.

MS. SCHNEIDER: And we would offer into evidence Table D, which is entitled "SDWA Disinfection By-product Rule Proposed Stage I." And that would be DW Exhibit 45.

DR. KAVANAUGH: What I've tried to summarize in this chart is the significant details of this proposed Stage I rule that I think are very relevant to the Board's deliberations.

What is shown here, of course, is the promulgation date and everyone agrees it's likely to be promulgated in November of 1998. Mr. Krasner mentioned that all the parties had agreed to all of the essential details last week. This shows the proposed maximum contaminate levels for THM's, haloacetic acids and

bromate. And it also shows the data for removal of total organic carbon, percent removal of 30 percent, if you're between 2 and 4; 35 if you're between 4 and 8. You'll note that there's no 20-percent safety factor required.

So to my knowledge and to our knowledge there's no requirement in this Stage I that says that you have to meet any kind of a safety factor in this regard. You might choose to do so because of the way you operate your plant, but there's no requirement.

Now, the key point on the compliance requirements is how frequently do you have to monitor to show that you're meeting these various standards? In the case of the disinfection by-products it's based on quarterly samples for the organic disinfection by-product, monthly for bromate. And primarily for bromate because of the scarcity of information available on bromate. And what you also see is: How will this be determined whether or not you're in compliance? The number that will be used is the quarterly running annual average. That is to say, an annual average based on this quarterly monitoring.

Now, let's get to the total organic carbon, which is a very key issue in this dispute, or proceeding. Again, monthly sampling will be required. Certainly, larger utilities will monitor more frequently. And,

again, in order to determine whether or not you are in compliance with the percent removal requirements and, again, most utilities using Delta -- using -- relying on export water from the Delta will be required to remove 30 percent. This is based on an alkalinity of roughly 60 milligrams per liter you're going to, again, see it's a quarterly running average. That is to say you will measure your percent removal on a monthly basis, you will compute a quarterly running average and you will compare that average to the requirement of 30 percent. If you're over -- if you're under 30 percent you'll be out of compliance and must proceed accordingly.

I think this is key. This is not a daily requirement. This is not a continuous requirement. This is a quarterly running annual average. And this is very intentionally done to account for a high degree of natural variability in natural systems across the country where surface waters are being treated.

All right. I wanted to address the second half of Mr. Krasner's discussion of the disinfection, disinfection by-product rule. And that's the Stage II. And I think the key here with respect to Stage II is that it is very much in the developmental stage. Information is just now being collected under the Information Collection Rule to provide a basis for the final Stage II

requirements.

I put together a new figure to, I think, summarize pictorially what is going on with respect to Stage II. And I think it's important to see that once Stage I is promulgated and actually in parallel with that, there are significant information requirements that are in progress. The Information Collection Rule -- I'm sorry, I should identify this as Figure A and it's a new exhibit.

MS. SCHNEIDER: Yes, this will be Exhibit DW 46.

DR. KAVANAUGH: And the title of this is "D backslash DP Rule, Stage II Development Steps, General Overview."

The kinds of information that must -- that remain to be developed, or remain to be collected include the monitoring results from the information specified under the Information Correction Rule, Analytical Development. For example, you've heard that bromate MCL might drop to five. Currently the practical quantification limit for bromate is ten micrograms per liter. So clearly in order to go to five you'd have to develop new and better techniques.

There's significant health defects research underway. There's a significant amount of treatment research that remains to be done. All of this

information will then be put into the regulatory negotiation process and a final rule will potentially be promulgated by the year 2002. So the point of this chart is to illustrate, number one, how much information remains to be collected in order to set the stage for defining the actual numbers that are included in the Stage II Rule. And also to point out that to talk about them now as fixed numbers is quite premature.

MS. SCHNEIDER: You've discussed the complexity of the Stage II rule and the need for much more study before that final definition of the Stage II Rule is promulgated; is that correct?

DR. KAVANAUGH: Yes.

MS. SCHNEIDER: Do you have additional support for your opinion?

DR. KAVANAUGH: Yes, I do. We have obtained a copy of a letter that was sent to Mr. Byron Buck, who's the Executive Director of CUWA, of course, from Mr. Robert -- let me read his name because it is a long one, Derciasepe, who is the assistant administrator for the Clean Water Program. I'll spell it for the person here, D-E-R-C-I-A-S-E-P-E. I meant to say Court Reporter, excuse me.

MS. SCHNEIDER: And is that letter dated May 7, 1997?

DR.KAVANAUGH: Yes, it is.

MS. SCHNEIDER: We would introduce that into evidence as Delta Wetlands Exhibit 47.

DR. KAVANAUGH: This is a lengthy letter and I think it should be -- it, certainly, will be part of the record. I wanted to highlight, I think, two points that are stated in this letter that illustrate the current status of the Stage II rules.

And on page two the Mr. Derciasepe states: That in light of the ongoing work in both of these two areas, referring to Stage II and the Enhanced Surface Water Treatment Rule, it is too early in the Stage II regulatory development process to confirm whether specific future regulatory control options will, or will not be carried forward.

He goes on to say in the second paragraph of his letter: While your study, referring to the CUWA study which was included as part of my exhibit, applies a reasonable reflection of current knowledge, the entire premise of the process for developing the long-term rules is that we will approve substantially on our present understanding.

So I think this letter, again, just stresses the importance of the process that is underway for Stage II. And it is premature to use any of the Stage II numbers as

a basis for a decision making at this time.

MS. SCHNEIDER: I'm returning to Mr. Krasner's Exhibit 5-H. Mr. Krasner used as DOC data and the Malcom-Pirnie revised THM Model to predict that possible impacts of the Delta Wetlands Project on THM formation. He then stated that these results show that utilities would lose, quote, a margin of safety, unquote.

Aside from the fact that DOC values of 16 and 32 milligrams per liter are unlikely, is his chart an accurate assessment of what might happen at the treatment plant?

DR. KAVANAUGH: No, I don't think it is. Again, one of the questions that was asked of Mr. Krasner is whether or not THM's are formed in the Delta. And, of course, the answer was, no. This chart, in fact, is based on using DOC levels that are in at the H.O. Banks pumping station. So this, in fact, is an artificial way of estimating THM formation if you took the Banks water directly and exposed it to treatment. And then a subsequent chlorination and -- and then you would use the Malcom-Pirnie revised model to estimate your quantities.

What you see, again, is that for the base condition in the 8 milligrams per liter approximately similar results. It's only when you get into higher numbers that you see very high exceedances above the

Stage I standard. In fact, when you undertake a coagulation process you would, of course, significantly reduce the amount of DOC that would be exposed to TH2 chlorination. And as a result you would see numbers significantly lower than this.

The use of this type of analysis was what Dr. Brown did, and that was he compared the DW project to a no-project condition. So it's useful for a comparative analysis. But it does not tell you what's going to happen at the treatment plant. I would, again, like to take Mr. Krasner's numbers and put them on a 12-month basis and use this data to show what appears to be happening with respect to this particular analysis.

This is a new table, Table E. And the title of this table is "Comparison of Median and Quarterly Running Annual Values for THM Formation Using the Pirnie Model."

MS. SCHNEIDER: I'd like to introduce that as Delta Wetlands Exhibit 48.

DR. KAVANAUGH: Now, this data, again, comes from Table 7 of CUWA Exhibit 5. And, again, I've put this on a 12-month basis for the 13 months added to make it easier for me to get a median value.

These are then the THM simulated formation potential using the DOC values that are in the H.O. Banks export -- at the export location. And you can see that

during the months of July, August, and September, during the time of DW discharges, there is some elevation in the THM levels.

One, again, must look at the quarterly running average here. Again, you need a longer record for this, but this just illustrates the manner in which the quarterly running average would be computed. You take the three monthly numbers you come up with a quarterly average. You take the next three numbers you come up with an average. You average that with the previous value and so on. And you get your monthly, your quarterly, approximately, running annual average.

What you can see from the base condition is a median value and a quarterly running annual average that are somewhat similar, a little higher for the quarterly running average. Next, if we look at the DW Project under the eight milligram assumed DOC level you can see that the median value, actually, decreases a little bit because you now have some advantages. You get a benefit during the nine months when you're not discharging. There's no agricultural drainage.

The three months during the times when you have a discharge you can see that there is increase of 72 to 78; 76 to 89. So you do see some increases during those three months of discharge which leads to a slight

increase in the quarterly running average, but they are comparable at the end of the year.

Now, again, one would have to take a larger database in order to verify what was going on here. The point of this chart is, again, to show that the quarterly running annual average is going to be the basis for compliance. And when put on that basis you see essentially no difference between the base condition and the eight milligrams per liter, which as I pointed out is my worse case scenario. Even going up to the 16 milligrams per liter discharge, which as I said is highly unlikely, you see a relatively modest increase in the quarterly running average of THM's.

Let me just point out one last key issue here. I have used the median level of bromide in these analyses, because I think that's a more reasonable number. The median value of bromide at the H.O. Banks. You heard that bromide has a greater impact on THM's and DOC. In the exhibit from Mr. Krasner he used the 90th percentile value which tends to, of course, show much higher values by 10 to 20 percent. So I believe using the median value, which he did do a chart of the median value, is a more appropriate way to analyze this problem.

MS. SCHNEIDER: In Mr. Krasner's direct testimony he stated that the Delta Wetlands Project could lead to

significant increases in treatment costs due to projected increases in DOC at the export pumps.

For example, he stated that Contra Costa Water District would experience a significant increase in annual operating costs due to the Delta Wetlands Project. In your opinion, are his conclusions correct?

DR. KAVANAUGH: Mr. Krasner did an analysis of that issue with respect to treatment costs. And I've taken the liberty of summarizing that information as well as others in a new chart, Table G.

MS. SLOMSKI: Table G?

DR. KAVANAUGH: It's the third one. Put that one up there. And this is a new exhibit and I'll give the title, "Impact of DW Project on Water Treatment Costs."

MS. SCHNEIDER: And we would introduce that as Delta Wetlands Exhibit 49.

DR. KAVANAUGH: Now, what this chart summarizes is the -- some of the issues related to water treatment costs. Under a no-project alternative using Mr. Krasner's numbers, Table 6, CUWA Exhibit 5, we have an annual average of DOC of 3.4 milligrams per liter. In order to meet the Stage I requirements for D/DBP, you would have to complete at least 25 to 30 percent removal of this DOC, that would be completed by enhanced coagulation.

If there was no coagulation process present at the treatment plant, that is no coagulation was in place, the cost would be $26 per acre foot according to Mr. Krasner's analysis. However, most treatment plants in the Delta currently have coagulation. In fact, I'd say all of them have it. It's just a question of what kind of coagulant doses they use.

So, consequently, the more appropriate number would be the incremental cost. An example would be Contra Costa County's Bollen plant where the current alum dose is roughly 30 milligrams per liter. How much additional alum would be required under the enhanced surface water treatment -- under enhanced coagulation, one has to look then at the incremental increase in treatment costs due to changes in the DOC, because the enhanced coagulation is already going to be required regardless of the DW -- Delta Wetlands Project.

What I've shown here is under the Delta Wetlands Project for eight milligrams per liter, as shown in my previous chart, the annual average drops slightly to 3.41, essentially equivalent. So there would be no change in the base condition with respect to treatment requirements. In other words, you still have to implement enhanced coagulation. You would not have to do anything else. And there could potentially be a slight

decrease in cost if you take credit for the removal of the agricultural drainage during the nine months of the year when agricultural drainage would no longer be discharged.

Now, I've stated previously that if you removed all of the agricultural drainage from all four of the Delta Wetlands islands you would see a decrease in the DOC at the export pumps of approximately .08 milligrams per liter, or roughly .1 milligrams per liter. So comparing to the base condition this could drop the annual average down to 3.3. And this could lead to a possible decrease in treatment costs of approximately 50 cents per thousand gallons. So what you're looking at if you increase or decrease the dissolved organic carbon on an annual basis by a tenth of a milligram you're looking at a cost estimate of about 50 cents per thousand per acre feet.

HEARING OFFICER STUBCHAER: Per acre foot.

DR. KAVANAUGH: Per acre foot, excuse me. So it could be a benefit. It could be a slight increase. I've shown up here for the sake of completeness the 16 milligrams per liter number, even though I don't expect that to occur. Here you see an increase of up to about 3.51, or roughly an increase of .1 milligrams per liter DOC. And here you would see an increase then of roughly

40 to 50 cents per acre foot in the annual treatment costs.

Again, one has to look at the balance over the year. There would be a slight increase in costs during the months of discharge. There would be a slight decrease in costs during the months of nondischarge if one accepts credit for removing the agricultural drainage from the Delta.

I wanted to -- if I could just put into perspective the issue of treatment costs and treatment operation in the context of looking at H.O. Banks DOC versus the concentration of DOC and other parameters throughout the State Water Project.

If you could place on the overhead Figure B, --

MS. SCHNEIDER: We, actually, have two figures, a Figure B and a Figure C that I'd like to introduce now so as not to interrupt Dr. Kavanaugh. Figure B is entitled "Total Organic Carbon in the State Water Project." And that would be Delta Wetlands Exhibit 50. And Figure C, is not up, but it will be entitled "Bromide in the State Water Project." And that would be Delta Wetlands Exhibit 51.

DR. KAVANAUGH: Mr. Stubchaer, this information is taken from the California State Water Project Sanitary Survey report dated 1996, published as a draft. Final

report January 1, 1996. It has the California Department of Resources as the author. And we would propose to have this incorporated by reference, but the document is clearly available.

This particular chart summarizes the total organic carbon levels at various locations within the State Water Project. And referring first -- I lost my light here. I have -- if I -- let's see, how can I do this? We refer to the first -- second column there it says "Banks." And you can see that this is the famous Box and Whisker plots. And I know this causes eyes to roll so let's be as quick as possible.

The median value shown there is four. There is a relatively steady value -- thank you, we're getting replacements here as we speak, Banks checkpoint 13, 21. And so you see that the median values are roughly comparable, a little bit of increase in some locations, significant ranges. And you see some decrease with distance. Castaic Lake has a lower value, Devil Canyon. The database, of course, is somewhat limited here.

So the point of this chart is not to prove that DOC decreases as it moves down through the State Water Project, which it might do, but rather to stress the point that each individual utility must look at the quality of the water at the point where they extract it

and treat it in order to evaluate their treatment requirements.

So clearly the utility using Castaic Lake as their terminal reservoir is going to evaluate TOC data over time and not be looking at the changes in DOC at the H.O. Banks. For example, the range of values is lower here indicating, of course, the changes in -- during transport and the fact that the water is stored in Castaic Lake.

HEARING OFFICER STUBCHAER: Do you know where San Luis Reservoir would be on that? Is that by the Delta Mendota Canal?

DR. KAVANAUGH: I have the map of that. And let's see if I can quickly get it. It doesn't look like it. Let's see, San Luis I think is check 13. I'm not exactly sure.

HEARING OFFICER STUBCHAER: All right.

DR. KAVANAUGH: Check 13 is further down. I think San Luis is somewhere around the DMC.

HEARING OFFICER STUBCHAER: Okay. Thank you.

DR. KAVANAUGH: Yeah. And, of course, Silverado is further on down -- Silver Lake, excuse me.

The next chart shows a similar summary of data for bromide. And, again, you can see that in this case we do have San Luis which is in between. And what you

see here when compared to Banks, .22 median value. A slight increase as we move further down the State Water Project, which would be indicative of evaporative losses. And if one looks at total dissolved solids this is an even more dramatic change as you move down the State Water Project.

So this, again, points out the importance of looking at the water quality at the point of extraction for treatment as opposed to what exactly is going on at the Banks station. Now, this, again -- these charts both Figure B and C, again, stress the significant degree of variability that is present in surface water sources, and the Delta is no exception.

And what water utilities do in order to be sure that they're meeting their requirements is incorporate into their plant design sufficient operational flexibility so that these kinds of variabilities can be easily handled. And I've summarized some data from two plants who use -- rely on Delta export water in a new table, Table F. The title of this table is, "Impact of Source --

MS. LEIDIGH: Just for the record --

DR. KAVANAUGH: Yes.

MS. LEIDIGH: -- that last one that we were looking at was Figure C. And it was Delta Wetlands 51. It was

referred to as "this figure."

DR. KAVANAUGH: I'm sorry.

MS. LEIDIGH: And this one is --

DR. KAVANAUGH: And this is also from the State Water Project Sanitary Survey dated 1 January 1996.

MS. LEIDIGH: Okay. I have a question with regard to that: Is Delta Wetlands offering that sanitary survey report in evidence?

HEARING OFFICER STUBCHAER: They said by reference.

MS. BRENNER: Just by reference.

MS. LEIDIGH: Okay. But you are planning to offer it in evidence by reference, so it will need an exhibit number. And it will have to be offered, right?

MS. BRENNER: These are the only pertinent portions of that report that we're taking out.

MS. LEIDIGH: Okay. Then you can just offer these and that would be fine.

MS. BRENNER: I'd like to just offer these and not the whole report.

MS. LEIDIGH: Okay. Thank you.

DR. KAVANAUGH: All right. Please, put Table F up. Now, what is summarized in this table, whose title is "Impact of Source Water Quality on Water Treatment Plant Design Primary Coagulant Dose Requirements --

MS. SCHNEIDER: Let me interpret you. That will be

Delta Wetlands Exhibit 52.

DR. KAVANAUGH: What we -- what I have summarized here is three water treatment plants in Contra Costa Water District: The Bowman and Randell Bolt plants, in the Santa Clara Water District Santa Theresa water treatment plant, what's shown as the water sources. And then the water treatment plant process trains.

I just draw your attention to the coagulant doses that have been incorporated into these plants. As you can see the average at Bowman is 35. They have the capabilities to go up to 60. Randel Bolt is only 3, because they use direct filtration, but it can go up to 20. Santa Theresa average of 10, maximum of 60. So these are just three examples of treatment plants that currently rely on export waters from the Delta. And they have addressed the degree of variability that we observed by making sure that their treatment plants have the necessary flexibility to deal with varying levels of DOC and turbidity.

MS. SCHNEIDER: There has been testimony that you did not consider the possible recirculated water from the seepage control system as a source of DOC onto the reservoir islands.

Have you looked at this issue and what is your conclusion?

DR. KAVANAUGH: Yes, I have. And I've prepared a new table to summarize this information. As you may recall one of the questions that was raised during cross-examination was whether or not the seepage water that is proposed to be collected and then recirculated back to the reservoirs would contain a significant quantity of dissolved organic carbon, and thereby represent an additional source.

And I stated during that, that I had not looked at that issue. In this new table, Table H, which has the title "Estimated Impact of Recirculated Seepage Return Flow on the DOC, Dissolved Organic Carbon Budget."

MS. SCHNEIDER: That would be introduced as Delta Wetlands Exhibit 53.

DR. KAVANAUGH: This table summarizes my assessment of this particular source of DOC. What I have summarized here is, first, the quantity of recirculated seepage passing through the peat soil. The peat soil -- the seepage passing through the peat soil would be the potential primary source of DOC.

Based on estimates completed by Mr. Ed Hultgren the quantities are shown for Bacon Island and Webb Island. The number of days expected to be pumped are approximately 180 days. This gives a total flow as shown 2700 acre feet for Bacon Island; and 900 acre feet for

Webb Island.

The estimated DOC in that seepage water, certainly, this is an unknown. I have chosen 20 milligrams per liter because that is equivalent to the DOC that you currently see in the agricultural drainage on average. I think that's a reasonable number. Certainly, there are ranges of DOC values in the pore waters. It's uncertainly what the concentration is going to be due to very slow movement of the water through the peat soil. So 20 milligrams per liter, I think, is a reasonable number.

This gives a certain mass of DOC in the recirculated seepage. And I have compared that to the total DOC loading as estimated in my Table 5-5 in the CUWA Exhibit, DW 13. And you can see that it represents less than four percent of the estimated DOC that I am projecting. So based on this calculation and, of course, I'm relying on the analysis of Mr. Holtgren, this would not represent a significant new DOC source to the islands, the reservoir islands.

MS. SCHNEIDER: I have a final question, Dr. Kavanaugh. CUWA recommends that no discharges from Delta Wetlands's reservoir islands be allowed if reservoir water DOC levels exceed ambient DOC levels in the channels.

Given your analysis of DOC changes expected in the reservoirs, do you think that Delta Wetlands would be able to discharge if the CUWA condition were imposed?

DR. KAVANAUGH: No, I don't think that they would be able to discharge off of the islands if that is the condition of the permit.

As I stated in my analysis, I expect the DOC in the reservoir islands to increase, but not at the magnitude that has been proposed by the commenters on the application. As I've stated somewhere between one to two milligrams per liter increase is what I expect. It could be somewhat higher. It could be somewhat lower. Clearly, if you presume that the DOC in the diverted water is approximately four, the level will then be somewhere in the range of five to six.

The ambient DOC in the channels during the months of discharge are likely to be in the range of three to four. So because of this, you would likely never be able to discharge off of the islands. The important point here is to consider the quantities of DOC and to think of them, "quantities" in the context of constraints on the project.

The Delta Wetlands Project, in my view, is not going to contribute DOC greater than what is currently being contributed. And so the approach really has to be

based on the impact at the export locations and not at the ambient conditions in the channel.

MS. SCHNEIDER: Thank you. Our next rebuttal witness is Dr. List. As Dr. List gets ready, I'd like to introduce into evidence another exhibit, it would be Delta Wetlands --

MS. BRENNER: 54.

MS. SCHNEIDER: 54. And it's comprised of three figures. Figure 1 is entitled "Agricultural Return Flow From Bacon Island, Comparison of Measured and FDM Values."

Figure 2 is entitled "Bacon Island Drainage Volume Flow Rate, Comparison of Averaged Measured and FDM Values." And Figure 3 is entitled, "Bacon Island Return Salt Flux, Comparison of Measured and FDM Values."

Dr. List, you were contacted by Contra Costa Water District regarding the agricultural return salinities from Bacon Island; isn't that correct?

DR. LIST: Yes. On July the 3rd my office received a fax from Contra Costa Water District, which is basically included as Figure 1 here, which is -- do we have Figure 1? Which was a comparison of salinities of drainage water from Bacon Island as measured by the municipal water quality investigation, which is the bottom curve here, or the bottom scatter of dots which

would put an average curve through it in comparing that to the concentration of drainage water that was used in the simulation that were performed with the Fischer Delta Model.

The conclusion that Contra Costa Water District had drawn from these data was that the salinity of the water in the -- drainage water in the Fischer Delta Model here being somewhat higher would lead to increased benefits when that drainage water was no longer put into the Delta. So that the inference was that the Delta Wetlands Project was going to not improve the water in the Delta as much as it would have if the salinities would have been lower in the drainage water. So it's a little complex.

The improvements that are in the project came from no longer putting drainage water in with salinity. Contra Costa's inference was that because the Fischer Delta Model had higher concentrations of salinity that this would lead to more improvements than what would actually occur. And we reacted to this inference by computing the total mass of salt that would pass up the island. Because the key thing to understand here is that if the -- there's salt going into the channel, it's massive salt going into the channel and not concentration of water going into the channel.

Because the concentration of the water going into the channel is -- is with -- associated with the low degree of flow, than there's very little salt going into the channel. If it's associated with a large degree of flow, then there's a large amount of salt. It's the amount of salt that would be forgone if the agricultural drainages were removed. So we did some computations of the flux of salt, or that is the transport of salt that would pass up the island.

MS. SCHNEIDER: When you did these analyses in response to the July 3rd fax from Contra Costa, what did your analysis indicate?

DR. LIST: Well, it required two pieces of information. One is the flow rates, of course. And the other one is the salinity. And the net result of these as shown in the next slide, which is the drainage volumes, you see that -- this is the flow rate of the drainage off Bacon Island. And the dark lines are the -- what the flow rates were that were used in the Fischer Delta Model. In the -- and the shaded lines here are the flow rates that were included in the EIR/EIS.

In fact, they come from table -- Table C2 -- C2-1, I believe. But to note here that the Fischer Delta Model flow rates are substantially reduced from the measured flow rates, where as the opposite was true of

the salinity. And the basic conclusion that came out of this multiplying up these flow rates and the -- and the salinities in the forgoing chart was the actual mass of salt that was returned to the Delta in the Fischer Delta Model was about half of what was actually occurring.

So if we can see the next slide. So this slide here is the product of the flow rate and the salinity. So the estimates from the Fischer Delta Model in each move average for this period of time shown in the dark blue. And the estimates from the measured one, measured flow rates are shown in the gray. The net result of adding it up for the year is that the flow rate of salt from the Fischer Delta Model is about half of what was actually occurring. So the net effect would be -- in the Fischer Delta Model would be underestimating the improvements that would actually occur from taking away the agricultural drainage as it occurs on the Delta islands.

HEARING OFFICER STUBCHAER: Question. Is there a reason why you didn't show the mass instead of the flux?

DR. LIST: This is the flux. It was just easy to compute this. You multiply the flow rate by the salinity.

HEARING OFFICER STUBCHAER: I see.

DR. LIST: You notice that the units up here are

microsiemens per centimeters squared times --

HEARING OFFICER STUBCHAER: All right. So it is --

DR. LIST: It's the product of the two.

HEARING OFFICER STUBCHAER: All right.

DR. LIST: So basically --

MS. SCHNEIDER: If you --

DR. LIST: -- the inference, the implication by Contra Costa Water District is not correct. The Fischer Delta Model is actually submitting about half the amount of salt that was actually occurring. So when the agricultural drainages are foregone, the improvements from the forgoing agricultural drainage would be about twice what the Fischer Delta Model predicted.

MS. SCHNEIDER: If you go back to Figure 2 it shows different amounts for the Fischer Delta Model drainage volume and for measured values of drainage.

Can you explain how you calculated the Fischer Delta Model values and what the measured values in contrast represent?

DR. LIST: Yes. These are rather complex. Let's start with the easy one. Measured flow rates are the flow rates that were in the EIR/EIS and were computed from the pumping times and the pumping horsepower on the island. And if you add them up for a year, they represent something like 34,000 acre feet of return flow.

Now, the way that this is done is Fischer Delta Model agricultural return flows can't be for a specific island, can't be computed directly, because of the manner in which the nodes are set up in the modeling. So the way in which it is done is by relating a fraction of the Delta island space to the total amount of agricultural area.

And the agricultural return flows are taken from DWRSIM and consumptive uses. And then multiplied by the fraction of Bacon Island area relative to the total Delta area. And that comes out to about .0124, something like that for the Delta. So it's about 1.2 percent of the actual total area.

The point is that the -- the agricultural water use is -- is associated with crop use. And it comes out as part of DWRSIM. But then it's allocated to the number of nodes that are associated in the Delta. And some of those nodes represent Bacon Island and associated islands. So that one way to get these numbers is to simply just multiply the fraction of Bacon Island area with the total area of the Delta.

The measured agricultural return salinities were obtained from the DWR municipal water quality investigation through the Division of Local Assistance Home Page. And the measurements were from the two

pumping islands, from discharge pumps that are on Bacon Island, pump stations.

MS. SCHNEIDER: The Department of Water Resources conducted a comprehensive survey of Delta island drainage flows in water year 1955. That data is summarize in Table C2-1 of the Draft EIR/EIS.

How do those 1955 measurements compare to the measurements shown on your figure from the 1988 to 1992 pumping data?

DR. LIST: Well, the 1955 measurements that DWR had performed were associated with an area they termed Bacon Island, which was an area of about 19,357 acres for which they measured 74.4 inches of drainage water. And if you associate that -- this is a total flow of 120,000 acre feet. Now, the Bacon Island that we're referring to here is about 5,539 acres that was used in the Fischer Delta Model. So if you prorate that you get 34,000 acre feet, approximately 34,000 acre feet in 1955.

The numbers which are -- if you add up these flows here, which were the flows that appear in the -- from the basis of the pumping records, it comes to about 31.3 thousand acre feet. So the numbers that DWR measured in 1955 and the numbers that are used in this computation are basically in the same ballpark of around 31 to 34,000 acre feet per year. So I think that these

are a fair estimate.

MS. SCHNEIDER: Let me just ask you one last question: Does the discrepancy between the measured values from 1955 and 1988 through '92, discrepancies between those measured values and Fischer Delta Model calculated values in any way discredit the results of Fischer Delta Model simulations that you performed?

DR. LIST: No, I don't believe so, because it is unreasonable to expect any model to calculate exactly all of the flows and all of the salinities in a system that is as complex as the Delta. As you've seen in Figure 1 the measure -- if we can just go back to Figure 1.

Typical of the measured salinities are these dots that are shown around here for Bacon Island, which represents samples. And it would be impossible for any type of modeling to reproduce that kind of fluctuation. Point is that the Delta represents -- the Delta Modeling gets the total flows correct. And it gets the total masses of salt correct as was shown in the previous testimony. We've done the salt balances and water balances. And so, overall, the model is well calibrated. And it has to be expected that sometimes the computed values are going to be a little more than what you would measure, and sometimes they're going to be a little less.

But, overall, calibrations which Contra Costa

Water District and ourselves have intimately been involved in over a period of time have shown that in general these models can -- are a proper representation that can be used for a comparison -- a comparative analysis of the Delta Wetlands Project.

MS. SCHNEIDER: Thank you, Dr. List. Our next witness is Dr. Alex Horne.

Good afternoon, Dr. Horne. Could you, please, state and spell your name for the record.

DR. HORNE: My name is Alex Horne, H-O-R-N-E.

MS. SCHNEIDER: And would you, please, summarize your professional experience as it relates to the Delta Wetlands Project.

DR. HORNE: Yes. I've been a professor at University of Berkeley in the Department of Civil and Environmental Engineering for about the past 26 years. During that time I've carried out research, which is essentially tried to provide answers to the questions of the sort that come up here, whether they be in streams, or oceans, or lakes, or wetlands.

My original training was in biochemistry in limnology and oceanography. And I came to engineering when they essentially told me that we can design anything so long as you get numbers. And so my research essentially has been to try to solve that very question:

Can I get ecological systems to give numbers such that things can be designed in some particular fashion?

The things I'm most proud of I think of that nature are the California Standards on Delusion for San Francisco Bay came out of my early research with enclosures. Some of the standards on chlorine, namely the removal of chlorine by dechlorination also came from some early work that I carried out. And a number of other projects, including the design of some of the recent reservoirs such as the Domenigoni reservoir where I monitored the water quality in the early stages. A number of local reservoirs, the Truckee River, a number of other places.

I think my research has made a contribution to the eventual solution of such problems. And most recently, I've been working heavy with Wetlands in terms of wastewater treatment for large industry, large groups of people like the five million people in the Orange County Water District group.

MS. SCHNEIDER: Thank you. Would you start out with summarizing your general opinion of the limnological aspects of the written and spoken testimony that you have examined.

DR. HORNE: Yes. I think with a few exceptions the limnological testimony that generally opposes the Delta

Wetlands has shown a consistent bias to extreme high, or unfavorable ranges of the variables discussed. This may or may not be appropriate for the agency, but in particular CUWA, DFG, and the Department of Water Resources -- I beg your pardon, and California Fish and Game stated what could happen rather than what would happen.

And in this rebuttal I'm going to try and demonstrate the most likely limnological events that would occur in the Delta Wetlands's reservoirs. And then the most likely water quality resulting from the most probable events. So, a mean course rather than an extreme one side or the other.

MS. SCHNEIDER: Generally, what are the factors, in your opinion, that are likely to affect the amount of DOC entering the water column from the Delta Wetlands's reservoirs?

DR. HORNE: This question requires consideration of the DOC likely in the short-term when the reservoir is first filling in the first year or two; and then in the long-term, when the reservoir is in equilibrium. All reservoirs show this initial short-term response. And that is usually a poorer water quality than the long-term response.

One of those dramatic examples is like Cariba,

which is on the Sambezi in East Africa, where the initial response having flooding 200 miles of tropical forest, the H2S was so strong it took out the turbine blades. Less dramatic examples have occurred more locally, and I'll give one, Castaic Reservoir where when it was filled in 1973 happened to coincide with an earthquake and pore water quality. And one of the taste and odor events there was due initially to its -- partially to its spilling. Castaic reservoir, another one of the terminal reservoirs down there in Los Angeles, also had some problems when it was first filled, which have become somewhat less.

There was a good deal of comments especially in the new revised CUWA exhibits of the effects of advective and diffusive water mixing. And there seemed to me to be some confusion as to what would exactly happen in this reservoir. This is rather a shallower reservoir than we used but, of course, there are many people in the world that use reservoirs of this depth.

So I would like just to look at one, or two of the CUWA exhibits and point out the mechanisms that are available, whether they will be applicable, and what the net result would be on DOC releases. So I think the first thing to do is to look at the CUWA Exhibit 6B.

As you can see here there is a dispute between

the two groups, obviously, of the importance of these mechanisms and whether or not they were effective in this particular situation. Dr. Kavanaugh has gone through this already, so I'll be pretty brief about what I think here.

If we can have my first exhibit, which is a new exhibit. It's the one that you've got at the top there. The picture -- yeah, the textbook pie diagram. That's the one. I feel a little hesitant to introduce this since I just -- I'm following one of the world's top mixing experts but, perhaps, he knows too much to simplify this.

MS. SCHNEIDER: We need to identify this exhibit first, Dr. Horne. This is labeled Figure 5-1 from your book, Limnology, 1994. This will be introduced as Delta Wetlands Exhibit 55.

DR. HORNE: This indicates most of the mechanisms that are available in lakes to mix water. And this will occur no matter what size the lakes are, whether they're oceans, or small puddles, basically, though the importance of each of these varies. This one here is a Langmuir spiral, which is -- was mentioned in the CUWA testimony.

These are some breaking waves. And here are some mixing currents going down. There are other

mechanisms of mixing, including evaporative cooling, and all these will mix this upper part of the water. In our reservoir in the Delta Wetlands reservoir, this thermocline here will probably not exist. This will act as the bottom of the reservoir. And so what counts is: Will the energy that's put in here get down to here? And if I can have my next exhibit, please.

MS. SCHNEIDER: 5-4?

DR. HORNE: No. The other one.

MS. SCHNEIDER: 5-6. This is figure -- Figure 5-6, again from Dr. Horne's book, Limnology, 1994. And this will be introduced as Delta Wetlands Exhibit 56.

DR. HORNE: What you can see here is that the -- is the wave height here. And this is the wavelength. Now, the amount of mixing that occurs with these waves is dependent not only on the wave height -- we heard some testimony of how these might get to three feet. I think that might have been a breaking wave, not a real wave. The fetch on this island is not long.

But what really counts is this wavelength. And if the wavelength is short, mixing does not go very far. With each -- each wavelength we reduce the mixing as you can see. So we're sort of talking down here in the Delta Wetlands. So a wave of a foot would have a tenth of a foot at one wavelength, and here you can see it would be

even smaller.

So I don't expect to see a big peaty mess in this reservoir when it's full. It will certainly be peaty when they first put water in it if it's a windy day. Not to belabor this point too much, I think what will happen is there will not be a large amount of mixing from top to bottom in these lakes. They will mix like most lakes of their depths do. If we can have the next figure. There was also --

MS. BRENNER: Do you want this one, or the next one?

DR. HORNE: No. This one.

MS. SCHNEIDER: This is labeled Figure 5-4. It's from a report technical memo co-authored by Dr. Horne in 1975. And this will be introduced as Delta Wetlands Exhibit 57.

DR. HORNE: The concern here is what will happen to water when it piles up at the end of the reservoir. As Dr. Losee puts it: Will this water sink down to the bottom, swirl across the bottom and mix up the sediments, or will it not?

This is an actual measurement made using NASA's extensive facilities of Clear Lake, which is a lake that is not too dissimilar from this lake and has been mentioned in some ways. And these are actual current

measurements made by taking photographs every hour and then laboriously plotting the distance of an incorrect signal of algae on the surface. And what you can see here is that most of the water swirls around like this. And that's what will happen to water --

HEARING OFFICER STUBCHAER: Dr. Horne, I want to remind all the witnesses that we have a written transcript here. And when you say "like this" or -- it doesn't read too well. So if you can give a little description, we'd appreciate it.

DR. HORNE: Yes. The water in this case tended to spiral and to move in a clockwise direction. And did not tend to pile up at one end and then disappear underneath. This kind of circular motion is what I would expect in a small -- relatively small shallow and warm system such as what will occur in the Delta Wetlands reservoir.

So, again, I think most of the wind's energy will be expended in sending the water round and round and not in stirring it vertical.

HEARING OFFICER STUBCHAER: Pardon me. Do you have any knowledge of any vertical motion, or return current, or anything like that in this lake at the same time that these surface measurements were taken?

DR. HORNE: There are vertical motions. And one of the vertical motions that was occurring simultaneously to

this -- not simultaneously in the same day. This was a fairly calm day, but in more windy days at the same period of time, particularly Langmuir spirals where the water spirals down. Now, the important thing about a Langmuir spiral is it mixes down to the thermocline.

And in this lake the thermocline will be -- there will be no thermocline. And the other way to look at it is you can actually go out on a boat and measure the width of a Langmuir spiral. And on similar site reservoirs the ones we expect, I expect the diameter of one of these spirals to be about ten feet, which means that under a full condition it would not impinge upon the bottom water. So, again, I don't expect that mechanism, which is another main mechanism here, to impinge upon the bottom.

We can take that one off now. I think there's one thing that might help. Listening to the testimony and reading, the testimony has been that there seems to be almost a semantic problem in difussion and advection. And this was partially clarified by Dr. Kavanaugh in his testimony -- his rebuttal testimony. And I'd like to clarify it a little further, because I think it's more of an apparent problem than a real problem.

There is no real common English word for oozing out in scientific terms. And so Dr. Kavanaugh used the

term diffusion as a lot of people would. And in his overall discussions of diffusion he's actually including both advective mixing and molecular diffusion. And I think that's where Dr. Losee didn't really sort out the differences. And that's where I think the idea that these other mixing mechanisms, the wind mixing, stirring, Langmuir spirals, whatever they may have been were not considered.

The difference between Dr. Kavanaugh's approach and the CUWA approach is that Dr. Kavanaugh allows all the available DOC in the upper peat layer to be moved into the water column, really regardless of any mechanism. The only difference then left after you've got all of the material out of the top layer is to -- is to look at molecular diffusion. And if I could have my next exhibit -- no, let's leave that on for a second.

To clarify this further, Dr. Kavanaugh attributes less than half a milligram per liter of DOC to short-term advective mixing in the top three inches of peat. The remainder of the contribution will then be long term and true molecular diffusion. And I agree with his statement. And I don't think he's in conflict with the CUWA interpretation. If he could remember that the advective terms have been considered as acting prior to the diffusive terms.

If the CUWA estimate of six inches of advective peat is used rather than three inches, then one milligram of DOC would be released in the early years of the reservoir's life.

MS. BRENNER: Go ahead.

MS. SCHNEIDER: Did Dr. Kavanaugh and Dr. Brown's analysis of the Delta Wetlands reservoir operations assume no change in DOC release levels over the years of use?

DR. HORNE: Yes.

MS. SCHNEIDER: Why was this a conservative assumption?

DR. HORNE: Because the surface layer of the peat will rapidly become leached in most, if not all, DOC. And this will occur whether it's three inches of mixing, or six inches of mixing, and whether it's mixed by one, or all of the processes that I just summarized in my first three exhibits, also with the same -- with regard to the CUWA exhibit, discussing the inadequacy of consideration of Dr. Kavanaugh's testimony. So whoever -- whoever you're listening to, all these mechanisms have been considered. And it's a conservative estimate.

Shallow or deep there's a finite amount of peaty sediments that can be disturbed by wind, or biological

forces. You can only stir so much. And after that, that will be the end of that. After that only molecular diffusion will operate. And both Delta Wetlands and CUWA agree that this is a very slow process. So I'd just like to illustrate this a little bit with my figures -- next figure which is --

MS. BRENNER: That one.

DR. HORNE: We've had "One Day in the Life of DOC," I'd just like to have a couple years in the life of a potential reservoir in the Delta --

MS. SCHNEIDER: Before you start, we should introduce these exhibits as a set, perhaps. This will be Delta Wetlands Exhibit 58. And it is comprised of two pages. It's entitled "Factors Influencing Water Column DOC," 1-A and 1-B are on the first page. And 1-C and 1-D are in the second page. And those two pages are Delta Wetlands Exhibit 58.

DR. HORNE: This exhibit was -- was specifically created to rebut the CUWA testimony 6B -- Exhibits 6B and C, and to show what probably would be most likely to happen. Here's the situation in Figure 1-A where the reservoir is dry. It's the first year.

We have shallow peat and whether it's three inches deep, as suggested by Delta Wetlands, or six inches deep as suggested by CUWA that is to say the

potential mixing, we have shallow and deep. We then add water. And this is the first water addition going in. And DOC is then at its highest, because there's little initial flushing and -- there's initial flushing, rather, and little delusion. We then add water. We have shallow water, we have the maximum amount of mixing and the shallow peat is mixed around. The deep peat remains undisturbed.

The next figure which follows on this is the reservoir in its first year on operation. At a depth of about 22 feet any sedimentary peat that has been suspended when the reservoir is shallow will sink down again, having leached out much of its DOC. So we'll have a moderate level of DOC, because the initial flush from the peat will be diluted by water with low DOC. Again, the deep peat is undisturbed.

Now, take -- I'd like to take us a few years into the future when the reservoir has stabilized. Typically reservoirs take three to five years to become stable with regards to many of their water quality parameters. So this might be the reservoir in three to five years time.

Again, it's full of water. We have a layer of leached peat. We have a layer of undisturbed peat and only molecular diffusion can move peat from the

undisturbed area into the leached area and on. And this is why I think Dr. Kavanaugh's estimate was conservative, because he assumed a continual leaching here at the high initial rate.

The DOC and equilibrium will be lower in the first year, because as I said before this layer of leached peat, the mixed layer will essentially be leached to either all of its material, or it may leach a little bit for a long time. But I would agree with Dr. Kavanaugh that all of these leaching experiments show a high amount of leaching in the first occasion. And it gets less with time. The shape of that curve, we don't know.

Yes, I'd like to introduce the next figure now --

MS. SCHNEIDER: And while you're getting that up that will be -- that is entitled "Factors Influencing Water Column DOC," number two is on there. And it would be Delta Wetlands Exhibit 59.

DR. HORNE: This contrasts the base condition with the Delta Wetlands's reservoirs. And we have the base condition with irrigation water, continually disturbed peat layer, and an undisturbed peat layer, and a drainage in the Delta Wetlands -- well, when they were under agricultural operation is about 24 to 30 inches. It's --

essentially they're drained by ditches, which means you have arranged a perfect leach field for the top two or three feet of peat.

So this formally undisturbed peat, though it's undisturbed physically now, has advective motion because as a head of water passing through this peat layer. And so, in fact, instead of only having what we all consider is a low molecular diffusion of TOC up through the disturbed peat layer into the water, we have a second process which is advective flushing of water through this deep peat layer.

And since as we know the land is continually sinking, this layer is continually renewed further and further down and we never get to the equilibrium where all the TOC has been flushed out of the system.

Contrast that with the Delta Wetlands reservoir where we have this long list stable peat layer, instead of this continually irrigated plowed layer, we only have the process of molecular diffusion. So whichever way you examine this situation, the TOC and the DOC coming from the Delta Wetlands, whether it be a shallow reservoir or somewhat deeper, will be very much less than with -- with continual agricultural production.

MS. SCHNEIDER: There's been testimony that all carbon sources have to be considered. In your opinion,

what are the most likely dominant processes of carbon production and loss in the Delta Wetlands's reservoirs?

DR. HORNE: For this I'd like to introduce my next exhibit.

MS. SCHNEIDER: That would be introduced then as Delta Wetlands Exhibit 60. It's labeled "Factors Influencing Water Column DOC."

DR. HORNE: This is essentially a rebuttal, or a clarification of CUWA Exhibit 6A which considered only a few of the carbon sources, namely, only the ones that went one way. I think we should include lust terms in order to be more realistic.

This is my best estimate of what will happen in the Delta Wetlands, which is an unusual reservoir in that its drawn down every year. We don't normally draw reservoirs down to zero, but we do draw them down a long ways sometimes. The wet part of the cycle which occurs from roughly November to July has three or four sources of TOC. Algae will become TOC, total organic carbon. This total organic carbon will sink to the bottom. There will be a lost to earning of CO2, which will be the majority of it. And the rest will remain there and produce some DOC.

And the amount of DOC -- or the root of the DOC is indicated here. Algae would also produce DOC. And

this will remain in the water, but it won't remain very long. This DOC is highly labile and is conventionally not normally considered in limnology, because it doesn't come in and out. It's just there for a very short time. Nevertheless, it will be DOC and will eventually go to CO2 or will be eaten.

In the dry period, what I call damp because I think that's what it will be, we will get some growth of aquatic plants in this restricted season here. And that TOC will fall to the bottom and when it's flooded will become this TOC -- DOC term here illustrated in the box in the figure.

MS. SCHNEIDER: And you're pointing to a box labeled "algae" and appointed DOC, correct?

DR. HORNE: Yes.

MR. SUTTON: Excuse my, Dr. Horne. For quick clarification if I may, we've had discussions about TOC versus DOC. And the implication has been that TOC includes DOC, and you seem to be separating here.

When you're talking about the algae forming TOC, is that actually particulate carbon as opposed to dissolved organic carbon, or are you using TOC in a slightly different terminology here?

DR. HORNE: I was merely indicating here that the algae will -- will become TOC as well as DOC. So the box

labeled out with an arrow from algae to TOC in my mind indicates algae that is dying or sinking.

MR. SUTTON: Which would be particulate organic carbon as opposed to dissolved organic carbon?

DR. HORNE: Correct.

MR. SUTTON: So when you're using the term TOC you don't -- you're not including dissolved organic carbon in that, or are you?

DR. HORNE: No, I'm not -- well, technically you have to.

MR. SUTTON: Yeah. That's the question -- the reason for my question about clarifying that.

DR. HORNE: Yeah. I think then what we should do is I should have drawn a "P" there instead of a "T" in the box. That says "TOC" and should say "POC" and that would make it clearer as distinct to what I was meaning here.

MR. SUTTON: And then that would apply to both places where you have TOC?

DR. HORNE: Yes. Yes.

MR. SUTTON: Both the left and the right side of the figure?

DR. HORNE: Yes. That would be correct.

MR. SUTTON: Thank you.

DR. HORNE: I would add that the use of TOC and DOC

though very convenient is going to cause us a lot of problems in the future, because if we have an algae bloom TOC increases, but DOC doesn't. In particular DOC the problem doesn't. So it's a little difficult now, because we've gone so far along this road, but it is important, I think, to distinguish between TOC and DOC particularly in storm flows.

MS. SCHNEIDER: Coming back to the general discussion of the factors influencing water column DOC, you have a table that summarizes the various aquatic sources of DOC, can you turn to that table?

DR. HORNE: Yes. Do you have the table?

MS. SCHNEIDER: This table is entitled "Factors Influencing Water Column DOC, DOC from Various Aquatic Sources." And that would be introduced as Delta Wetlands Exhibit 61.

DR. HORNE: I'm going to try to go a little slower here as my Mississippi accent is confusing the Court Reporter.

One thing to remember in this particular reservoir is how much material we'll have, because the amount of peat, the amount of algae, and the amount of wetland plants will be the only source of TOC and DOC in the future. We've talked about peat. And these are -- this table indicates DOC from the various aquatic

sources, the constituent, and the long-term contribution relative to agricultural drainage, or drainage from a natural wetland. The peat constituents will contribute little, because it will be leached out in the early years. Later it will be sealed by deposits. There will be a sediment deposit on the bottom of this reservoir which will tend to seal in some of the peat itself.

Algae, this is a question of some contention but the nutrient supply provided to the Delta Wetlands on most years would appear to me to be quite good. I'm not talking about its DOC content, but its nitrogen and phosphorous content, in which case algae production may be lower than most people are expecting. In addition, as I'll mention later, drawing a reservoir down in the fall is not the best way to grow algae, because they don't grow very well when it's dry.

Finally, wetland plants, again, wetland plants will be lower than I think most of the testimony has been assuming so far, because they only start to grow when light is diminishing in winter. And that's, again, some of these are flowering plants and they don't grow just any time. You have to plant them at the right time of the year.

So my general conclusion is that the Delta Wetlands's reservoirs provide a poor habitat for peat

leaching relative to the agricultural situation. The Delta Wetlands's reservoirs provide a poor habitat for nuisance algae growth relative to most natural lakes and reservoirs in California due to the inflow of relatively nutrient pore water unrestricted growth season.

Finally, the Delta Wetlands's reservoirs provide a poor habitat for wetland plants relative to the situation in natural, or constructed wetlands due, again, to a restricted growth season.

The net result is a relatively low probability that photosynthetically influenced water quality in the Delta Wetlands's reservoirs will be as pore as the reservoirs relied upon by most water supply agencies in California.

MS. SCHNEIDER: Looking at those other water supply facilities, Dr. Krasner has stated at least twice in oral testimony that DOC does not change in concentration through the entire several-hundred-mile length of the State Project from Banks to MWD's treatment plants at least.

In your opinion how much more, if any more, DOC will be produced in Delta Wetlands's reservoirs relative to that produced in other State Project reservoirs and the State conveyance system?

DR. HORNE: Throughout the entire several hundred

mile length of the State Project from the Banks plant to the MWD's treatment plants, DOC shows a slight decline from about 4 to 4.4 milligrams per liter down to about 3 to 3.5 milligrams per liter in a terminal reservoir. This was alluded to in the exhibit of Dr. Kavanaugh. I don't know the number of it.

MS. BRENNER: It's Figure 13.

MS. SCHNEIDER: I think you can just refer to Dr. Kavanaugh's previous testimony.

DR. HORNE: Okay. It was the one that showed DOC decreasing through the system. Now, I think here I differ with Dr. Krasner and -- in his questions to you -- rather in your questions to him that the -- with regard to the limnological situation of DOC generation in the State Conveyance Systems versus the Delta Wetlands's reservoirs.

In particular, Dr. Krasner stated that the size of Castaic, and by implication Silverwood, Perris, Pyramid, and other reservoirs of the State Project were much deeper than those of the Delta Wetlands's reservoirs and thus very little shallow water. So there would be a great dissimilarity between the two systems.

Well, it seems that way in a way, but that's because we always draw reservoirs as very steep. Both the Delta Wetlands's reservoirs and the State conveyance

system, we have to include, of course, the aqueduct and the shallow out to bays and forebays have a large percentage of shallow, well-mixed and eliminated water and sediments.

The California Aqueduct and the Littoral areas of the epilimnion, that is the warm upper layer of the reservoir, in the State Project reservoirs are examples of such shallow well-mixed conditions. The only difference of importance between the DOC generating potential of the Delta Wetlands's reservoirs and those of the State conveyance system are the peat bottom of the former. I think this was taken into account in Dr. Kavanaugh's testimony. And in my opinion, would decline substantially over the first few years of operation.

If algae, or wetland plants, or hedge plants were to be a major contributor to the DOC pool, then instead of declining through the system, the State Water Project system, DOC would increase. In fact, we see it in a slight decline. And that to me is a very good empirical statement that we don't see long-term DOC generation in conveyance systems whether they be shallow or deep.

I looked at some data where DOC changes in lakes have been measured under dark conditions and calculated

that about .6 milligrams of DOC a month would be lost under normal conditions in these State Project reservoirs and conveyance systems. That's about the amount we see and that's about the amount of time that water could take to go down those systems.

So it would seem to me that the decay term, which has not been considered and is normally fairly small but, of course, becomes longer with time is the dominant factor over any DOC production within the conveyance systems. So we're left with only the peat as being the difference.

MS. SCHNEIDER: Dr. Losee has predicted that algae in the Delta Wetlands's reservoirs will produce very high concentrations of taste and odor compounds.

Do you agree with that?

DR. HORNE: It's not exactly whether they will, or not, it's how frequently. Anything could happen and I think this is another example of overstating extreme events. It's certainly an important question, high taste and odors is one of the worse problems in drinking reservoir supply systems.

Dr. Losee stated the State Water Project reservoirs receiving water from the Delta annually experienced cyanobacteria algal blooms that have produced MIB up to 177 nanograms per liter and geosmin of 2,700

nanograms per liter. And this was -- this is a quote from a paper by Taylor, et al., in 1994, which has been offered into evidence by CUWA, I believe, and Dr. Losee was the second author.

To continue the quote, "There is a near certainty that these kinds of blooms will occur in the project reservoirs from time to time rendering the water unusable by the water utilities." This quote is from CUWA Exhibit 6, page 17.

Again, I think this is what could happen, but not what would happen. Using the data in the paper of Taylor, et al., I estimate the amounts of high geosmin occurred for a total of 8 months in 21 years. I don't think that's very often compared to what I experience in most State -- not just our state, reservoirs around the world.

In addition, the causes of geosmin in MIB blooms in the MWD reservoirs, with that I include those of the DWR of which they are the main customers, these conditions that cause these taste in odors are not likely to be replicated in the Delta Wetlands's reservoirs. So somewhat surprisingly I conclude that although there's a possibility of taste and odor causing blooms in the Delta Wetlands's reservoirs, these events are equal, perhaps, even greater likelihood in the Delta channels without

Delta Wetlands's reservoirs projects, or in the supply reservoirs that the CUWA members now use.

Examples of such reservoirs would be San Luis Reservoir, Castaic, Perris, and Mathews, or for that matter, upper San Leandro which is not directly connected to this project. However, reservoirs that will occur in the future, and Los Vaqueros is the logic example.

MS. SCHNEIDER: Would you explain why Delta Wetlands possibly could have lower taste and odor problems than CUWA reservoirs?

DR. HORNE: Yes. The restricted growth season in the Delta Wetlands's reservoirs will result from the save and release of much of the water prior to the worse taste and odor season which is September to December.

Blue-green algae often called cyanobacteria that produce taste and odors are creatures of warm stable conditions such as are found in stratified reservoirs in late summer and through the autumn. The Delta Wetlands's reservoirs will be well mixed by winds and virtually dry by autumn. It's quite likely that they will have less taste and odor problems than many of the State Water Project reservoirs, at least, in the fall when these problems are most common.

MS. SCHNEIDER: DWR witness Raymond Tom stated that there will be an increase in nutrients following flooding

of Delta Wetlands's reservoirs and implied that there will be more algae in the reservoirs and in the State Water Project storage and conveyance systems. Testimony of other groups also indicated that Delta Wetlands would be highly productive, perhaps, similar to Clear Lake.

Do you agree with those assessments?

DR. HORNE: Shorter answer is, no, I don't agree. And this is -- since this is not an expected conclusion, I think I need to explain it a little bit. Written testimony by the DWR indicated that they feel that nutrients will rise in the Delta Wetlands's reservoirs following winter flooding, and implicitly that this will result in unacceptable water quality.

The California Fish and Game Department is liken the algae in the Delta Wetlands to the algae blooms in Clear Lake and is worried about oxygen depletion in the Delta Channels if such large amounts of algae were to be released. So what will really happen in the Delta Wetlands, now, it is true that nutrients are released in soils in some seasonal wetlands. This is what makes them so productive. And that's why we get so much ducks there.

Nutrients released from flooded soils as is best known from the Varsia flood plane of the Amazon River, from where we derive most of the information for our

textbook. In such areas, the annual flood does release nutrients in the soil. And these nutrients were left by decaying vegetation that grew during the last flood.

However, the flooding experiments carried out by Jones and Stokes for the mostly permanently damp Wetlands's reservoirs shows the opposite effect. In the Jones and Stokes's study the four major important plant nutrients: Nitrate, ammonia, phosphate, and total phosphorous declined between 70 and 90 percent in the weeks following flooding.

This effect of nutrient reduction following flooding may be due to the nature of the Wetlands's soils. Peaty soils are often nutrient depleted. And they're also often acid. I'm not sure if the general situation applies to the formally saline Delta salts, but the experimental evidence is quite clear that nutrient additions -- nutrients fell following flooding rather than rose.

MS. SCHNEIDER: Turning to experimental results, examining the flooding experiments of Jones and Stokes that was a microcosm. You talked about microcosms. Could you explain what a microcosm is briefly.

DR. HORNE: Microcosms are experiments in small cosms or enclosures. In detail, microcosms have been defined as experiments in containers of less than one

cubic meter, mesocosms in volumes of up to several hundred cubic meters, and macrocosms are large enclosures with no well-defined limits.

I teach a graduate course on the theory in practice that these are cosms of all sizes. And the connection with the Jones and Stokes's flooding experiments is that they would be considered experimental -- experimental enclosures, or cosms experiments. However, for simplicity some work is considered all experiments to be microcosms since they're small versions of the large real world. So the actual term microcosm, mesocosms, macrocosm enclosure, or in Canada limno-corral is not important for most nonspecialist.

MS. SCHNEIDER: Looking at the Jones and Stokes's experiments, those experiments were conducted by Jones and Stokes with input from the water agencies as well as the Water Board.

Do you consider those experiments to have been reasonable to help design the analysis of the Delta Wetlands project?

DR. HORNE: Yes. I consider myself an expert on these kind of experiments, and it's so listed in my resume. I carried out my first enclosure experiment on the affects of nutrients on blue-green algae in Clear

Lake in 1973. And I've since carried out research on all kinds of enclosures in lakes and reservoirs, San Francisco Bay estuary, and even tropical oceans.

I published 14 scientific papers and did peer review literature on this subject. In addition, I've published 22 reports. Finally, I carried out whole-system experiments in lakes and reservoirs of over 3,000 acres and with Wetlands's up to 500 acres.

In fact, right now my students and I are working on an enclosure experiment in an east bay reservoir concerning DOC production from wetland plants relative to algae. So regarding the Wetlands's flooding experiments regarded out by Jones and Stokes for Delta Wetlands's reservoirs, in contrast with CUWA and DWR testimony, I find their mesocosm experiments to be appropriate for the tasks of estimating DOC releases.

MS. SCHNEIDER: So these experiments were a reasonable way to measure DOC concentrations?

DR. HORNE: Yes. I think they were a good way to assess the DOC, not just in concentration, but also by extrapolation to DOC per unit area that will be released from future Delta Wetlands's reservoirs.

MS. SCHNEIDER: So if the Wetlands's were flooded with twice as much water than the experiments, would the DOC concentration be reduced by 50 percent, or would it

remain the same?

DR. HORNE: The amount of DOC released in the several month-long shallow flooding experiments gave DOC values that I think can be diluted with low DOC Delta inflow water in a meaningful fashion. I estimate that the final result will be much closer to half the initial value since I see no reason why the future deeper reservoir would remove more DOC from the peat than the shallow experimental flooded area.

MS. SCHNEIDER: Would it have been reasonable, or necessary to replicate this particular set of experiments that Dr. Brown conducted to adequately assess the Delta Wetlands Project impacts? And, in particular, what is your opinion of Dr. Losee's suggestion that smaller replicated enclosures should have been used?

DR. HORNE: Regarding CUWA's criticism of the lack of replication, I agree that replication in the sense of more flooded enclosures seems a good idea. However, I've looked at many of the large macrocosm, or mesocosms experiments published in the peer review and Gray literature carried out over the last 30 years.

I found that replication is not usually carried out in large scales. There is a theoretical justification for not replicating large enclosures in that sometime space scale, the enclosure becomes an

individual, its own universe in ecological jargon.

CUWA suggested in oral testimony -- testimony that replicated small enclosures will be better than one large one. Since scale, in terms of wave action and mixing, is nonlinear at smaller enclosure sizes, it seems to me that for the dominant mixing variable of concern, smaller flooding experiments could not be justified over the large actual enclosure used. And, in fact, replicated enclosures, smaller enclosures, the barrels were used to estimate maximum DOC releases.

So I was not convinced by the argument made by CUWA that there was no replication in TOC measurements as distinct from replication of experiments. TOC was used as a surrogate for DOC in these tests. The written testimony of Dr. Jones indicate some replication for TOC. In addition, it's permissible to replicate over time so that the general continued similar values for TOC during the reservoir experiments assures me that the values shown are likely to approximate the real values.

The differences between the TOC values that the Jones and Stokes contract laboratory and those of the MWD lab were occasionally different by a factor of two. That's a large amount. However, I've carried out and study many inter-laboratory calibration tests, and find that occasionally vary odd results are to be expected.

Nevertheless, taken as a whole the almost 50 TOC measurements were results from both laboratories can be compared assure me that enough agreement in concentrations to reach conclusions as to what the TOC and this DOC can be expected in the Delta Wetlands when they're opened, when they are in operation. In addition, I was not concerned, the ions did not balance in the Jones and Stokes's laboratory -- contract laboratory. I found this problem before. And it's -- I've not found it to influence, or cause errors in the measurements of other variables such as TOC, or nutrients.

MS. SCHNEIDER: Were all the DOC release mechanisms reflected in the CUWA testimony taking place in the Wetland enclosure experiments?

DR. HORNE: Yes. I think the advective mixing processes of poor water pumping, Langmuir spirals, bioturbation, direct wave action, and molecular diffusion mentioned in the CUWA Exhibit 6B as well as several other mechanisms discussed in my exhibits would appear in the Jones and Stokes experiments.

MS. SCHNEIDER: Could you state your overall conclusion on the Delta Wetlands flooding experiments as a method to estimate DOC concentrations that will result when the reservoirs are operating?

DR. HORNE: It is my conclusion that the two, four

winter and winter/spring large-scale unreplicated Delta Wetlands's reservoirs flooding experiments combined with the smaller scale replicated experiments in microcosms and soil leaching tests are an adequate basis for determining the likely concentration of DOC from the peat and other sources. Other sources being algae and wetland plants.

It's my opinion that these combined experiments will allow a good prediction of the likely concentration of DOC in the fall Delta Wetlands reservoirs.

MS. SCHNEIDER: I'd like to move to the affective DOC and algae biological oxygen demand on dissolved oxygen in the Delta Channels as an issue. In unstratified reservoirs, such as Delta Wetlands, will oxygen go down to critical levels?

DR. HORNE: The amount of oxygen in an unstratified reservoir depends on the balance between the amount of oxygen produced by algal photosynthesis, the amount consumed by plant decomposition, and the amount added or subtracted by the atmosphere at the reservoir surface.

In shallow unstratified waters the atmosphere tends to keep oxygen from going down very far, even at night when photosynthesis is shut down. It's rare to find very low oxygen in such mixed conditions. And these conditions are identical in the upper water with almost

every reservoir in the State.

Even in extreme conditions such as those found in very eutrophic Lake George, which is on the equator in Uganda, surface water dissolved oxygen did not normally fall to very low levels at night. The absence of anoxia, or low oxygen is attributable to high oxygen production today, which takes a while to go down, as well as oxygen added by wind mixing during afternoon winds.

MS. SCHNEIDER: Would discharge of algae and DOC in the water from Delta Wetlands's reservoirs have a substantial affect on Delta channel dissolved oxygen in your view?

DR. HORNE: I think the concerns raised by the Department of Fish and Game regarding the effect of outflow from the Delta Wetlands's reservoirs was on the oxygen in the adjacent Delta Channels. In particular, the question was: Would the outflows affect fish respiration?

And Mr. Nuzum stated that lower oxygen could harm salmonid fish in the area. Let me first look at the DOC in the reservoir. By definition almost all of the DOC leaving the Delta Wetlands reservoir will be in a refractory form, which means it cannot use very much oxygen. If the Delta Wetlands reservoir DOC were able to be degraded and use up oxygen, such degradation would

occur in the reservoirs prior to release to the channels.

Thus, DOC generated by peat leachate by macrophyte decomposition, or algae would not be a source of BOD, that is biochemical oxygen demand, in the Delta Channels of a sufficient magnitude to show a measurable declined in dissolved oxygen. In fact, the inert or refractory DOC released would tend to help fish health since that kind of DOC binds toxic metals, such as copper, and prevents that metal from harming the fish.

If we turn to BOD from other sources, which is particularly algae in the reservoir, only labile DOC can exert oxygen demands, or have very much of a BOD. The algae in the Delta Wetlands's reservoirs are likely to be similar in amount and kind to those already present in the channels with specific reference to their ability to generate labile DOC.

The DOC from such living algae will be released as small organic molecules, such as glycollate and is collectively referred to as extracellular products, or photosynthesis, or ECP. The amount of ECP generated in the Delta Wetlands's reservoirs was included in Dr. Kavanaugh's written testimony.

In any event, these small molecules do not exist long since they are the prime food for bacterial plankton, but are present in the Delta Wetlands's

reservoirs. And these bacteria will consume most ECP before it leaves the system. So if --

MS. SCHNEIDER: In your experience would you expect to see low oxygen levels in the Delta Channels near Delta island reservoir outflows?

DR. HORNE: No. Based on my observation of eutrophic lakes and reservoirs systems with ample amounts, that is, of planktonic algae and importantly with surface or shallow outflows, I have not observed substantial, or even measurable decreases in oxygen in the receiving waters below the dam or outlet, even in the early morning when the greatest affect would be anticipated.

The affects would be due to labile DOC, or particulate matter which will be made up of living algae and zooplankton. Typically there's some kind of mixing, or turbulence as the water leaves the reservoir or lake and becomes rivery. Pumping and release would be such mixing events.

The situation in top release reservoirs or lakes is in contrast with typical reservoirs with deep bottom outlets where the lack of top to bottom mixing often reduces oxygen to zero near the outflow. Also based on the above paragraph's observation as well as my recent studies on the long and short-term affects of DOC based

BOD on oxygen in the quiescent hypolimnion of water supplied reservoirs, I do not expect that the Delta Wetlands's reservoirs outflow will reduce oxygen in the Delta Channels even after some time has elapsed to allow the DOC based BOD to have its effect.

MS. SCHNEIDER: Finally, in your opinion will the water quality of the supply to CUWA agencies be improved, or degraded by the construction and operations of the Delta Wetlands Project?

DR. HORNE: There's a good case to be made that an improvement will occur especially regarding nutrients that will cause algae problems in the CUWA reservoirs. Since overall agricultural runoff and overall nutrient loading to the Delta from fertilizers will be decreased by the Delta Wetlands Project, there should be some general improvement in all water quality to the Delta so that CUWA agencies could expect lower algae blooms themselves.

MS. SCHNEIDER: Thank you, Dr. Horne.

Mr. Stubchaer, we have more rebuttal.

HEARING OFFICER STUBCHAER: I know you do. The question has run into our minds -- well, through my mind is are we going to finish tomorrow?

MS. SCHNEIDER: We estimate that Mr. Hultgren, Mr. Forkel, and Mr. Korslin together would be

approximately 45 minutes or less. I would hope less. And I don't have an estimate right now for Mr. Marine and Mr. Vogel.

HEARING OFFICER STUBCHAER: Well -- and then the cross-examination and rebuttal of others. So we can't -- we just can't say. We just have to see how it goes.

MS. SCHNEIDER: We would be glad to stay as late as you wish, both nights.

HEARING OFFICER STUBCHAER: Well, we have reserved some dates in the future. Unfortunately, they're pretty far away, but we'll see if we can revise -- we can see in the morning if we can get some earlier dates to continue the hearing.

MR. MADDOW: May I be heard on that matter, Mr. Stubchaer?

HEARING OFFICER STUBCHAER: Yes.

MR. MADDOW: I think we just went about three hours. I guess if they were to finish in 45 minutes tomorrow morning that means sometime around 10:00 we'd be given our opportunity to cross-examine.

I kind of feel like it's taking a sip out of a fire hose. If there is, in fact, going to be a delay, if we can't finish what I'd like to recommend, what I'd like to suggest, or I'd like to request on behalf of Contra Costa Water District is that we receive copies of the

statements from which these witnesses were just reading.

In fact, the record is now going to show Dr. Horne referring to statements made like "in the previous paragraph," and things like that. He was obviously reading. Several of the people were not. To the extent that these are prepared documents that they've had the opportunity to work from, I'd like to see them so we'd have the chance to engage in some cross-examination that would be more meaningful than what's going to happen if we're going to go after taking this little sip out of the fire hose.

I don't think that's an unreasonable request under the circumstances given, there's going to be five hours of rebuttal testimony on top of five hours of direct testimony for which we did have a chance to prepare.

HEARING OFFICER STUBCHAER: I understand and --

MS. SCHNEIDER: I strenuously object to that, Mr. Stubchaer. Those were notes that were used by various witnesses. Cross-examination can be done on the basis of notes that Mr. Maddow took. These are documents that were prepared and are not required to be provided in writing as is direct testimony.

HEARING OFFICER STUBCHAER: If, per chance, we have a delay, substantial delay the transcript might be ready

before the next day of the hearing would be, also.

MR. MADDOW: Certainly wouldn't be ready by tomorrow morning at 9:00 o'clock.

HEARING OFFICER STUBCHAER: No. No. No. All right. Your request is noted. We've had an objection to it. We'll take it up, again, in the morning after we have a chance to discuss it.

Now, just out of curiosity, would the other parties who intend to present rebuttal testimony just stand one-by-one and tell me the estimate of their time required.

MR. NOMELLINI: I think 20 to 30 minutes for Central Delta Water Agency.

HEARING OFFICER STUBCHAER: What safety factor should we put on there?

MR. NOMELLINI: Since you've been so lenient I think we're going to hit the mark.

HEARING OFFICER STUBCHAER: Okay. Who else? Thank you, Mr. Nomellini.

MR. ROBERTS: Mr. Stubchaer, it's hard for me to estimate. I had about a half hour estimate, but that's subject to some change, I believe.

MS. BRENNER: Rebuttal is of direct testimony not of rebuttal testimony.

HEARING OFFICER STUBCHAER: I'm sorry?

MS. BRENNER: He's indicating that -- CUWA's Counsel is indicating that their rebuttal will, perhaps, increase. And I'm just reminding all in the room that rebuttal testimony goes directly to direct testimony not rebuttal testimony.

HEARING OFFICER STUBCHAER: That's up to me to remind them, not you.

MS. BRENNER: Thank you.

HEARING OFFICER STUBCHAER: Okay.

MR. MADDOW: 30 to 45 minutes I'm suspecting. We very frankly have more work to do this evening independent of any of the issues that Ms. Brenner just attempted to address.

HEARING OFFICER STUBCHAER: Okay. Anyone else?

MS. MURRAY: We estimate 30 to 45 minutes, possibly up to an hour.

HEARING OFFICER STUBCHAER: Well, we'll see how the recross goes. It may be that we're going into tomorrow evening, we might do it.

MS. SCHNEIDER: We will endeavor to be about an hour and a half. It is a function of the fish work.

HEARING OFFICER STUBCHAER: I thought you just said 45 minutes plus some other witnesses.

MS. BRENNER: Plus the fish testimony.

HEARING OFFICER STUBCHAER: Well, all right. We'll

see how it goes. And any other comments, or questions in our procedure?

Mr. Canaday.

MR. CANADAY: Mr. Stubchaer, are you hinting to the parties in this room that they should plan to go for a long day tomorrow? Is that your --

HEARING OFFICER STUBCHAER: It's my inclination that if it looks like we could finish tomorrow evening to go into the evening. But, frankly, I don't know how attentive people can remain late in the day. And it may be a disservice to some of the parties to have them go on at 9 or 10:00 at night. I know we're just creating a record, but anyway that wouldn't be my intention to go that late.

MS. SCHNEIDER: Mr. Stubchaer, is it possible to take another half hour now to finish Hultgren leaving only our fish testimony for the morning? I assure you we'll do it as expeditiously as possible and we'll try to finish within a half an hour.

HEARING OFFICER STUBCHAER: Okay. Any objections? Anyone have to get out of here right now?

THE COURT REPORTER: I'd like a break.

HEARING OFFICER STUBCHAER: Okay. About how long of a break?

THE COURT REPORTER: About five minutes so I can

change paper and tape.

HEARING OFFICER STUBCHAER: Okay. We'll take a five-minute break.

(Recess taken from 4:58 p.m. to 5:05 p.m.)

HEARING OFFICER STUBCHAER: Let's come back to order. We've had a change of plans. What we've decided to do is have all the rebuttal testimony tomorrow. No cross. And we will reconvene on August 19th and 20th as necessary for cross-examination on the rebuttal testimony. So we're going to not hear your cross-examination this afternoon. We're going to recess now.

MS. SCHNEIDER: Could I ask a clarifying question, Mr. Stubchaer?

HEARING OFFICER STUBCHAER: Sure.

MS. SCHNEIDER: Since there is no cross-examination tomorrow, may we excuse certain witnesses who have already provided their rebuttal testimony?

HEARING OFFICER STUBCHAER: Yes.

MS. SCHNEIDER: They wouldn't be called in cross.

HEARING OFFICER STUBCHAER: Yes, you may. Any other questions?

MS. SCHNEIDER: I do have another question. So does that mean that everyone's rebuttal testimony in full will be provided tomorrow?

HEARING OFFICER STUBCHAER: That's what we expect. And we'll stay here until it's done.

MS. SCHNEIDER: Thank you.

MR. MADDOW: August 19 and 20th?

HEARING OFFICER STUBCHAER: That's Tuesday and Wednesday, August 19th and 20th. If there's nothing else we'll be recessed until tomorrow morning at 9:00 a.m.

(The proceedings concluded at 5:11 p.m.)

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REPORTER'S_CERTIFICATE

STATE OF CALIFORNIA)
) ss.
COUNTY OF SACRAMENTO)

I, MARY R. GALLAGHER, certify that I was the Official Court Reporter for the proceedings named herein, and that as such reporter I reported in verbatim shorthand writing those proceedings; that I thereafter caused my shorthand writing to be reduced to typewriting, and the pages numbered 2058 through 2307 herein constitute a complete, true and correct record of the proceedings.

IN WITNESS WHEREOF, I have subscribed this certificate at Sacramento, California, on this 18th day of August, 1997.

MARY R. GALLAGHER, CSR #10749