COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII

PETITION TO AMEND INTERIM INSTREAM FLOW STANDARDS FOR HONOPOU, HANEHOI/PUOLUA (HUELO) WAIKAMOI, ALO, WAHINEPEE, PUOHOKAMOA, HAIPUAENA, PUNALAU/KOLEA, HONOMANU, NUAAILUA, PIINAAU, PALAUHULU, OHIA (WAIANU),WAIOKAMILO, KUALANI (HAMAU), WAILUANUI, WAIKANI, WEST WAILUAIKI, EAST WAILUAIKI, KOPILIULA, PUAKAA, WAIOHUE, PAAKEA, WAIAAKA, KAPAULA & HANAWI and MAKAPIPI STREAMS	CCH-MA13-01 VOLUME 9

CONTESTED CASE HEARING

Taken on March 16, 2015, commencing at 9:24 a.m., at the J. Walter Cameron Center, Conference 1, 95 Mahalani Street, Wailuku, Maui 96793.

BEFORE: Jean Marie McManus, CSR #156

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Hearings Officer

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HEARINGS OFFICER MIIKE: I'm Larry Miike, the Hearings Officer.

We'll go back on the record. Counsel, appearance.

MS. SYLVA: Summer Sylva, Camille Kalama and Alan Murakami for Na Moku Aupuni O Koolau Hui, and Lurlyn Scott and Stanford Kekahuna.

MR. HALL: Isaac Hall for Maui Tomorrow and its supporters.

MR. SCHULMEISTER: David Schulmeister and Elijah Yip for HC&S.

MR. ROWE: Deputies Corporation Counsel Caleb Rowe and Kristin Tarnstrom for Maui County Department of Water Supply.

HEARINGS OFFICER MIIKE: Dr. Parham, I had ask that you and Glenn Higashi come and testify at the contested case hearing, because of the modeling and the application on those streams, the 16 streams.

First, I would like to call -- unless there's any objections -- I would like to qualify Dr. Parham as a hydrologist and aquatic biologist.

We've all read your reports, so rather than my taking you through anything, if you have anything briefly to say, then I'll just open it up to questions from the parties, okay?

DR. PARHAM: I'm fine. I'll be glad to take any questions you have.

HEARINGS OFFICER MIIKE: The court reporter wants to swear you in.

JAMES PARHAM

Was called as a witness by and on behalf of the Hearings Officer, was sworn to tell the truth, was examined and testified via Skype as follows:

CROSS-EXAMINATION

BY MS. SYLVA:

Q Good morning, Dr. Parham. My name is Summer Sylva. I am counsel for the petitioners in this hearing.

You prepared a declaration dated November 10th, 2014, for these proceedings. Is that correct?

A That is correct.

Q And is it a true and correct statement of your testimony you're prepared to give today?

A Yes, it was prepared prior to the report that Glenn Higashi, Skippy Hau and I did on the monitoring for the East Maui streams, so that was not included in that part of the declaration.

Q Any other changes to the declaration besides the inclusion of that 2015 report?

A I am looking over to see. I think it's pretty current.

Q You also submitted a resume together with your declaration. Is that accurate?

A Yes, that's what I was just going at.

At the time of submittal, it was accurate. I may have published a few things, and I think I have a role on the Executive Board for the Tennessee American Fisheries Society, but that's a three-year position and just lapsed last month.

Q Any other publications to be added to your resume outside of the 2015 study you just referenced?

A Nothing that would have to do with this case or Hawaii streams.

Actually, I will say it isn't yet published, but we just finished, or are close to finishing with the review through the Army Corps of Engineers using this technique on Manoa Stream on Oahu, but it is not published yet, but that is in the works and almost complete.

Q Do you know why you were asked to prepare a declaration for today's proceedings?

A I guess just from my various work on those set of streams.

Q Inclusive in that work is your role as lead

developer of the Hawaiian Stream Habitat Evaluation Procedural Model, correct?

A Correct.

Q Can you briefly describe how that model works?

A Sure. I will try to be brief.

But basically it's a habitat model that's based off the U.S. Fish and Wildlife Service, Habitat Evaluation Procedural Models. And the point of those models is to come up with a standard accounting approach to assess impact in any sort of habitat. That's used for birds and animals and fish, so it's not an aquatic-specific approach, but it provides a standard framework to assess how changes might happen.

And in the case of the Hawaiian streams, we're looking at variability in how the animals are distributed within the streams, and then variability on how they use habitat locally. And all that is captured within the model. And we then apply changes. In the case of East Maui, return of water or changes in the passage of barriers to reflect the changes in the habitat unit.

Q You mentioned that the model can be used to assess impacts for any number of species. With

respect to this study in particular, did you consider non-instream species or animals?

A No.

Q So would that include the fish that would be -- would otherwise be in the estuaries at the stream mouth, but not like native amphidromous species that use the streams for their life cycle?

A Correct. We did not consider those species. We were requested to do the sort of -- I won't say standard -- but the suite of native amphidromous species. So that's what we applied in this case.

And at the time of this East Maui work, we probably were not ready to address the estuarine species at that point also since this is the first application of the approach.

Q How about at this time, are you prepared if asked, to provide an assessment with regard to estuarine species impacted by streamflow -- streamflow outputs, I should say?

A I would probably say no. We have a substantial amount of information on that, but we have quite a bit of modeling done on the issue. We have a lot of information on the species, but a direct relationship between streamflow and the

estuary is still not clear.

In other words, we don't have, if you add 2 million gallons a day or something, you will get this effect in the estuary. That is not clear at this point. So would I say we are not ready to do that.

Q Now, with respect to the November 2009 publication entitled The Use of -- I'm going to use an acronym -- HSHEP. That will be my reference to your Hawaiian Stream and Habitat Evaluation Procedure model. So the title again of that publication, The Use of HSHEP to Provide Biological Resource Assessment in Support of Instream Flow Standards for the East Maui Streams.

Can you confirm that you were the lead author on that publication?

A Yes, I was the lead author.

Q And in your declaration, you indicate that you worked together with researchers from the State of Hawaii and the Division of Aquatic Resources.

Is that also correct?

A Yes, that's correct.

Q Do you recall who worked with you from the State of Hawaii?

A Yes, Glenn Higashi, Robert Nishimoto, Skippy Hau, Darrell Kuamo'o, Lance Nishiura, Troy

Sakihara, Troy Shimoda, and Timothy Shindo.

Q And are all of those names that you just identified all associated with the Division of Aquatic Resources, correct?

A Correct. Bob Nishimoto has since retired. And I think actually maybe Troy has moved on to a graduate program, but I think Glenn could better answer that question.

Q And it appears that this was the only study specifically referenced to in your declaration, again, outside of the 2015 publication, which happened after your submission. But I would like to know are there any other studies of which you were a lead author concerning the 27 petition streams?

A No, I was not lead author on any other studies.

Q Okay. How about a co-author on any other studies concerning the 27 petition streams? And that would be inclusive of the 2015 study at this point.

A I was co-author on the whole series of stream survey reports that came out for those set of stream.

In other words, DAR was the lead in the field, and then I helped them design the reporting system and statistics mapping and worked with their

folks to do that. So I was a co-author on a whole series of at least 15 publications on the various streams.

Q And are those identified in your resume or in your resume publication list?

A They should be. Let me -- if I'm looking away, I'm looking at a second computer screen with my resume, and they are referenced. Glenn Higashi was the lead author on those studies.

Q Any other studies which you were a co-author concerning these 27 petition streams?

A I don't know of any that were specific. I'm sure I have not co-authored on anything that was specifically to those.

We did work that addressed streams statewide in which those would have been part of them, but they were not focused on the instream flow issue for the East Maui streams.

Q How did you become involved with this November 2009 publication in particular?

A I've been working on modeling Hawaiian streams for quite a number of years. And when DAR approached me to sort of develop a model to help answer the specific question. We went through that process.

We had been doing a lot of modeling prior to this, and this was sort of the first case that came up where they needed an answer as opposed to sort of an academic approach to the question.

Q And the question again, can you state the specific question you were trying to answer with respect to your modeling?

A So what would be the impact of either water restoration or water removal on habitat for the native amphidromous species in the East Maui streams.

Q Did you make any assumptions about the availability of freshwater for off-stream uses at the outset of your study?

A The assumption was that the USGS reports documented that. So we used the data from Gingerich's 2005 report, I think it was, describing the distribution of water and its uses, and we built off that. We did not go out and do any additional work in determining the distribution of water, where it was going, and things like that.

Q And did you make any assumptions about the degree to which water flow would or could be restored to these streams that were the subject of your study?

A I'm sure we did make some assumptions. I would have to think. So the model lays out the

assumptions, based on what we would expect. So I spin over there and sort of walk through those assumptions. But the majority of this modeling approach in the report used Gingerich and Wolff's USGS study on the flow relationships between habitat and discharge to apply that to the model.

So, again, I guess the assumption is that the work that had been done by USGS was valid. So that would probably be the primary assumption. But there are multiple other assumptions in terms of how the model is designed.

Q Did the model consider or contemplate what the full restoration of all 27 streams as a possible scenario?

A Yes -- Oh, no, I take that back. We did not do all 27 streams.

When I became involved in this, the first eight streams had already been decided, and the second 19 streams were the consideration.

So during the modeling run, actually the whole state of Maui was done -- not the whole state, the whole Island of Maui was done, so all streams on Maui were considered. But we reported only those streams requested by the Commission on Water Resources.

Q Were your results or -- yeah, your results or the study results with respect to full restoration of at least the 19 streams under consideration, was that provided to the Commission at the conclusion of your study?

A It should have been. I can look right in the report. One of the assumptions of the model is that we calculate what would have been there naturally without those diversions in place, and then we sort of also calculate the amount that is at the current condition, or at that point, the fully-diverted condition. And then we returned water at various amounts to achieve different restoration targets.

So there should have been -- and I can go back and double check -- but by definition we should have had full restoration flows. That would have been the streams without diversions reported. That's sort of a fundamental modeling step.

Q If you have your report next to you, can you just briefly point to where that data set is provided for?

A Sure. It may not be in one simple table, but starting at Table 4 -- I'm trying see a page number, it's not jumping up on my screen right now --

would be for the Awaous guamensis, going through Table 12 shows each species individually and then the summary of the total amount of habitat for each.

For example, Table 12, it has the stream name, watershed ID, and total habitat units in the stream, which would be the undiverted condition. And then it follows with the various loss of habitat after flow diversion or various species, so that you can calculate all that.

Q So basically the third column identifies, on Table -- the third column on Table 12 identifies the 100 percent flow restoration scenario; correct?

A Correct. Actually, it would be 100 percent flow restoration and passage and no entrainment, meaning the diversions would not exist. This is not only returning the water at the diversion, it's actually if the diversions were not in the streams.

Q Got it.

Now, you mentioned that the first eight streams were excluded because they had already been decided. What was your understanding about the treatment of the eight streams prior to the commencement of your study?

A I think the decision had been mostly for taro production, but I was not involved in any of

that. So when I was first approached, we came on board, that was already decided and I was not a party to any of it. So I have very limited understanding of how the first eight streams were treated.

Q Do you think that the first eight streams would benefit from a similar kind of assessment with respect to instream flows and their variable impacts to biotic resources?

A Yes, I do. And we had attempted to achieve that, but we were not able to get that done in time for this hearing. In other words -- well, basically we weren't able to get that completed, but it would definitely help to put them all on the same sort of platform and look at the changes across the board.

Q And can you identify sort of what kind of benefits would come from knowing, you know, the full 27 streams, the totality or cumulative impact of that?

A Sure. From a water management or fisheries management perspective, humans are absolutely part of the equation. This isn't sort of an academic approach where we are saying there will be no human impact in the system. And so having all 27 streams, all the segments included in it, you would be able to prioritize the management actions to get the best

bang for the buck, the best amount of habitat returned per unit water across all 27 streams.

And it could be distributed by geography and location. And you also can choose for the simplest and cheapest actions. And you could go all the way up to complete restoration of water. So it gives the managers an approach to sort of compare across the whole set of streams looking at the best action that allows most water to be used for human activities, and most habitat to be created for the native stream animals.

Q And I think you said it more than once that in defining best action, it seems as though you're defining that as most water use available for human use or consumption, together with flows that are minimally impactful on stream species.

Is that your definition of what "best action" in terms of management of streams?

A I think it's a continuum. The continuum is 100 percent water diversion, maximum use for humans, to 100 percent water restoration, which is maximum for the animals.

The decision where that lies is a management decision. The modeling approach allows all of the specific points in between those two

extremes to be considered.

So it's not so much from my perspective that any one of those is correct. It's merely that we could look at the various actions in terms of what would be sort of the first action that you could take to return the most habitat with the least water. So sort of step-wise through actions that may provide no benefit to the animals, but ultimately could cost a lot of money to achieve.

So from the modeling perspective there is really not a consideration of what the final answer is. It's laying out all actions ranked from top to bottom in terms of sort of the most habitat returned per action.

Q Now, you mentioned that you had undertaken stream studies or an assessment that would begin looking at the eight streams that were excluded from your study. Is that still ongoing?

A That was never funded, so we are not doing that, no. The work had been done in the way the modeling works as far as the computational side of the effort was completed during this section, but as far as the analysis of the results, the actual writing of a report and looking at all the various species within the model, none of that was ever done.

Q And if that was something that was requested of you, do you know approximately how long that would take, or how close you would be to providing that kind of report?

A I think it depends on the extent of the reporting. There's a couple of things that have happened since then. One, we've approved the modeling work over time as we applied it to different situations. So if we wanted to have the latest updated things, it would take a little bit more time.

We do also have all the calculations already done exactly the same as presented in this report. I think a lot of the timing and effort involves how extensive the report would be. Do we need to go back through and meet with USGS and meet with State folks to assess each site and each impact as we did in this report, or is it merely creating a set of tables in which managers can look at and decide what their actions would be.

So there's quite a bit of range of possibilities here determining on how intensive we need to look at each site within the eight streams. Each site -- I mean above and below each diversion and how they impact gaining and losing reaches, the designs of the diversion, fish paths and all those

different aspects.

Q Could you parse out what it would take to create similar table sets for the eight streams that you created for the 19? Is that as involved -- I mean, does it require the same sort of intensive study and assessment you just described, or is it something that could be generated on, you know, a relatively shorter timetable?

A Well, it definitely could be generated on a shorter timetable. I would like to say that working with DAR on the final results and then on to their recommendation and understanding what the model meant, there are results from the model that are not necessarily accurate once we apply other information known to the system that's not modeled. For example, losing reaches, things like that.

And so just producing tables here without some level of looking at the other factors, some of the things that USGS was working on that were outside the model would probably be inappropriate. It may lead to misleading information even though the numbers are technically computationally correct.

Q In your resume I believe you list a number of studies specific to the eight streams. And the lead author was Higashi, Dr. Higashi.

Are those the kind -- well, if you -- I believe it's on page 7 of your resume, and it provides -- it's a report on the individual streams probably inclusive of the kind of factors including like stream characteristics that you've just described.

Would you be able to look at those studies already generated in conjunction with the modeling you have available to you presently to come up with that kind of table I earlier referenced?

A Yes and no. Those reports do not cover some of the work that USGS was doing in terms of things like gaining and losing reaches. They're covering all the survey work that the Division of Aquatic Resources has been doing in that area to make sure it was updated and that the sort of best available information from a biotic and GIS perspective from Division of Aquatic Resources' approach was available.

So they do not include everything that would be in those type of sections. There's other pieces. But the information does exist, so it's not that we need to go back in the field to collect the information, that's not what I was saying.

It's that in general we would probably meet

with USGS and Division of Aquatic Resources to walk through the results and make sure the results fit with what everybody knows from their field surveys, and adjust it where there is something that is obviously not taken into account.

Q In paragraph eight of your declaration you describe -- you identified the four goals of the East Maui streams HSHEP report. And I'm going to assume you're familiar with those goals, and I'm going to go straight to my questions pertaining to a few of them.

With respect to the diversion influence or impact on the first goal, which was distribution and habitat availability of native stream animals, can you just briefly explain why distribution is an important consideration, separate and apart from habitat availability?

A Sure. Those are the two main issues going on, these are amphidromous animals, and they migrate. They're born in the streams, and they drift to the ocean as larval fish. They develop in the ocean, and they return to the streams and move upstream to their adult habitat.

So distribution in the stream can quite easily be impacted by diversion in that the stream may be dry below the diversion and not allow the

animals to move upstream. And it may, the animals may also be entrained in the diversion and swept away.

So the natural distribution of these animals, some of them should be found upstream of these diversions or in the immediate area of the diversion, and their natural distribution, not just the habitat, but they can actually get to that and habitat is addressed in this model.

So both local habitat and the ability of the animals to use that local habitat are included in the model.

Q Now, going onto stream goal No. 4 -- I'm sorry -- the report goal No. 4. With respect to prioritizing habitat and passage restoration among the streams of concern in East Maui, what values informed basically those priorities?

A Sure. I'm going to scroll down. I think if you -- Table 13 in the report is the result of that work. And it looks at both the effect of the flow diversion on the loss of habitat and passage, but it also looks at entrainment issues and passage issues specific to the diversion itself.

And so prioritization is based on the amount of habitat units lost as a result of the

different characteristics of the diversion and potentially how much could be restored by fixing that problem.

And so entrainment is, or entrainment or barrier issues are included on one side, and then the flow diversion over lack of habitat is addressed as those two pieces.

So two different things are happening, and then they're prioritized, laid out in a rank system, which action would result in the most habitat.

I will also say this table shows why we need to work with the other partners in the field as Honomanu resulted in number one, but in discussions with USGS they felt that that was a losing reach for much of the lower end of that stream, and water restoration would not result in reconnection of that stream, nor perennial habitat in that area. So ultimately that was removed as a flow restoration priority.

Now, that's -- again, that's an overall possibility, sort of the wisdom of the folks that were doing the work in the field. But in terms of ranking, this is a perfect example of how you can see which actions would result in the most habitat in a stepwise sequence.

Q And so those values are actually sort of inherent in the modeling as generated by you. They weren't values identified by some third party, is that correct? Am I understanding you correctly?

A No, these are the output of the HSHEP model.

Q And earlier you indicated that, you know, while the assessments were limited to the 19 streams, the modeling itself was used for all 27 streams; is that correct?

A Correct.

Q Going onto paragraph 9 of your declaration, you identify three broad areas associated with the impacts on native stream animals' habitat, and enumerated they are basically the loss of habitat, barriers to -- let me back up a little bit.

These are impacts on habitat as a result of diverted conditions. And so they include loss of habitat, barriers to movement or migration of stream species, and then entrainment of those stream animals in ditches.

You know, to a layperson, those three things sound like negative impacts. Would you agree that that's an accurate characterization of those impacts as a result of the diversion?

A Yes. I would agree with that.

Q Would any of the above impacts be characterized as positive? Can you imagine a scenario where a diverted condition or ditch system would have a positive impact on stream animal habitats?

A Yes. Just totally depends what the management objective is. And so, for example, in some cases we have endangered damselflies or endangered species above some of these diversions, and introduced predatory fish have gotten in the stream, and the diversion or the barrier is preventing the upstream movement of these introduced animals. This is a completely unnatural situation.

But allowing passage in some of these places would allow a predator to move on up into otherwise predator-free habitat, and might result in a case where you harm otherwise endangered native species.

So, again, that's sort of a -- it's not a natural situation. But are there cases where, from a management perspective, you may not want to open on up passage to some areas.

Q And was that kind of factor considered in these modeling results that you generated?

A It was not. In the set of streams we dealt with, introduced species were not an issue, and the upstream position of the aquatic insects was not considered.

Q And can you -- so that scenario or that hypothetical was with respect to aquatic insects. Can you imagine a similar scenario for instream native amphidromous animals?

A Yes. For example, if small-mouth bass were stocked in the lower end of one of these streams, East Maui is less likely to have -- East Maui has extreme streams with many waterfalls, so the natural upstream movement of non-climbing animals is going to be limited.

But in sections where there was no waterfall to stop the animals, if the barrier was the only thing, if the diversion was the only thing that stopped non-climbing species, you could see a situation where say small-mouth bass might move upstream and prey on native fishes.

This, again, is not happening on East Maui right now, and would likely be very minimal on East Maui, given the geomorphology of the streams.

Q On paragraph 11 of your declaration, you describe that your modeling predicts the bearing

impacts from the restoration of streamflow. I wondered -- and then you go on to say that there are some streams for which little gains would be made by the restoration of stream flow.

Would you explain basically why that would be the case?

A Sure. It's the combination of the species' differential ability to migrate, and their differential habitat use. Not all species will be found in all places in all streams. And then the habitat that's found in these streams are not going to be necessarily the same. You might have different habitat in the lower reach and the upper reach. And then the location of the diversion and the amount of water that it's diverting may be completely different.

In the case of these 19 streams, there were streams that were undiverted. And so there was no impact of flow diversion on those streams, and so therefore, restoration of flow was not an action needed. And there were other streams in which the amount of water that was removed was small in comparison to the amount of water that was retained in the stream, and, therefore, the impact on habitat would be less than a stream in which 100 percent of

the water was removed. So the variable amount of water that was taken out would have a big difference in the amount of habitat loss.

And there was one more situation that occurs in which some of these streams have multiple diversions going up the stream. If the animals, as they migrate back from the ocean, move upstream and face the very first barrier dry section and entrainment, they have to pass that before they can get to the second one, and then they have to pass that before they can get to the third one. So there's already been a substantial decrease in their ability to use the most upstream habitat.

Therefore, the restoration, even if the flow amount was identical diverted at each diversion, the impact would be differentially felt because of the position of the diversions within the stream and related to each other.

Q Now, for modeling purposes, which streams did you identify as undiverted streams? And if there's someplace in your report where that can easily be identified.

A If we go to the report, I think, as I walked through, I want to say, it might be Ohia. I'm going to check that.

Okay, so Ohia Stream comes in. The stream was not expected to have any loss of habitat as no diversions were located on this stream.

And then that becomes, by definition, you will see no impact from diversion where no diversion exists.

Q And if I'm looking at one of your tables, where could you -- where would that fact be readily identified?

A Well, I will start on Table 4 as I -- almost has to be in there. I will check though. One moment.

So, Ohia in Table 4, about midway down, there are 228 -- I'm on Table 4 -- 228 habitat units, there are 228 still there after flow diversion, 228 still there after any barrier.

In fact, given there's no barrier or flow diversion, there's no loss in the AG habitat or Awaous Guamenis habitat to this. Loss is zero.

So it looks like Nuaailua is also in that case. I can go back and check the reading on why the loss is zero. Most likely it's because there is no diversion on that.

Q And from you -- you can stay on that table and then just identify any other of these streams

that you assessed by way of your modeling which fit the category of non-diverted streams. Would those Nuaailua and -- a?

A I would have to go back and look. The table here, it is possible that the location of the diversion is not having an impact on the species.

So in other words, if you're a lower-end species and the diversion is extremely far upstream and it diverts a small amount of water, it might not have an impact on that species. So I would actually have to look at what was described for that watershed to know why it's being scored that way.

And we can do that pretty easy. Let me get to the page where it's described.

Q I think it's page.

A So it does appear that this one does have a diversion on it, but it did not impact that species.

Q Now, from a purely scientific perspective, are these kinds of little gains a reason to not restore streamflow to a specific stream?

A From a purely scientific perspective, you're asking me a management question, so there's no simple answer to that. This is a value judgment for humans.

From a science perspective we're merely

answering how much habitat is returned for each action. The valuation on that is a management decision.

Q If the objective or the goal were to benefit the stream animals, would little gains be then a reason to nonetheless support restoration of streamflow?

A Yes. If the goal is 100 percent restoration of native amphidromous species habitat, by modeling definition, 100 percent removal of the diversions would be the action that would be needed to accomplish that. That's sort of by default. That's how it's designed.

Q You also identified in your declaration, and also through your study, three streams that had the greatest potential for restoration of habitat units as Honomanu, Puohokamoa and East Wailuaiki; is that correct?

A I'm checking to see what I said -- yes, that is correct.

Q And can you briefly, if you know offhand, why these had the greatest potential for habitat restoration?

A So, in general, and this is where I caveat by saying that you do -- that we do need to address

each segment of each of these streams specifically and what's happening. But in general, you're going to get more habitat return in streams that are larger. In other words, just more habitat to begin with, streams that have a diversity of habitats, meaning there is a low end where the lower species can get in there before it climbs deeply in the upper habitats, so you have a wider range of habitats that supports more different species.

And then where the diversions have a greater impact, meaning they take more water out in their design, entrains more animals. So it would be a combination of those things that would lead an area to sort of the maximum impact. There's a lot of natural habitat, and all of that natural habitat or majority has been lost. So those areas would have the greatest restoration potential.

Q And from a modeling perspective, your modeling in particular, those kinds of streams that fit that type of -- that have those traits or characteristics would qualify, I think you said this before even through your testimony today, as providing the biggest bang for the buck kind of habitat restoration return?

A Yes. The final determination of biggest

bang for the buck in working with the Division of Aquatic Resources included additional factors outside of the modeling. So how difficult it was actually to achieve some of these things, how much water would be returned and all kinds of things. But, yes, from a strictly animal perspective, those would the areas that would result in the greatest amount of habitat, and therefore most likely benefit the animals the most.

Q And then you stated that DAR came up with sort of factors outside of the modeling, considerations that you did to Honomanu further refine, I guess, and identify the streams with the greatest habitat potential.

Besides stream characteristics such as losing reaches, were there other factors communicated to you by DAR in terms of, you know, their consideration?

A Yes. And I think it's documented, it's in your writing in different responses. I'll have to hunt and pull that up. One moment, please.

So I will be looking at a letter from Bob Nishimoto to CWRM, what their recommendations were.

Q Before you begin looking at that, just can you provide me with a date?

A Sure. It's coming up here right now. And I don't know if this is the final date or anything. This is just what I have. April 1st, 2010, to Ken Kawahara from Dr. Nishimoto.

Q Appendix C to Dr. Higashi's submitted testimony today. Okay, go ahead.

A And in there, again, I just read this in the last day, there was the list of things. It's the first paragraph on the second page:

"DAR used several criteria to reassess the streams recommended for restoration. First, the amount of habitat units currently lost to diversion was considered." This would have been from the modeling.

Second, seasonality with dry season was considered. Third was related to losing reaches, which we discussed. Fourth, was consideration of restoration stream systems most biologically impacted by dewatering.

Fifth was the number and difficulty of modifications. In other words, how hard would it actually be to achieve this. And then, six, we considered if efficient use of water in terms of rate of habitat units restored per CFS water return. That's sort of the biggest bang for the buck

approach.

And then seven, we evaluated whether restoration of streamflow along a given stream segment involved commingling of stream and ditch water.

And then finally, we attempted to geographically distribute the streams across the entire East Maui system.

Q So you were familiar with this letter and the recommendations and reasons for the basis for those recommendations prior to this report being submitted to Ken Kawahara; is that correct?

A I'm not quite sure which -- when you say this report --

Q Or the contents of this letter. Were you aware and in agreement with the recommendations of DAR prior to this letter's submission on April 1, 2010?

A I was asked for my opinion on various aspects of this letter, but I did not draft this letter. So I was asked to help on some of these various aspects if, for example, we discounted losing reaches, what would the result be; or if we looked at how difficult it would be to restore some of these diversion locations.

Some of them are very hard to get to, and we scored various systems. DAR provided what they thought would be those, and we added that to the results.

So, yes, I was aware of a portion of this, and helped in determining the order in which these streams would be selected, based on the modeling and based on their additional criteria, but I didn't write this letter.

So does that answer your question?

Q Yes, it does. I'll come back to the letter in more detail a little later.

Attached to that -- before we move on to a difference set of questions, attached to that letter were reports or one-page tables for DAR's priority ranking.

Did you also look at and provide some input on the assembly of those one-page reports as well as --

A Yes.

Q And then the Table 1, I believe, which was a recommended East Maui streamflow ranking --

A One second. I'm getting to that table.

Q There are actually three tables.

A Yes, I did help in getting those numbers to

DAR.

Q And do you know whether similar kinds of reports were prepared for any of the streams that were part of your modeling study but not included as an attachment in this letter?

In other words, there's only eight reports of this kind in the letter dated April 1, 2010. Were similar tables or reports for each stream prepared for the 19 that were part your modeling study?

A Off the top of my head, I do not remember whether all 19 streams had an individual result, but I, from a modeling perspective, I would say that, yes, all 19 were assessed using the same classification, and that's how DAR ultimately decided on what they felt was their recommendation.

So they had the whole list, and then they responded with this, what we feel would be our recommendation. Which eight they chose and why is DAR's decision, not mine. But I would have, where I did this, I would have provided the results for all 19 in order.

Q Did you actually prepare these tables? And the report?

A No. I don't think I did the final tables here. I think this was a collaborative effort. I

did provide numbers from my work to them on the various portions --

Q So you could --

A -- but this was -- Aquatic Resources did some of this.

Q But you could provide the same kinds of numbers for the streams that were omitted from this 2010 report, is that correct?

A I think I could. I may have trouble on the grade sections. Things like point of diversion, effort to fix, those were determined by Division of Aquatic Resources, and their folks would actually visit those sites.

And then efficiency of water use and things like that were some of DAR's work in terms of their expertise. And so while I may have the complete tables, I don't know that I do, but I was not the one that was determining that.

So I could produce all the stuff from the modeling, which is basically over on the white side, and the stuff from the watershed atlas, which I'm author of, I would have that available too.

Q I'm going to go back to your declaration for a moment. Paragraph 13, you indicate that one result of your modeling was the need for both habitat

and passage to achieve suitable habitat for native amphidromous animals in East Maui streams.

My question is, are both habitat and passage necessary to support all of the biological functions required for the full life cycle of these native amphidromous stream animals?

A I'm not positive I understand. There are a few animals living in these streams, so none of this would be absolute to have an individual in the stream to achieve the best result for the amount of water returned.

You could easily have a case where you return water and see almost no biological affect if you didn't address these factors, and that would be from a management perspective the worst of all scenarios. In other words, everyone losses.

So I don't know if I'm even answering your question.

Q I guess my question was: It appears that based on both the report and the statements made in your declaration, that habitat availability, together with passage, passage made available for these stream animals, that both are needs or requirements to support the life cycle of these animals. Life cycle from the ocean larval stage all the way to their

upward stream migration, habitat occurrence and then stream migration downwards again to sort of begin the life cycle once more.

Is that a correct understanding?

A I think it's a little over general. Some of these species will not occur above the diversions naturally, and therefore passage would not be an issue for them.

Passage would be an issue for the climbing species that go above the diversions. So it's a species-specific issue. The general idea of what you're saying, I would agree with. But it's species specific and diversion and stream specific issue. That's why we result in all these various rankings, it's not same on every stream or for every species.

Q I understand. Thanks for clarifying that.

Now, with respect to those streams species that require passage, based on your study and/or analyses to date, how would, you know, CWRM best assure, insure, that passage was available to those species requiring it?

A I will defer that. I have opinions and experience in fish passage, but I'm not a fish passage engineer that would address each of those sites, and design them appropriately. So it's

probably either too broad a question, or I may not be the correct expert to ask.

Q Who -- do you know anyone who was involved with the study that would have been the appropriate person to answer that kind of question?

A Well, I guess I can back up. I think there's a lot of people who would have good input in it, myself included. But it's a specific diversion situation.

In other words, if the diversion is far upstream and the 'opae, the shrimp, is the only one that's passing, they have a different climbing ability than if this diversion was located downstream, and we're trying to pass three or four species.

So it's a site-specific question. And that would be not only in terms of how the diversion was designed originally, but what species are you trying to pass, and what the morphology of the site looks like.

So it's a hard generality to say that they should do the same thing at each site. I actually don't agree that there is one approach that would solve all problems in terms of an engineering approach. There are multiple ways to move animals

past barriers.

Q In the same paragraph -- yeah, I understand -- in the same paragraph that I referenced from your declaration, you actually elaborate on the -- how diversions can entrain animals, and reducing the barriers and potential entrainment, the positive effects of doing that kind of mitigation. I guess that's sort of the general approach that I was trying to get to.

Do you have an opinion as to sort of those more general statements that were actually opined on in your declaration?

A Okay, sure.

In general, these streams above the uppermost diversion are undiverted, and in general, in near pristine condition. There's not a lot of development in these upper watersheds. They're well forested. They're in very nice condition above the uppermost diversion.

And so the connection of that habitat is sort of a very effective way to gain lots of very suitable high quality habitat. Stopping the animals from getting to that very high quality upstream habitat is almost a huge loss in a sense, and the model reflects that, in that if the animals can't get

to the habitat, it does not matter how nice the local habitat is. And there are substantial sections of streams in these East Maui streams that are in very nice local condition.

And so the location of the diversions below them has a big impact on how many animals can get up there.

The second problem, even if we allow upstream passage into these areas, and we do see adult animals above some of these diversions, the babies that they produce drift downstream and under low to moderate flow conditions 100 percent of the water is diverted, in which case we are losing all of the babies that these animals are producing. That also was addressed in the model.

So that lack of connectivity from beautiful upstream habitats in a lot of these streams, and the ocean in both the upstream migration and the downstream migration is addressed, and is one of the primary issues that is based in these sections.

So restoring water only returns habitat in some of these sections and does allow the animals to move to the diversion. But the passage at that diversion could sort of lose a lot of the gains that you potentially might get.

Again, that's site specific and species specific, but for your upstream species, that's a major issue. And given that East Maui is a steep stream area, the upstream species are the ones that would occupy the majority of the stream habitats. That's where we are running into the problem.

So that would be my general response to your question.

Q Now, I guess I can get more specific. But site specific, and to some extent, species specific, are you familiar with the fish passage modification on Honopou Stream at Haiku Ditch?

A I am familiar, but I would need to be refreshed as I see many, many diversions, and I would want to make sure I'm talking about the exact one you are.

So do you have either a verbal description or a picture?

Q Yeah, I think we're going to pull up a picture for you right now. Hold on one second.

I'll come back to that question.

A If you can forward me any of those pictures, I'll probably get them -- if you know a list of these diversions you're going to ask about, I'll probably get them in a minute, you can see them

on this end, if that's possible.

HEARINGS OFFICER MIIKE: Perhaps you can ask that question of Higashi. He probably knows more about individual diversions.

MS. SYLVA: Okay, we'll reserve that for Higashi. Thank you.

Q You also reference that in addressing some of these passage issues that the -- while the cost may be high in the short-term, the benefits accrue for years to come.

What sort of short-term cost did you have in mind when making that statement? I'm referring to your declaration.

Actually, our court reporter didn't catch the first end of your response, so could you repeat your answer once more? Thank you.

A Sure. Sorry about that. Actually, I don't even know what I was saying.

Q You were starting to talk about the high cost associated with the -- the short-term high cost associated with addressing these passage issues.

I believe you began your answer with construction cost being one of them.

A Sure a lot these sites are -- the access to them is difficult. And to get in there and do the

modification could be costly. Some of the designs of the diversions don't lend themselves to an easy modification. A few of the just the designs, just basically how the stream is laid out, and the diversion was built, lend themselves to very easy and effective fish passage issues.

So the actual location, and then what needs to be accomplished varies with each of these sites. So there clearly would be -- some of these sites that would be more difficult to accomplish. And then ultimately the cost would be higher in the short-term.

Q And the benefits, can you briefly describe the benefits that you believe would accrue for years to come to these animals?

A So the benefits are enumerated in the report and the model. If fish passage and decreased entrainment at these sites is achieved, then you would gain all of that potential habitat unit over those areas, and ultimately have that many more fish over time.

So I guess with the accruing over time is looking at the population response for the native species, that they have a lot more habitat to live in.

Q In paragraph 14 you discuss -- you begin it by saying: From a system optimization perspective, enhancing passage, avoiding entrainment, and restoring habitat should all be maximized together to achieve the best ecological impact for the smallest restriction of use of the water.

I wondered if you could first start out by defining what you understood to be the system? Which system are you speaking of?

A From the management of the water for humans and for all of the other uses, and in this case, looking at off-stream use of water versus instream use of water to benefit native species. That actually is reflected in one of the tables that we looked at earlier.

Restoration of flow is important undoubtedly, but it is not the only thing to be concerned with in trying to restore habitat for these animals.

So a combination of those three things, restoration of flow, enhancement of passage, and avoidance of entrainment would result in the greatest habitat gains for the species while allowing the most flexible use of water for humans.

Q And so in your opinion, when the optimal

levels are reached by way of like these management practices, then the human uses as well as the native habitats are being served. Is that essentially the correct assumption?

A Well, that's by definition a management of resources goal. That is what management of resources is about. It's management of resources for human and the environment. So it's a definition of natural resource management.

It's not my personal position, but that's sort of what management is all about. Where on that spectrum to 100 percent diversion to 100 percent restoration is a management choice.

HEARINGS OFFICER MIIKE: Are you going to be going on for quite a lot more?

MS. SYLVA: I think so.

HEARINGS OFFICER MIIKE: Let's take a ten-minute break.

(Recess was taken.)

HEARINGS OFFICER MIIKE: Back on the record.

Q (By Ms. Sylva): Paragraph 15 of your declaration, you reference how testing these different management scenarios, which we discussed in some detail in your previous testimony, was an

important product of the modeling that you performed. And you go on to indicate that scorecards were created for each stream to highlight instream conditions and potential restoration benefits. And I just want to get some clarity on the scorecards that you're referencing.

Are they the reports that were attached to Appendix C, which is that April 1, 2010 letter that we discussed in some detail earlier, or is it something else?

A No, those are -- yes, that is correct, those are the scorecards.

Q So back to your statement, you say that scorecards were created for each stream. And as we've already discussed, only eight were provided for in that letter.

So is it your understanding that there are actually additional scorecards for the remaining streams that were created as a result of your modeling?

A That's a good question. I guess I may be inaccurate there. I am almost positive that the data for those eight scorecards was created. They may not have created the graphic for all of those streams.

I'm looking actually right now to see if I

have all of them. I find eight streams clearly. I would have to take more looking to see if the other ones had been done. So I think I was incorrect. I think it's for sure for those eight streams, but I'll just stop there.

Q Okay, no problem.

You go on to say in paragraph 16 of your declaration that the reports that were generated for the East Maui streams that were a part of the modeling study, were combined with professional judgments of DAR staff, and then some of the local mitigating factors that we have discussed already.

I wondered if you could -- basically who at DAR was -- who were you referring to at DAR with respect to, you know, issuing the kind of professional judgments contemplated here?

A I think that's pretty broad including probably most everyone in the authorship list. And Dan Polhemus was Administrator at that point, maybe some other folks. But it was -- it sort of depends on what the question was asked.

For example, Skippy Hau, Maui biologist, spends a lot of time, and so he knows a lot more than, for example, I would about the local conditions. But it was sort of a group discussion of

DAR's expertise.

Q And did DAR communicate to you at any time, any of their professionals with whom you were working, what priorities they were trying to achieve, or what kinds of objectives they were trying to satisfy by using the modeling study you provided?

A I think generally, yes.

Q And what were they?

A That's a pretty broad question. I think it goes back to the original point of the report, which is could I help them come up with an objective approach to understanding the benefits of flow restoration and fish passages and mitigation for the entrainment throughout the East Maui streams, so that when different issues came up, we could assess them systematically and apply that to the results appropriately without it being an opinion-based approach.

In other words, we saw what came out of the model, and then we're talking about how DAR adjusted it based on their professional judgment of things like, this actual site would be extremely difficult to deal with, and therefore, it may not be the number one choice. So that they provided sort of a list of the fees or the cost of modifying a diversion, for

example.

And they would be able to generate that, we could apply that to the results systematically and see what happens. So we were trying to avoid an opinion-based approach. So each diversion was assessed using the same criteria, and then they may have provided me that, and I matched it up with everything and returned the results.

So, yes, we worked together. The overall goal was to figure out the rank of the best things to do to restore habitat in that set of streams.

Q And the local mitigating factors, can you confirm that those were factors outside of the modeling consideration and informed by DAR's professional judgment as well?

A Correct. Those were things that were not included in the model design and, therefore, by definition, could not be captured in the results. And so we addressed those case by case, or DAR looked at those case by case so that we could adjust the results appropriately.

Q And did DAR -- to your understanding, was DAR also the entity responsible for providing data specific to assessing the difficulty in modifying diversion structures, or did that information -- was

that derived elsewhere?

A I think it would be a combination. I think the Water Commission also provided information on that, given that they have plans on some of these. I think the various entities that run the diversions may have provided information into that.

USGS, which had done work out there, also had information on it. I don't know exactly who provided what. That wasn't what I was working on, so I can't answer that specifically. But I don't think it was only DAR. I think it was the available information.

Q And you speak sort of broadly in your declaration about DAR's final recommendations. What do you know about DAR's final recommendations? And can you pinpoint precisely what you know and whether it was -- whether you're referring to the recommendations made in 2009 or 2010?

I'm just trying to get an understanding as to what you mean by final recommendation?

A I think I'm referring to the 2010. And I guess I would have to be refreshed on the 2009 recommendations. They may have been the recommendations directly out of this report in which additional things were brought up by other folks who

know a lot about different issues. And so by 2010 DAR had taken in comments from various folks and tried to account for that. I think that's how I would characterize it.

Q I think that's fairly consistent with what I understand. But I can point you, if you have a copy of Dr. Higashi's submission for these proceedings, Appendix B.

A I do not have that.

Q Okay. It's a letter dated December 15, 2009, so it would have been from Dan Polhemus, and it would have been immediately subsequent to the November 20th, 2009 study, or publication, I should say.

A I do not have that at my disposal.

Q You don't have a copy of that letter? Okay.

Well, I represent to you that I'm reading specifically from that letter. There's just a few statements in there that I would like to get your opinion on as to whether or not you are in agreement, or whether you're modeling supported the recommendations or the statements made in that letter.

One quote on page 2 of that letter states:

"While the return of the hundred percent of the diverted water and elimination of diversion structures would be the most desirable IIFS for protection and management of native stream animals, the DAR recognizes that this position is not compatible with the ongoing needs for water by the people of Maui."

With respect to that first portion of the sentence regarding the return of a hundred percent of the diverted water, and the elimination of diversion structures as the most desirable IIFS for protection of management of native stream animals; do you agree with that statement?

A I would probably change the word "desire". From a modeling perspective, it is the maximum potential habitat restoration by definition. So as designed, the complete restoration of flow and removal of diversions would result in the maximum that you could do in this case.

So from my perspective it's not really a desire, it's a point, one of the end points on the model. That would be your best possible achievement for habitat units in this case.

Q And the second part of that sentence, DAR recognizes that that position or that sort of

modeling end point, if you will, was not compatible with the ongoing needs for water by the people of Maui.

What did you -- did you have an understanding about what the ongoing needs were at the time that you undertook this study?

A In a general sense, yes. But my position here is not as a manager. So my position is to support the managers in their decision-making, and so if -- it's not really -- it doesn't really make any difference to the model. The one extreme of the model is 100 percent diversion of all flow; and the other extreme of the model is 100 percent restoration of flow.

So I'm not valuing any judgment on those positions, merely supplying them sort of an objective approach to determine what set of actions they may like to do.

Q And if information were made available to you that alternative freshwater sources were available to meet the ongoing needs of the people of the Maui, would that at all impact some of the input you provided to DAR with respect to the modeling recommendations?

A No. It is outside of the modeling

recommendations. If we wanted to build a larger model for water optimization for Maui, you could include that in there and then you could look at the cost benefit of those approaches, but that's outside of the modeling we did here, and sort of outside of -- this is not answerable by me right now.

It's also -- again, I'm not the manager in the situation. I'm not trying to value their decisions. That's actually what Aquatic Resources' goal or job is.

Q So getting back to your 2010 understanding of DAR's final recommendations, that is specific to the April 1, 2010 letter, correct, that you have in front of you?

A Yes.

Q And so this was your working understanding of the final recommendations DAR made based on some of the modeling results generated by your study, correct?

A Correct.

Q I'm going to point you to the first bullet point in the second paragraph of that letter, and ask whether or not you basically agree with some of the positions stated.

As to the first bullet point, can you read

that?

A Yes, I can. Would you like me to read it out loud?

Q Please, yeah.

A The first bullet point: Minimum viable habitat flow (H_{min}) for the maintenance of suitable instream habitat is defined as 64 percent of the Median Base Flow, base flow discharge 50, also defined as H_{90} by the USGS studies. DAR expects that these flows will provide suitable conditions for growth, reproduction and recruitment of native stream animals.

Q Are you in agreement that the modeling supports that DAR recommendation?

A No. It's not that the modeling doesn't support that. This is what I would call an input to the model that results in an output. So the model isn't, in this case, defining median baseflow or anything like that. So this is --

Q So let me rephrase my question.

So the 64 percent of median baseflow is derived from an accurate value that could be generated from the model, is that right?

A No, this would be an input.

Q I'm sorry, input.

A So if by definition DAR says that 64 percent of median baseflow or habitat will be improved 64 percent by restoration of half of the median baseflow, then we would apply that to the model to get the result.

So this is an input definition to the model, not an output of the model itself.

Q Do you agree -- well, understanding that you agree with the statement that DAR expects that those flows, the 64 percent of median baseflow would provide suitable conditions for growth, reproduction and recruitment of native stream animals?

A Do I personally agree with it, are you asking? Or are you asking whether the modeling supports that? I'm not sure.

Q Whether you agree -- I guess my question is, whether you agree as a scientist, based on your knowledge as a biologist, as a hydrologist?

A It's a very difficult question to answer. But if this was all I had, I wouldn't be able to answer it. I think the 2015 report supports this contention.

Q And what specifically in the 2015 report do you believe supports this contention? What in the 2015 report can you point to supporting this

contention?

A There was two seasonal flows defined. There was a winter and a summer flow, and it in general, this first bullet point would have been the winter flow. Whether it turned out to be exactly that, I'm not positive, but in general this is what was trying to be achieved by the winter flow.

And the second bullet point was trying to be achieved by the summer flow.

And so the results of the survey that DAR conducted suggests that little was achieved by the summer flows, and there was evidence of positive improvements during the winter flow.

So this value appears still with some gray and some room for dispute, but it does appear to produce positive habitat and potentially species responses.

Q And you reference that little was achieved with respect to the summer flow that was described in bullet point number two.

Can you expound on that a bit with respect to the 2015 study?

A Yes. It's unclear, so the application of seasonal flows is a coherent approach. There's nothing wrong with the idea. But the actual amounts

that were used was tested in the monitoring report.

Now, there's a lot of gray in this. There's a lot of reasons it could have been done longer, and more complete and everything, but there appears to be little or no biologic or habitat response to the restoration or the very small amounts of flow that were returned during the summer.

There is no measurable response in any gains that were observed in the winter season prior in either habitat, or the appearance of species appear to be lost in the subsequent summer. So there doesn't appear to be anything, there is no evidence basically, no values that we could see that suggest that those summertime flows were advantageous to the animals.

Q So based on the study results, the 2015 study results, would you agree that seasonal approach to setting an IIFS should be abandoned? I mean that it does not support the kind of suitable conditions for growth, reproduction, and recruitment of native stream animals?

A The application in this case is not supported. The concept was not confirmed to work or not -- for example, if the wintertime flows had been returned during the summer and complete flow

restoration had been done in the winter, that would have been a seasonal flow approach, and we might have seen completely different results. So the concept of varying flow over times is well supported in fisheries. It may not apply on East Maui, and it does not appear to be the correct flow amounts in this application.

Q So with respect to bullet point number two, can you, based on the 2015 study, can you -- are you able to tell us whether or not the streams achieve the kind of connectivity that was minimally required or contemplated at the time that this minimum flow was recommended?

A It doesn't appear that it was successful for what it was intended. There are a few -- there are a few 'opae did move upstream, and there was a few changes here, but it does not appear -- going backwards, the intent was that during these low flow periods the animals would be able to drop into stream pools and live.

So we should have seen them all there, and they should have been swimming around. They may not have been able to reproduce and their babies not made it to the ocean, but the adults should have been seen in these sites.

They were seen in a number of the winter periods, and then they were gone again the next summer. And then they might appear again sporadically. There wasn't a very clear signature to this.

So if the thought was that the animals would be able to move under this flow, and then maintain the habitat, that does not appear to have occurred.

Q Can you explain -- I'm going to skip to bullet point number five. And specific reference to the use of trans-basin water diversions from ditches to restore stream sections. And the recommendation that they should be avoided where at all possible.

Can you provide some explanation for that statement, and what trans-basin water diversions are specifically?

A Sure. This is not my personal recommendation, although I agree with it.

The overall concept here fits with the modeling concept in which we are not -- or the model was designed not to suggest that we divert water from one stream to build beautiful habitat, theoretically more than 100 percent habitat in another stream. That would actually be a net negative, because you

would have lost habitat in one stream to gain it in another. So natural flow was determined to be the objective.

In other words, this is what these animals live in, so we're not trying to create something different here. That's not to say there aren't situations where that could be done, but from a modeling perspective, sort of the best approach, would have been natural flow in all streams.

So trans-basin flow, moving it from one stream watershed or one stream to another, would result in an overall negative. It couldn't achieve the 100 percent natural flow objective. So at a modeling side that is built into the modeling.

On the second side of it, you have issues of moving species from one watershed to another which may not be appropriate. For example, if introduced species get into one watershed, then they are spreading into other watersheds. That causes a whole secondary problem.

So from the management of aquatic resources it also has additional value. From a modeling perspective, it's actually designed in as part of the overall assumption.

Q The latter part of your answer kind of

started to address the subsequent bullet point, correct, with respect to commingling of stream and ditch flows?

A Yes.

Q And the avoidance --

A So that would be one possibility. Now, if the commingling of stream and ditch flows are only from the same stream, you wouldn't have this issue. But if practicality, the way the divergence work, they start cutting across watersheds, and therefore, collecting flow from three or four or five different streams, and then adding it to a stream and taking out again has the potential to move species among watersheds.

Q Are you aware that this commingling, the risk of commingling, and then the option to avoid that where at all possible, inform CWRM to opt against restoring -- CWRM staff anyway -- to opt against restoring streamflow to certain, what we would describe as conveyance stream. Do you understand what a conveyance stream is?

A Yes.

Q So it informed an opinion to opt against restoring streamflow to avoid that commingling risk. Is that -- is the risk of commingling or is the lack

of streamflow preferred over commingling? I guess that's my question.

A That's a value judgment from a management perspective --

Q How about from a biological --

A -- it would depend on the situation and what you're worried about.

Q How about from a biological perspective?

A I would have to give the same answer. There's good evidence that, for example, letting the Asian carp into the Great Lakes could result in huge economic damage and huge species damage. And in that case, restricting water between those two water bodies would be a giant priority.

So it depends on what your objective is and your specific location. So in general, I don't have an answer for that.

Q Practically speaking, do you at least understand that during high flows that the ditch system often overflows, and during these high flows, commingling inevitably occurs, because overflows are then released into down -- the streambeds, you know, below the diversions themselves.

Are you aware of that occurring naturally?

A Not so much naturally, but yes, it occurs.

Q Right. And so there's complete avoidance of -- that kind of commingling is not, practically speaking, a real option; correct?

A I would disagree.

Q And can you explain --

A I don't think practically it could be achieved. It's not currently the design. So it would be a case-by-case basis again. It depends on what your objective is. There could be cases where having the ditch flow contained within a pipe where it crosses would be advantageous. I can't really comment on the particular site where it may or may not -- the decision to make commingling, or to do it or not, would be a site-specific decision based on a series of objectives, to try to avoid sort of species movement into places they're not desired.

Q And do you know, based on that 2015 study, whether diversions were successfully modified to provide safe passage for those amphidromous stream animals requiring such passage?

A That was not tested, so I can't respond to that. The sites were all below the diversion, so this was not looking at fish passage or entrainment, which definitely needs to be done, but that was not what that study was about.

Q Looking at your 2009 study, specifically on page -- oh, I'm sorry, the version I think attached to your -- the version attached to Mr. Higashi's testimony doesn't have page numbers, so I'm going to draw your attention to the summary conclusions provided for -- I guess it's the best I can say is after Figure 6 and concerning -- actually, before we get there, the summary conclusion concerning the oceanic larval face.

Apparently some copies have page numbers, so page 6 for those who have page numbers. The management actions that are provided for in that summary, are you familiar with them?

A Yes.

Q And did those management, did DAR's final recommendation, which you understood to be their 2010 recommendation, reflect this kind of objective stated in this summary?

A Yes.

Q And that is consistent too with their seasonal recommendation? You think that's a consistent statement?

A Well, the first bullet point suggests that improvements in instream habitat, which is what the model is predicting, would result in more animals and

therefore greater output than the current situation. So while they may not have restored year-round improvements to output, the plan was to restore at least six months improvement output, so they would have achieved bullet point number one.

Bullet point number two was addressed in their geographic spread of the sites of restoration, trying to get sort of the biggest spread of these restorations so that you improve the probability of successful output, and then recruitment. So I think they did both those two.

Q Okay, my only -- I guess I'm confused, because I think I recall you saying that the dry season IIFS's were so minimal that they actually erased gains made during the winter season.

So the summer season standards for IIFS values were so low that they erased the gains to habitats made during the wet season.

And so is it still your testimony that overall improved reproductive output did in fact occur even with the elimination of those gains?

A That's a good point. I would say it was a very -- it did not achieve what would be hoped, I will say that for sure. But there were adult animals observed on occasion. There were more 'opae observed

at some of these sites. So, yes, there would have been more output.

Now, that appears to be not even close to what you would hope, but, yes, there appears in some cases to be more animals in certain locations.

So there was some gray in this. There's a lot of gray because of the monitoring and the nature of these Hawaiian streams and these animals. But there were a few more animals in some of these locations. But it wasn't consistent, and you weren't seeing the suite of animals showing improvements over time.

So in terms of would I say that it was successful? No; but were there limited gains in some locations and some places? Yes, but not what was intend. That would be my opinion.

Q And the study itself was a short-term study, correct? So we have yet to understand what the long-term effects on these stream animals would be; is that accurate?

A Four years. But, yes, in terms of animal populations in the long-term, four years would be a short time. But it was, you know, it was a lot of work that they put in to get that answer.

Q Now, regarding -- now we can go to the

second summary recommendation with respect to recruitment. This is the one that is displayed under Figure 6 on page on --

A I have it.

Q -- page 8. Are you familiar with this summary recommendation there?

A Sure.

Q And were those recommendations consistent with DAR's final recommendation provided for in 2010?

A I would say that we -- I should not say "we". I would say the actions did not result in all of these hoped things here, in that return of more -- actually return of any water, even the summer flows would have resulted in larger fresh water plume, by definition. Would it be any marginal difference in the scheme of ocean around Hawaii that animals would see it, probably not.

So I don't know that the amount of water returned really achieved the first objective, and I'm not positive the amount of water that's available would do a lot to that. That's more of a flood flow effect.

And then a similar thing happens on how often the stream mouth is open. That's a geomorphology issue. Some stream mouths are open all

the time. Some close very quickly as the waves get up, just picks up the sand and cobble that's on the beaches and throws them back into the stream mouth. Those are open in response typically to higher flows.

So number two is, again, really more controlled by flood flow than it is by low flows.

And the final one is there may have been a little bit improvement to adult populations, but I don't know that. Again, your argument from the first one applies. It really wasn't very successful. And so overall, this one probably wasn't achieved by the flow.

Q Now, with respect to the upstream migration summary conclusion which you can find on page 14, again, same question whether or not you believe DAR's final recommendation in 2010 reflected these objectives?

A I'll caveat this one by saying what they said, absolutely reflects this. I do not know actually what was done to repair some of these barriers and how it was done, so whether or not these were achieved in reality, I can't answer that.

But the first one, were they attempting to minimize the barriers upstream migration? Absolutely. That was discussed. That was talked

about.

The increase the window of time that that pathway from the mouth to the upstream habitats, that was hoped to be 100 percent of the time because the summer flows were intentionally connectivity flows. That was all they were trying to do.

The winter were connectivity plus a lot of other things. So the intent was to have a wetted pathway 100 percent of the time.

And then decreased entrainment again was discussed. Whether it was actually done in practice, is a different issue. So I would say the goals of what they were talking about in 2010 were absolutely supportive of these.

Q But it's very questionable, at least with respect to the window of time for pathways, whether or not that was actually achieved, and I'm pointing to the results of the 2015 study in particular; correct?

A Again, it appears the winter flows provided connectivity, but the summer flows did not. So an improvement of six months a year connectivity is an improvement, although the intent was to get year-round connectivity, and that does not appear to have been supported by the information.

So there is still an improvement of connectivity, but it wasn't what was hoped for.

Q And can we get agreement that a six-month improvement on connectivity that is subsequently erased in the six months of summer, six summer months, is probably not a success overall?

A Correct, I would agree with that.

Q And the summary conclusions concerning instream habitat, again, same question, page 16, and you can answer it based on how you've categorized your answer in the last section about intent versus actual achievement based on the 2015 study results.

A For bullet point number one, I don't -- I think the improvement of allowing low flows was the intent for sure. And in general, high flows in Hawaiian streams still exist overtop the diversions, and so you still have flood flows in these streams, and so there is somewhat of a natural pattern.

Of course, there is diversions, so it's not 100 percent natural. But the intent was to try to get to a more natural flow.

So number one, I would agree that was their intent. The number two, they absolutely having year-round flow of some sort was an intent to keep water in the stream, and that was mildly achieved at

best for the summertime flows; but clearly -- not clearly, but I would say indications that it was achieved for the winter flows.

The third bullet point, that was absolutely the goal of what they were trying to do. Number four, they were attempting to accomplish that also. Number five, I don't know that we really knew enough to address that. That is definitely a goal, and the summertime flows may have been detrimental to that. That might have been one of the problems here in that they were just too low and things were drying up too much. They had hoped that keeping some water in the streams would avoid this situation, but it's possible that it was too small amount of water to achieve that goal.

Q And the goal was to maintain suitable water depth to assure the nests of eggs of amphidromous animals did not dry up, correct?

A Right. And in the overall sense, was there just enough water for the animals to survive? Not so much that they would go and reproduce, but the animals that were there would be okay, and it doesn't appear to be that was the indication, and so it's also possible that the nests were drying up. Unproven though. We don't have any information on

the specific --

Q But it's critical to the life cycle of the animals, right, to do more than just survive? They really want to be able to reproduce in order to sort of have sufficient populations to continue this life cycle; correct?

A Correct, reproduction is critical.

Q Now, you opined on the intent being met by DAR's final recommendations, but can you quickly assess whether for any of those bullet points that you just went over, whether that was actually achieved by way of, you know, some of the 2015 study results?

A I guess the same thing will come up again. The summertime flows appeared to be too low too long. They didn't really create a stream-like habitat. It was still relatively disconnected. Pools, maybe a thread of water between them, but it wasn't really a stream like where you see, you know, water flowing through the system.

So I don't know specifically which of these were achieved or not achieved, but overall instream habitat appears, for a number of the species, appeared not to be suitable because they were there in the winter before, and they did not appear in the

summer after that, and then show up again.

And so in very simple perspective, habitat did not appear to be suitable. Whether it was temperature or diatoms or reproduction, we don't have any information to say exactly what was happening.

Q And this is going to be my last question for this report and probably my last question as well to you.

But the summary conclusion for downstream movement migration and drift, can you walk us through the same kind of analysis for those bulleted points?

A Okay, the intent was to at least have six months of year which the higher flows would trigger spawning, and while those higher flows were going, they would swiftly move the animals to the ocean.

So the window of six months was hoped to be the trigger to spawning, the actual event, and then the maturation of the eggs in the downstream drift. So the intent was that the six-month window would improve that. Sort of obviously, flows year round would improve over that. So that was the intent.

It looks like the winter flows may have done some of these things. Again, it's not crystal clear. It's not a definitive result from that monitoring study, but it does appear the winter flows

had some positive impacts. The summer flows do not appear to have been sufficient to do this, although, again, we did not measure downstream drift.

And then the entrainment issue goes back to the fish passage. This study was below the diversions, it was not addressing fish passage or entrainment. So the overall goal in the 2010 report was to minimize entrainment. What actually happened in application is not as crystal clear right now, and, in whether that was achieved.

Q That's all. That concludes my questions.

HEARINGS OFFICER MIIKE: Mr. Hall. Cross-examination.

CROSS-EXAMINATION

BY MR. HALL:

Q Hello, Dr. Parham, my name is Isaac Hall. I represent Maui Tomorrow. Good afternoon to you, I suppose.

You don't have the letter that Mr. Polhemus wrote dated December 15, 2009, but it includes a description of the mission of DAR, which I would like to read to you.

It says, "The Division of Aquatic Resources, DAR, is responsible for the protection and management of living aquatic resources in the waters

of Hawaii?"

Would you agree that's DAR's primary mission?

A I would agree.

Q It's DAR's mission, is it not, to figure out how to get the biggest bang for the buck out of the watershed; correct?

A Could you restate your original sentence? Did it include "management"?

Q No. It does say management of living aquatic resources. I'll go on to the next sentence in here.

"The DAR realizes that the Commission on Water Resource Management, CWRM, has responsibility of balancing the current and future value of multiple uses of water when rendering its decisions on specific instream flow standards. By contrast, the DAR's recommendations below focus only on the requirements of the native aquatic biota that fall within the scope of our authority, and do not consider additional instream or off-stream uses of water."

A Okay. Is there a question?

Q So you've been talking about management. You've been incorporating the potential needs of

off-stream users in your analyses, correct?

A Tangentially, yes. I mean I can -- how the water is used, isn't what I was looking at. They were asking -- I was asked to determine what actions would result in the restoration of habitat in what sequence.

Q Well, you ranked the streams in order to help CWRM make a decision. We would like to restore five, maybe restore ten. I've ranked them for you to help you make your decision; is that right?

A Correct.

Q But your -- the role of DAR is really to look at what it would take to protect the native aquatic biota in any given stream; correct?

A I think you said "protect and manage".

Q Yeah, the biota in the stream; correct?

A From my teachings, "management" is a combination of humans and the environment. And so it's a balance. And if DAR's saying that their goal is protection and management, then the consideration of human value is inherent in their decision-making.

Q That's pretty--

A That's DAR's position, not mine.

Q CWRM is going to decide how to balance the human values versus the biotic values, correct, not

DAR?

A I don't control DAR's decision. It seems what Dan stated in DAR's decision, it sounds like they have management authority, which is the balance of human use and the environment.

Q Can you cite anything that gives DAR the authority to balance the human uses versus the biotic uses?

A In general, I work in the fisheries world, so the classic example would be fishing. Determining size, limits and things like that which would fall in DAR's purview, and that is the management of human take of the environment while trying to protect the animals --

Q Don't you agree that it's the CWRM's role --

HEARINGS OFFICER MIIKE: Let him finish before you start. She can't cover both.

THE WITNESS: I'm finished, thank you.

Q (By Mr. Hall): In this context, don't you agree that it's the CWRM's role to balance human uses versus instream uses, not DAR's?

A I guess I'm the wrong person to ask, because I'm not at DAR, and I'm not really the person who decides.

HEARINGS OFFICER MIIKE: Let me interrupt this, Dr. Parham.

I don't think -- he's never made the position that says that he's going to tell CWRM what to do in terms of a balancing act. He's been consistent in saying he's providing information to them on what would improve habitat and recruitment, et cetera.

I don't think he's ever gotten into that. Plus you're asking him questions about DAR. You have a DAR person here. You can ask him directly.

Q (By Mr. Hall): Let's go through your stream-by-stream analysis then, and see what you said.

Could you go to page 68 of your study. Let's start with Kolea Stream.

A Okay, I'm there.

Q You said in general 50 to 80 percent of the habitat of the species that you listed was lost with about 20 percent of that loss due to flow diversion and the rest due to entrainment issues, correct?

A Correct.

Q And you state later on: "Restoration of flow especially related to providing passage for stream animals, and protection from entrainment would

likely result in increased habitat availability for native species"; correct?

A Correct.

Q So stream restoration would increase habitat availability in Kolea Stream, correct?

A Yes.

Q Let's go on to Waikamoi. You say: "In general, almost all habitats for native species (97 to 99%) were predicted to be lost with about 30% to 60% percent of the loss due to flow diversion and the rest due to entrainment issues"; correct?

A Correct.

Q And with respect to that stream, you say: "Restoration of flow to increase local habitat and improve fish passage would benefit the stream greatly by providing large amounts of habitat for native species". Correct?

A Correct.

Q So if we just look at that stream by it itself, you recommend stream restoration; correct?

A Yes.

Q With Puohokamoa Stream you say that: "Where surveyed the diversion removed 100% of the stream flow." Correct?

A Yes.

Q And you conclude: "Restoration of flow to increase local habitat and improve fish passage would benefit the stream greatly by providing large amount of habitat for native species."

A Yes.

Q So stream restoration would benefit Puohokamoa Stream, correct?

A Correct.

Q Now, go onto Haipuaena Stream. You say: "In general 55 to 90% of the habitat for these species was predicted to be lost with about 40 percent of that loss due to flow diversion and the rest due to entrainment issues." Is that right?

A Correct.

Q And you say: "Restoration of flow to increase local habitat and improve fish passage would benefit the stream by increasing habitat for native species."

A Correct.

Q So for that stream too, restoration of flow is recommended; correct?

A Correct.

Q Then Punalau Stream, you say: "In general, 60 to 95% of the habitat of these species were predicted to be lost in the range of 2.5%" for one

specie "to 43.9" for another species "of that loss due to flow diversion and the rest to entrainment issues." Right?

And you conclude again: "Restoration of flow to increase local habitat and improve fish passages would benefit the stream by increasing habitat for native species." Correct?

A Correct.

Q So your findings again support stream restoration for Punalau Stream, correct?

A Correct.

Q Honomanu, you say: "Dry sections of the stream bed were observed below the diversion and where surveyed, the diversion removed 100% of the stream flow." Correct?

A Correct.

Q And you say: Entrainment of downstream drifting larvae would be high in this stream and upstream passage would be limited to high flow events." Correct?

A Correct.

Q And you say, again, you conclude:

"Restoration of flow to increase local habitat and include fish passages would benefit the stream greatly by providing large amounts of habitat

for native species." So your particular findings --

A I would agree this stream, with further information coming in from the USGS and from DAR, was probably the poorest captured in terms of its response.

Q Are you talking about the --

A This was the number one stream to restore. But given the fact that the indication was it was dry for quite a section naturally, then the benefits were probably much less than what you see here.

Q Well, you weren't here to get the benefit of Dr. Gingerich's testimony. He qualified that there was a losing stretch on diverted conditions and qualified that he did not know if water were restored, whether it would lose or not.

Would that make a difference to you?

A Absolutely.

Q So if water were restored, and it was no longer losing, would it go back up to your number one slot?

A Most likely, yes.

Q Now let's move on to Nuaailua Stream. You say in here: Some entrainment of downstream drifting larvae may occur in this stream and upstream passage may be limited during dry periods." Correct?

A Correct.

Q "There is a potential to recover 0.5 km of habitat units in this stream alone and it ranked fifteen among all streams in this report."

But you conclude again: "Restoration of flow to improve fish passages would have limited benefits to the stream by decreasing entrainment of drifting larvae for native species."

So there would be some benefit?

A Correct.

Q For restoration of stream flow, correct?

A Yes.

Q And, again, entrainment is an issue that you identified with that particular stream?

A Correct.

Q And Ohia Stream. Again, you say no diversion, and you testified to that before. So let's move on to West Wailua Iki Stream.

You say: "In general, flow diversion eliminated about 50 of the habitat for the middle reach species." And you list them. So that's flow diversion.

And "Entrainment issues associated with the diversions had a large influence" on two other species. "Recent surveys found a range of native

species in the stream although substantial loss habitat was reported below the diversions."

A Correct.

Q And you conclude again: "Restoration of flow to increase local habitat and fish passages would benefit the stream by increasing habitat for native species".

So stream restoration would benefit West Wailuaiki Stream; correct?

A Correct.

Q And the species in it, correct?

And you isolate out West (sic) Wailuaiki Stream. And you say of it: "In general the loss of instream habitat was due to water removal which resulted in about 45% loss of habitat" -- water removal means diversions, correct?

A Yes.

Q "For lower and middle reach species while Lentipes" -- and another species -- "were mostly affected by entrainment issues." Is that right?

A That is correct.

Q And you conclude again: "Restoration of flow to increase the local habitat and improve fish passages would improve stream conditions for native species."

So restoration of flow to East Wailuaiki Stream would also improve conditions for different species?

A Correct.

Q And Kopiliula Stream, you state: "Loss of instream habitats due to water removal resulted in about 20 to 45% loss of habitat" -- and you list two species -- "were mostly affected by entrainment issues." Correct?

A Correct.

Q And you conclude again: "Restoration of flow to increase local habitat and improve fish passages would improve stream conditions for native species."

So for this stream, again, restoration of flow would benefit conditions for native species; correct?

A Correct.

Q Waiohue, you say: In general, the loss of instream habitat due to water removal" -- diversions -- "resulted in about 40% loss of instream habitat for these species" -- and several others -- "were affected more by entrainment issues."

Is that right?

A That is correct.

Q And you conclude again that: "Restoration of flow to increase local habitat and improve fish passage would improve stream conditions for native species."

So, again, you conclude with respect to this particular stream, that restoration of flow would increase local habitat?

A Correct.

Q Paakea Gulch. You say that: The loss of instream habitats due to water removal resulted in about 3% percent loss of habitat."

But you conclude: "Restoration of flow to improve fish passage to upstream sites would improve stream conditions for native species."

So it's a fish passage issue at Paakea, correct?

A I think so, yes. I was reading it.

Q I'm sorry, it says, restoration of flow to improve fish passage would improve stream conditions for native species.

So you recommend restoration at Paakea Gulch as well; correct?

A Yes.

Q And Kapaula Gulch you say that there's 50.4% of this loss due to the combined effects of

stream diversion; is that right?

A Yes.

Q And you conclude, again: "Restoration of flow to improve fish passage at upstream sites would improve stream conditions for native species."

So you recommend restoration of flow to Kapaula as well, correct?

A Yes.

Q And Hanawi Stream, you state that there is a 45.6% of habitat loss due to entrainment by the stream diversion?

A Correct.

Q And restoration of flow to improve fish passages would improve stream conditions for native species.

So you recommend restoration at Hanawi Stream as well, correct?

A Correct.

Q And Makapipi Stream, you conclude that 54.6% of the loss of habitat is due to the combined effects of stream diversion?

A Correct.

Q And you recommend restoration of flow to increase local habitat and improve fish passage and that that would improve stream conditions for native

species; correct?

A Correct.

Q Now, we're left with the eight other streams. Do you know them well enough -- I notice that you did reports on a number of them. You did reports, according to your resume on Honopou, correct?

A Correct.

Q And Hanehoi, Piinaau, Wailuanui, Waiokamilo, right?

A Correct.

Q And on those, has the streamflow been limited by diversions?

A I would have to go back and look at those streams. The reports that we did on those streams were on an accumulation of known information for the biota and habitat. They were not stream diversion studies. So I would have to revisit what USGS has stated on the flow situations in those streams to give an accurate answer.

Q Are there barriers to fish passage on those streams?

A Again, if there's diversions, then there's likely barriers to passage also.

Q And are there likely entrainment problems

created by the diversions on those streams as well?

A Likely, yes.

Q So assuming that there is diversions of water causing low flow and that there is barriers to fish passage and also entrainment issues, would you say if those problems exist, that the habitat for the kinds of species that you studied have been degraded by those kinds of things?

A Yes, that would be true. If they exist, that would likely have happened.

Q And would you expect to make the same kinds of recommendations if those conditions exist on those streams that you made with these other streams, that stream restoration or modification to the diversion were to allow fish passage and modifications to prevent entrainment, make the same kind of recommendations on those streams?

A Yes, it would be likely.

Q I'm looking at the conclusion of Appendix E, Monitoring Changes in Habitat Biota, the 2015 study.

A Sure. One moment. Okay, where are you?

Q In the middle of page 67 actually.

A Okay.

Q When considering -- the first sentence --

"When considering instream flow quantities to support stream animals, it is axiomatic that 100% flow restoration to natural undiverted flow would be best for native stream animals."

Do you agree with that?

A Yes.

Q And I think the rest of your conclusions have been addressed by Ms. Sylva.

I don't have any other questions.

HEARINGS OFFICER MIIKE: Let me interrupt for a second. You're deferring to HC&S?

MR. ROWE: Yes.

HEARINGS OFFICER MIIKE: About how long are you going to take?

MR. YIP: I anticipate about 45 minutes to an hour.

HEARINGS OFFICER MIIKE: Okay, Dr. Parham, let's try to continue on so we can get through with your testimony. We will go about another 45 minutes.

MR. PARHAM: Sounds fine.

HEARINGS OFFICER MIIKE: Okay, let's go.

CROSS-EXAMINATION

BY MR. YIP:

Q Dr. Parham, my name is Elijah Yip. I'm the attorney representing HC&S.

I just want to start by asking you, besides the 2009 report and the 2015 report, and the declarations, your declaration as well as Mr. Higashi's declaration, what did you review in preparation for your testimony today?

A I reviewed the 2009 report, the 2015 report, the two USGS reports, the 2010 DAR statement, and some various spreadsheets to make sure I understood all of the calculations, just to double check.

Q Did you review any submissions by the parties to this proceeding?

A Let's see -- I don't think I had any of the stuff sent to me. No. So I don't think I have seen the submittals.

Q Thank you.

Are you familiar with the PHABSIM model?

A Yes.

Q How much work have you done with that model?

A Quite a bit. We've been working for years. I'm trying to understand the implications of PHABSIM, and it's well known to have some low flow issues in its predictions. And so much of the work that I've been doing is trying to understand the applications

of a micro half-tap model in context of macro habitat conditions. And so have I been running the calculations of PHABSIM? No. But I've been working very much with the whole concept of understanding physical habitat simulation modeling.

Q Are there similarities between PHABSIM model and HSHEP model?

A Their intent is different. There are some similarities absolutely. They deal with the same location and same species. PHABSIM has a different intent, different inputs and different outputs. And the output of the PHABSIM is the input in the HEP model.

Q I see, but they're both habitat-based models. Would you agree?

A Yes.

Q Is it a basic assumption of the HSHEP model that there is a relationship between the amount of habitat available for animals and animal populations?

A Yes.

Q And what is the relationship? Is it, for example, a linear relationship between the amount of habitat availability and animal populations?

A Over the long term the assumption would be a linear relationship or habitat result or animals

over the long term, but not at any necessary specific point in time.

Q And we've been talking about different H levels like H_{90}, H_{60}; are you familiar with that terminology?

A Yes.

Q Is there -- could you describe the relationship between the different H levels and animal populations? Is there a relationship?

A Yes. H just means habitat. So 90 percent of the habitat or 50 percent or 20 percent, then there would be a given understanding in both the PHABSIM approach or really the IFIM approach and in a HEP model that over the long term, better habitat would result in more animals. And so greater values of habitat would result in more animals.

Q And that would be a linear relationship?

A It's hoped that's true.

Q What are the reservations that might make that assumption not true?

A It could be -- it could have a relationship in which animals attract other animals, so the occupancy of a site results in more animals in that area. And so it's not purely the random filling of unavailable habitat, but for -- they may aggregate

for reasons, so it may not be one-to-one relationship.

Q So based on your knowledge as a biologist, on the scientific literature in this area, how strong is the evidence for a linear relationship between the availability of habitat and animal populations?

A I would say there are no direct studies proving a linear relationship, but it's a very sort of solid conceptual approach.

Q I want to -- before I go there. You remember Mr. Hall taking you through each stream that was covered by the study, and asking whether recommendations for restoration were made; correct?

A Correct.

Q Isn't it true that the way the HSHEP model is set up, that any restoration, any restoration of flow or removal of diversions would result in increase in habitat?

A Correct.

Q So any time we have got a removal of a barrier or return of flow, there will always be an increase in habitat, therefore, benefits the species per the model; correct?

A There could be limited cases where that wouldn't be true, but your general concept is

correct.

Q I want to take you through Table 12 of the 2009 study.

A Hold on please. Okay.

Q And that's H_{95}. Are you there?

A Yes, I have it.

Q Am I correct to understand that this is a summary of the combined total amount of habitat units for all the native species analyzed in the study?

A Correct.

Q And the second column -- rather the third, I suppose. This is total habitat units in the stream. That's the total number of habitat units in a given stream under undiverted conditions, correct?

A Correct.

Q And just so I am clear on how the habitat units are calculated, they're calculated by multiplying a unit length of the stream by a suitability of that length of that stream; correct?

A Correct.

Q So the suitability values would range from zero to one, correct?

A Correct.

Q And the suitability is a measure of how usable the habitat is to a stream animal, correct?

A Correct.

Q So, for example, if there are 100 meters of habitat in the stream reach and the suitability value of that habitat is .5, that equals 50 habitat units?

A Correct.

Q And similarly, if there 50 meters of habitat in that stream stretch and suitability value is one, that also equals 50 habitat units; correct?

A Correct.

Q Now, if a stream segment has a diversion, isn't it true that the suitability value of that habitat is reduced by 80 percent?

A Come again? Sorry.

Q Let me say that again.

If a stream segment has a diversion, is it true that the suitability value of the habitat in that stretch is reduced by 80 percent under the model?

A No.

Q Is there a reduction of --

A There may be, depending on how much flow would be -- how much baseflow would be removed. So it varies based on the amount of flow removed.

Q I want you to take a look at Table 3 -- actually, let's take a look at page 28 of your 2009

study.

A Unfortunately, mine is jumping up here with no pages. What's the topic?

Q Give me a second, and I'll try to point you to what I am looking at. It is the -- we're looking at the -- there's a list of -- it's an explanation of the model. It's under the heading: Final HSHEP model construction. And then continues onto 15 numbered paragraphs.

If you look at number 13, I believe that talks about a reduction or a discount in the suitability value based on the presence of diversions; is that true?

A Yes, that's true.

Q So based on that, how does the discount work?

A The example there is 100 percent removal of baseflow, which is a sort of typical design of some of these diversions. They're removing 100 percent baseflow, and then they're overtopped during higher flows. The evidence suggests that's about 20 percent of the time that they're overtopped based on the various hydrologic studies on these diversions.

So it provides a blockage if it was that case 80 percent of the time, if that make sense.

So in other words, there is passage, there are conditions even when 100 percent of the baseflow is removed by these diversions, that water overtops and fills the channel below it.

Q About 20 percent of the time, correct?

A About 20 percent of the time.

Q That's the assumption. Okay.

So how does that translate into the model? I mean, how does that assumption work into the model?

A Okay. So there's three components that we're generally looking at, local habitat, upstream of the diversion -- if this was a single diversion on a stream, upstream would have natural flow. There would be no loss of habitat.

At the site of the diversion, there could be loss of habitat for the construction, but in general for East Maui streams we have seen animals living in the pools on both sides of these diversions. There does not appear to be really a loss of habitat. Just small cement structures, like, it's a large channelized segment like you might find on Oahu or Iao stream on Maui.

So you're not -- it's really not a loss of habitat at the specific site.

Downstream of the site you would have a

dewatered segment that would result in the loss of habitat. So for the one variable loss of habitat, it generally occurs downstream of the diversion.

The second feature would be upstream movement of animals, and it would be a barrier if the design created an overhang. For example, some cases the water flows through PVC pipes and then is sort of shot out through the air and lands in the pool below it. These animals need a wetted surface to move upstream, So that would be a blockage. Again, this is a site-specific consideration.

The third piece of information would be downstream entrainment. So the little babies, after they hatch from their eggs, passively drift with the current. And if you're diverting 100 percent of the baseflow, any animals that come down during baseflow are entrained. But some water overtops it during high flows, as we suggest about 20 percent of the time it's overtopped. So it would be about 20 percent of the time that animals could not be entrained in the diversion.

So those would be the three main factors that we're looking at, and how they would be linked to a specific site with 100 percent removal.

Q So are these assumptions applied in

calculating the amount of habitat units for a given stretch of a stream?

A Yes.

Q And how, mathematically how are they applied? Let me give you a hypothetical.

Say you've got a stream segment that has 100 meters of habitat, and let's just say suitability value is one. But there's a diversion in that segment. How would those assumptions play out in calculating the habitat units for that segment?

A Okay. And I'll say hypothetically, because it will not be every calculation, but I'll put the diversion in the midpoint of those 100 meters, so we see both downstream and upstream, and we'll talk about one species that should have been in all of those sites.

So if the water was 100 percent of the baseflow as diverted, the 50 meters below the diversion would be dry 80 percent of the time, and functionally that's not habitat for a fish. Fish can't live in dry habitats 80 percent of the time. So that's considered no habitat below it.

Upstream of the site there's still natural flow, so you have 100 percent of habitat above the diversion since you are not diverting it until it

hits the actual diversion point.

So from a local habitat perspective, you've lost 50 percent of the habitat that has gone from a suitability of one to a suitability of zero. So that's your local flow consideration.

Now, on the upstream movement of those animals, this would be a network calculation, meaning it matters where you are. The animal would move upstream, and if -- we will just say for sake that there was enough water below this diversion all the time -- that wasn't your example that you were using, but we'll say for sake that there is, these animals were able to move up to the barrier.

If the barrier is merely a gradually sloping cement barrier, these species most likely would climb over it and would result in no impact of the upstream habitat to those.

If it was, in contrast, an overhanging barrier where the example of the PVC pipe shooting water out into the air, it would restrict passage at that site 100 percent, or possibly during overtopping periods it would only be 80 percent. So we would now have a barrier impact to the upstream movement that is being calculated on all upstream sites, so overtopping 20 percent of the time would -- that

would result in a barrier 80 percent of the time. The 50 meters upstream of the barrier that had a suitability one, would now be 80 percent less, because these animals could not get to that site but under limited conditions.

Now, the animals pass that barrier. They're living up there fine because local habitat is excellent. There's no diversion. They reproduce, and their babies go to drift downstream. As we discussed, 80 percent of the time they would be entrained.

Therefore, the habitat value is decreased again because while they reproduce on the site, they're not actually contributing to the downstream population, because we're eliminating those young from the system.

So entrainment has an additional impact, and the suitability of those upstream sites would be further decreased.

And this highlights why passage and entrainment can have a large effect. It's not only local habitat, but it's the combination of those three, and where it is, what species it is and how suitability the habitat is.

Q Am I correct to understand that in my

hypothetical where you have diversion that's in the middle of the segments, in order to arrive at a calculation of the number of habitat units in that segment, you would have to calculate the number of units both upstream or above the diversion as well as below, taking into account the various -- the assumptions and the various outcomes that you've just discussed?

A Correct. You would calculate local habitat both up and below, and you'd calculate the impact upstream movement and downstream entrainment.

Q And you would combine the habitat units above and below to arrive at the calculation of habitat units for the entire segment, correct?

A Correct.

Q And in applying the assumptions of blockage of passage or entrainment, and the effects of that on the animals, you would apply a discount to the suitability value; is that right?

A Correct. Because habitat may look nice, but if the animals can't get to it, it's functionally -- for example, if someone builds you a nice house, but there is no doors to it, it's not a very suitable house. So there needs to be access to the site also.

Q Right.

And so if you look at the -- going back to Table 12, and actually the tables preceding it, because Table 12 is just a combination of all the habitat unit calculations in the preceding tables; correct?

A Correct.

Q So in looking at Table 12, in analyzing the number of habitat units for each segment, was there a site-by-site consideration of the location of the diversions and, therefore, their impact on amount of habitat due to entrainment and passage?

A Yes.

Q So the number of habitat units calculation takes into account then the effects of entrainment and passage, correct?

A Yes.

Q And is that -- for the reasons that you just discussed, the effects of entrainment and barriers to passage, is that why making modifications to diversion structures to restore connectivity at a small number of locations can result in large gains in habitat units?

A Yes.

Q Now, if you look at Table 13, if you have

page numbers, it's page 96. That table ranks diversion sites by the amount of habitat units that could be potentially returned at a given site, correct?

A Correct.

Q And each site is ranked twice, once for habitat loss due to flow diversion and once for barriers to migration or entrainment, correct?

A Correct.

Q And by barrier, loss of habitat by barrier, does that include natural barriers to migration such as terminal waterfalls or bermes at a stream mouth?

A Not at this table, but that is included. So natural barriers, heights of waterfalls and their location is -- if you back up to Table 12 in the estimate of habitat units naturally, that's taking into account natural barriers too.

So terminal waterfalls and all the rest, that is already included in the natural situation.

Q Okay, got it.

So on Table 13 though, in looking at the number of habitat units lost, and therefore potentially could be recovered, that number does not account for barriers due to naturally reoccurring barriers like waterfalls and bermes, correct?

A I would disagree with that. I would say it absolutely includes it, because the maximum restoration of units is including the natural waterfalls and barriers.

So if, for example, there's 2000 units in the stream, the stream could be extremely long but has a terminal waterfall, therefore only a few species can get up there. All of the impact of the barriers and flow disruption are only going to occur on the species that can get there.

So it has been addressed already, and the natural system is already in place here, the natural barriers are already included.

Q I'm a little confused, because my understanding which -- please correct me if I am wrong -- is that when we look at Table 13 of the Habitat Units Lost column that that figure, that column, reflects the total of habitat units lost on Table 12, either through flow diversion or migration barriers. Am I wrong?

A I guess we are disconnecting in our logic here, because what you're saying sounded correct there, but clearly you're asking me something -- the natural system is already included in it. And so this, for example, this would be putting your

diversion on a stream with a terminal waterfall that would have already eliminated a whole bunch of species. Therefore, the total habitat in the stream only includes the species that go above that waterfall. Therefore, the diversion can only affect those species that would have passed that terminal waterfall. So I'm not positive what you're asking me.

Q I apologize for that. Let me try again.

Maybe the simplest way is to look at Table 12, and use that as a starting point. On Table 12, the third column, total habitat units in a stream, you said that was undiverted -- I'm sorry, the amount of habitat existing under undiverted conditions, but that also includes naturally occurring barriers; is that right?

A Yes.

Q And then in the subsequent columns, what the calculation there is, is the number of habitat units remaining after certain conditions like flow diversion or migration barriers; right?

A Correct.

Q And so when we get to the seventh column, Total HU Lost, that's the summation, the sum of all the habitat units lost in the previous three columns,

correct?

A Correct.

Q And what I'm trying to understand is, is the Total Habitat Units Lost column, that figure, does that correlate to Table 13, Habitat Units Lost?

A Yes.

Q I think that's all I was trying to establish.

A The correlation will not be one-to-one in that it is saying the individual action in Table 13 that may be a portion or may be multiple diversions on these streams, so the single individual action that restores the most habitat units scores number one. Ultimately adding up all actions on a stream should equal this table.

Q Correct, okay. I think we're on the same page now.

Now, if a diversion were modified such that passage could occur, would it be true then that the 80 percent discount would not be valid anymore when calculating the number of habitat units available for that segment?

A For upstream passage, correct.

Q And similarly for entrainment for the downstream drift of larva, correct?

A Yes, that would be much more difficult to achieve, because remember they're passively drifting on water, so you would have to have a way to filter these out of the water. But there are ways that exist, so your concept is correct. You could design a system where entrainment was minimized and that would decrease those values.

Q And speaking of the downstream drift of larva, would you agree that native amphidromous species face many obstacles in order to successfully propagate, as a general matter?

A Yes.

Q Would you also agree that even under naturally-occurring conditions, undiverted conditions, that for larva to successfully drift down to the ocean and then recruit back is really a very challenging situation?

In other words, that there are again a number of barriers or number of obstacles that could prevent that from happening?

A Yes, but it's a site-specific issue. And that's certainly the intent of the model. If you have beautiful habitat not far from the ocean, then that's not that difficult for the babies to get to the ocean. But that same habitat far inland results

in all kinds of potential barriers, and that's part of the issue of site-specific nature of the modeling. So in general there are lots of troubles for the babies ahead of them, and it is not an easy path.

Q In fact, I read with a little bit of amusement -- maybe I shouldn't be amused -- but I think the analogy is interesting. On page 5 of your study, you compare the success of oceanic larva being able to successfully recruit to winning the lottery, don't you?

A Yes, this is Peter Sales (phonetic) work, and it was developed on coral reefs. These animals are very much analogous. They share the same life history as the majority of our coral reef animals. So they have a pelagic oceanic larval phase.

And if you look at these gobies, instead of recruiting to a specific coral-head type on a coral reef, they're going to a different exclusive habitat, a small stream on these islands.

So the analogy of what he was talking about, these animals drift on the open ocean, and then when they're ready to recruit, they have to be really lucky.

So what you see at a local site is not necessarily as simple as some situations where the

animals, there's sort of a direct relationship between their babies and the adults observe, so fish on coral reefs and in the streams tend to have very successful recruitment events that you'll see lots of animals from a single recruitment class, and then can have failures.

So it is very much a lottery sweepstakes approach to recruitment.

Q The oceanic larval pool, the plankton pool, does that consist of larva from just one stream?

A No, that would be a mix.

Q And is there scientific evidence that the larva in that pool necessarily recruit back to the stream from which they originated?

A There's conflicting thoughts on that right now. There has been some recent publications suggesting that they may be holding in the immediate vicinity of the stream mouth and recruiting back to the stream. There's lots of evidence that suggest that that's not happening also, and it could possibly be that both are happening, that sometimes they go to the open ocean and luckily recruit, and sometimes a portion of them are being held at the stream mouth and recruit back to that stream.

But that's unconfirmed right now in either

way based on studies available.

Q And given that conflicting evidence, is it strategic then, if you're trying to improve propagation of a particular species, to ensure healthy habitat and healthy propagation in a select number of streams in a given region?

A Basically, the better the habitat and in the wider distribution, the more larval output and the more chances that they have a place to land.

So, again, it's the better the habitat in general will produce more babies, and the better the habitat in general gives a larger dartboard to hit basically, if you can take that analogy.

So designing a reserve system, say, we are only going to protect one stream, or we're only going to protect three streams or eight streams, there's still a lot of uncertainty in that design. Put it that way.

Q We talked a little bit about losing stretches and streams -- or streams with losing stretches. Does the HSHEP model account for losing and gaining stretches?

A It didn't at this point. The production of this, no. It was merely reflecting what the USGS said was in those segments. And then the USGS said

well, wait, while we are going to have that much water going into it, it's not actually going to do what we were saying, so we backed off.

I guess DAR backed off on saying some of these sites would be so highly restored. So at the point of this model, it's better incorporated --

Q So from a habitat perspective, what is the problem with streams with losing stretches?

A They go dry. So fish need water. In a very simplistic approach, they need water to live in. If it's a losing segment and you have dry -- say you go a month without rain, those segments can naturally go dry and all the animals in them will dry up and die. So losing reaches have the potential of not being long-term suitable habitat.

Now, if the losing reach stays perennial, then that's not true. Again, there's a lot of -- USGS does very nice work on this system, but that doesn't answer all the questions, nor do our things answer every question. It's a very complicated system when looking at surface water flow in Maui.

Q If you've got a stream with a losing stretch, is one of the concerns that the animal might recruit back up while there is water, but reach a dry stretch and basically get stranded there?

A Yes. So the example of that, not so much losing sections, but diverted sections. When a stream is overtopping the diversion and wets the stream, the animals will recruit and attempt to move upstream. And then as flow drops, the diversion cuts off flow immediately, and we do observe animals stranded and dying in the stream.

So it would be almost the same thing. It might dry up more slowly than the diverted situation, but the outcome would be identical.

Q Is migration of the native amphidromous species a continuous year-round activity, or are there certain seasons for that to occur?

A It's not continuous, but it can be specific to moon phases and to months. And it appears to happen -- it can happen -- appears to happen at most any time of year, but it doesn't appear to be like a steady trickle of animals into the stream. So it tends to be a large recruitment that is not necessarily random, but not absolutely fixed in time.

Q In assessing the success or validity of the hypothesis for summer flows in the 2015 monitoring study, what was the metric -- what was the measure of success? I think you mentioned observing the presence or absence of animals in the pools.

Were there any other measures used?

A Yes. Let me jump over to that. There were three measures of success, and I want to make sure I get them correct, so one second.

Q Sure.

A So the three measures were --

Q Oh, I'm sorry. Where are you looking?

A Sorry. I'm reading off page 22, although it occurs multiple times in the report that I referenced.

Q Thank you.

A It looks like the lower half. Let me know when you're there.

Q I'm there. Page 22, there's two charts.

A The three areas would be changes in habitat. Did we observe -- I should say did DAR observe improvement in habitat, more habitats or more stream animals.

Second, did we see animals recruit to the area, and then did they grow. And so did we see these animals show up and exist over time.

And then the third one was to see about connectivity. Were we just seeing the animals appearing.

So I should have said those in a different

order. They need to appear, and then do they sustain and grow themselves at the site.

So there was the issue of just physical habitat measures. Secondly, do the animals show up. And then thirdly, if they show up, do they persists and grow.

Those are were basically the three things being looked at.

Q If you look at page 16 of the 2009 study, the summary bullet points that Ms. Sylva went over with you.

A Yes.

Q The last bullet point there says: "Management actions that maintain suitable water depth, especially at low flows, will assure nests and eggs of amphidromous animals do not dry up."

Do you see that?

A Yes.

Q Was there a measure, or was there observation of nests and eggs in the monitoring study?

A I really should defer to Glenn Higashi here. Yes, there was things like, they did observe the female shrimp, the shrimp that hold their eggs on their abdomen so you can see them. And various

different reproductive actions. I don't believe that direct nesting in the gobies was observed. I can go back and read for that specific thought.

But there were various reproductive observations made, and they were noted. So I don't know if that answers but --

Q I guess my question is, is that data, the data reflected in those observations, is that reported in the 2015 study?

A Yes.

Q And if so, where?

A In the description of each site, and then again in making conclusions about those sites.

Now that I've jumped over there I can point you out. I think it's almost more in the conclusions than in the results, but it may also be in the results. So I am in conclusions right now. I'll have to go back and hunt through the results.

But in the conclusions there's a discussion in Changes to Stream Animal Populations. And in the second paragraph Macrobrachium grandimanus, which is a native shrimp, was observed in the lower stages of all three streams in different size classes with varied females. This supports growth and reproduction. And so it walks through. We see egg

capsules present.

And then it also says while no reproduction was directly observed for the gobies, they were consistently observed in multiple size classes, according the contention that the lower reach conditions were suitable to recruit growth of these species. So where they were observed, we tried to include it in the report.

Q But was there any enumeration of number of animals that were buried, that were observed, was that reported in your study?

A Again, I think Glenn could -- I wasn't in the field with this one, I was helping with the report.

Appendix 1 shows the monitoring field sheets, and so on the back page of that it has sort of the notes of the species occurring and the abundance.

And so I think Glenn Higashi and Skippy Hau are the ones to answer this question, how did they note the presence of reproductive ability in this.

Q Okay, that's fine. I'll ask them.

A It would be enumerated in the field sheets that DAR has from the sites.

Q Just a couple more questions, and I think

we're done.

On page 29 of the 2009 study, it's a review of the model itself, and step three says that the model validation is reviewed by species authority, and that at the time the model was still undergoing peer review.

Has that review been completed?

A Well, that's a great question. So in one sense, yes; in one sense, no. It has actually been applied now to multiple of these cases, so your review here, and multiple other people's review of it has occurred. There's a lot of people who have looked at this now.

Have we published in terms of a peer review on the science side, no. So it has just undergone peer review by the Army Corps of Engineers Pittsburgh Waterway Station. That is complete at this point, and it is not yet published.

So I have that on my desk, so I do know what the thing is, but that isn't available yet for you all. So the peer review is at that point.

Q Is the monitoring report in 2015, is that in part of the process for validating the HSHEP model?

A No. It is directly -- no. It was really

trying to understand whether the direct application of the seasonal flow amounts worked in a very simple sense, because part of -- and this is not only true in Hawaii, but true with every place that we work, and in the sort of the overall stream and river issue the adaptive management paradigm in that we make these assumptions, and we make these models and we set these levels. Do they actually achieve anything?

And so this was more of a response of an adaptive management of, it seemed like a really good idea with a lot of support behind it, but did it actually work?

And so that's a validation of the model directly at site, but not a validation of a model of, say, take random sites across the state and apply them in the statistical approach.

Q And speaking of the monitoring study, why were there only three streams selected as a subject of that study when there were more streams where additional flow was released?

A I know the answer, but I will defer to Glenn Higashi on this one.

Q Fair enough.

I believe in an answer to a question from Ms. Sylva, you said that the hypothesis with respect

to the winter flows was confirmed, is that a fair restatement of your answer?

A It definitely has not been invalidated, so there isn't a huge amount of proof that it was great. Like we didn't get this gigantic response that occurred everywhere at all sites, but it does appear that we were seeing a positive response from the winter flows.

Q And I ask you that because throughout the study there were remarks that the correlation between return flows habitat and biota was weak.

A Oh, absolutely.

Q Is that what you meant by it's not invalidated, but neither is there strong proof that the hypothesis is correct?

A Exactly. So from almost professional experience looking at the results, you could see some positives, but it's hard to tell whether -- we don't see any positives in the summer flows. It's hard to tell whether the summer flows we lost the gains that we would have been seeing in the next winter flow, so there was a confounding impact that maybe the winter flows just weren't good enough also, but there was indication that they were.

And so at this point I would go as far as

saying the winter flows were insufficient. But there is also not outstanding evidence to say that they are sufficient. But at this point, it's up for argument basically.

Q Is there a way to determine if the results in the monitoring report are reflective of errors or inaccuracies in the HSHEP model as opposed to other factors like sampling size or lack of flow, other factors?

A All of those other factors go into your unexplained variance in a statistical sense, so it would have had to been designed to partition those various errors to be able to differentiate the error that is sort of the natural variability of recruitment or seasonal rainfall versus model. It was not designed to separate those components of error.

With that said, and having now used the model across Hawaii in various places, we are seeing really good reflection of what it's telling us should be in these streams, and what we're actually seeing. So that is yet to be out in peer review for you to cross-examine me on, so it's an opinion you're hearing from me.

But we are seeing places, for example in Na

Wai Eha streams where USGS surveyed, and they said it was really strange, we didn't expect to see these animals in this location. It turned out to be one of the most highly suited area for that species. It was just sort of a weird quirk of stream geomorphology.

But the model was capturing that and telling you that's where you should have expected them. But it's hard to see that when you're surveying on the ground to see what's going on in the whole watershed.

So there is a number of events like that that suggest we are right on target that I can give you. Anecdotally now, as the peer review comes out, that will have more evidence to support that.

Q Are there any current plans to tweak the model?

A Yes, it's been ongoing. And the model we're discussing here was the first application. And yes, there have been improvements to the model. One of the major improvements was this was an instream flow battle, and still is a lot of times in Hawaii in the sense of that's one of the major issues. So things were focused on instream flow very heavily.

It's expanded to look at any stream channel modification flow, whether channelization, whatever

is going on, so that it's no longer really focused on the instream flow and still captures that, but also captures all of the other things that can happen to a watershed or a stream.

Q Thank you very much. I have no further questions.

HEARINGS OFFICER MIIKE: Anybody else?

MS. SYLVA: Yeah, just a really quick two or three questions.

RECROSS-EXAMINATION

BY MS. SYLVA:

Q Summer Sylva again.

Regarding the discussion on modifications to the diversion structures, you know, would you agree that the effectiveness of those modifications depends on their design?

A Absolutely, 100 percent.

Q So any associated gains with respect to the increase in habitat units are necessarily connected to how effective that modification design is, correct?

A Correct. And that's why I kept saying it's a site-specific issue that's hard to give a generality.

Q So have you seen any modifications applied

here to any one of these 27 -- one of these streams? And I ask you that without looking at a photo that I believe was emailed to you recently.

A Yes, I did get that. Let me get over to that, and then we can specifically address that.

Q And we're circling back to photo 19, November 16th modification, photo from the field updates which were part of Dean's submission.

MR. YIP: So what was the date?

MS. SYLVA: November 16, 2011, I believe.

A That was which, the field investigation of --

Q Of Honopou, November 16th. So November 16th modification photo number 19.

A One moment. I got two e-mails in, and that was not the one you were asking about. Okay, so this was Alan's one, 11/16; correct?

Q Correct. And it's the email from you. And basically my question is: The modification that you see there to the left in photo 19, it's about -- previously Dean estimated that it was about a six-inch wide ramp created to allow for the kind of passage, fish passage along Honopou Stream.

Is that an adequate modification, in your opinion, particularly if you understand what the

width of Honopou Stream is at that diversion point?

A Well, I'm going to caveat this in a whole bunch of ways.

One, this is directly testimony. And so if I'm going to answer you from a perspective, which is the way I view these things, this is a directly testable situation to understand how passable this site is, both in upstream and downstream directions.

So it can actually be looked at in terms of how suitable this is for passage, and how much potential for entrainment or blockage in both up and downstream directions there are.

And so from this picture, would I say is this what I would consider a perfect like 100 percent thing? No, not at all. But what was trying to be achieved here is a different question.

And so I think in general, one of my takes on these diversions and entrainment issues is the attempt to make a passage as far away from the diversion as possible.

So in not all cases is that an easy thing, especially with these grates that run across the bottom of the stream. But there are also diversions that are side diversions. And so to try to get the animals away from the actual diversion, in this case

you can say there's still, you know, drops and everything else, but these animals do move up relatively small, wetted pathways. They're not moving up the center of exploding, torrential flow. They're kind of going up the edges of it.

So providing a small trickle of flow may actually provide passage. But it is testable. Don't get me wrong. You can trap on both sides of it. You can do a lot of things. You can downstream drift, propagules that are the same specific gravity of these eggs, you can do all kinds of things.

Looking at this you can make that assumption, and there have been discussions about this. There's a huge amount of literature in the fisheries world about fish passage both up and downstream.

So I'm not going to answer you maybe like you want to say this is good or bad. I'm going to say that this may have some positive impacts, but it's unlikely to be the best possible solution --

Q And to the best of your knowledge --

A -- in terms of fish passage.

Q Got it. And to the best of your knowledge, have these kinds of passages been tested on these streams thus far to date?

A I do not think they have been tested to date. And it has been an on-going discussion. And I don't mean to knight for DAR, but it is limited budgets that determine it. Getting out in East Maui and doing a four-year study takes a lot of time and effort.

And so addressing the instream flow issue is a priority. Addressing these fish passage issues is a priority. It's just another priority. And so I think it is really important to look at that, because of the potential gains that you could get for these species with basically a modification, not a restriction of water.

So the restriction of water use is a different issues. You can do a lot of good things with passage, and so I think that both of those issues are very important to look at.

Q Okay, and my final question -- I'm sorry, you wanted to say more?

A I'm done, thank you.

Q And my final question is: Regarding the winter flow results from the 2015 study, if I understand your earlier testimony, it's not absolutely conclusive, which I think you said flow values, or at the very least not invalidated, and

that the flow amounts were not necessarily insufficient at this point.

Would you agree that more flow, not less flow, would provide further clarity on the benefits, if any, of streamflow restoration efforts?

A By definition 100 percent flow will improve habitat. So probably from a scientific perspective, setting up a direct study in which you had a set of streams with some at 20 percent restoration, some at 50, some at 80 that are in close proximity, while you're also looking at recruitment, would be an approach to look at your application of instream flow.

How much of this is the result of variety of recruitment or other issues, and how much of this is actually insufficient flow. That's why it's so hard to give you a direct answer to that right now.

But it does appear that the winter flows had some positive influence, and so your characterization is true. And it's also true that more water is better for the fish by definition in the model, and I'm speaking in terms of how we modeled it, that's an assumption.

Q Thank you very much.

MR. HALL: I have literally two.

HEARINGS OFFICER MIIKE: I'm going to ask a question first.

Since the model was a model, it put out a hypothetical number that would be sufficient for reproduction and recruitment, et cetera.

It's not surprising that you're not going to get the answer that you got when you put the water in the first time, correct? That's basically a way of seeing where you go from there?

THE WITNESS: Correct, I agree with that.

HEARINGS OFFICER MIIKE: Okay, thank you. Mr. Hall.

RECROSS-EXAMINATION

BY MR. HALL:

Q Dr. Parham, you talk about the cost of modifying the diversions. Is there any document that was submitted that included estimated costs?

A None that I'm aware of. The costs were extremely crude in terms of -- I wish I could pull up some of these pictures -- in terms of just looking at the site and saying, is this something that could be modified.

For example, I think East Maui -- I mean East Maui -- East Wailuaiki -- pulling this out of my head -- is an example of a diversion in which there

is a natural stream channel that flows by the diversion. There's a small dam placed upstream, and it pushes it into a second channel that goes to the diversion. It would be relatively easy to notch that little upstream thing and create a bypass channel up the whole diversion. Any animals moving upstream or that got caught in that bypass channel downstream, are independent of the diversion. A very simple V notch kind of fix. Other sites, there is no easy way. Maybe they're located in a very steep and torrential spot, you have to build some kind of passage that doesn't get destroyed by the boulders, or it's just not an easy engineering fix to see the amount of stream power and the size of the boulders that roll down these streams.

It just wouldn't be simple to figure out how I would put something in here that doesn't get destroyed in the next big flood. So that's as crude of an estimate as there was, just looking at it, is there obviously a simple fix here or does this look like a site that would require some serious study in how to get passed it.

Q So there's no documentation of that on a diversion-by-diversion basis?

A So the documentation was in the 2010 DAR

letter to CWRM about -- and in the green columns one of them was point of diversion, cost or difficulty. I'll pull it back up and tell you exactly. One moment while I pull that one back up.

It's down at the end, it's in Table 1, Recommended East Maui Streamflow Ranks. And POD is point of diversion effort to fix, and there's a ranking placed on that. And that was DAR's expertise given they surveyed it, spent a lot of time in that area, and looked at a lot of pictures and things like that.

Q There's no --

A Very crude.

Q There's no figure for what it would cost to modify any particular diversion?

A No, right now -- again, I'm probably jumping way out of line. There have been discussions and the approach I was saying we need to do on these diversions here is address this general concept of these stream diversions, because there's only really a few ways that these streams are modified, really. Amount of grade, a side grade, and few other things.

So we take those, and we overlay your typical fixes and then run it across the engineers, and they could give you ballpark costs to put in. So

you'd begin to look and say, oh, we might have to spend a million dollars to gain very little in this case, but this one could be done with a couple bags of cement.

But, again, this would require some on the engineer side folks and the construction folks to come in and give that sort of treatment so that we could look at it, and actually have some validity to our cost estimates to repairing these things.

Q Just the last question. I know Mr. Yip asked you about making modifications to the diversions and for entrainment purposes and for fish passage purposes. But in most instances the benefits of those won't come unless there's sufficient flow in the stream in the first place; isn't that right?

A In a very general sense, yes. But much -- in these diversions which we're talking about overtopping, there will generally be water in the channel during the overtopping event, so these animals potentially could get up through that area and pass the barrier during the event. But that's a small window in a lot of these. That's why the restriction of passage is so strong.

But I think that restoration of flow, passage improvements and reduction of entrainment are

all very important, and they should all be considered. I don't think any one of them is the answer by itself.

Q Thank you.

HEARINGS OFFICER MIIKE: Thank you, Dr. Parham. You've been very patient. So thanks again, and we're going to sign off.

A Well, thank you. Great talking with you all.

HEARINGS OFFICER MIIKE: Let's adjourn until quarter of 2:00. It's now about five past 1:00.

(Noon recess was taken.)

HEARINGS OFFICER MIIKE: Let's go back on the record.

Our next witness is Glenn Higashi from the Division of Aquatic Resources. Before we open him up for cross-exam, I just want to offer him as a witness in aquatic biology, expert in aquatic biology. Go ahead.

GLENN HIGASHI

Was called as a witness by and on behalf of the Hearings Officer, was sworn to tell the truth, was examined and testified as follows:

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CROSS-EXAMINATION

BY MS. KALAMA:

Q Good afternoon, Mr. Higashi. Should I call you Doctor?

A No. My education is not high enough.

Q But you definitely have a lot of experience. I see, 29 years working for the Department of Aquatic Resources.

A That's correct.

Q By the way, I'm Camille Kalama, for Na Moku Aupuni O Koolau Hui, as well as Lurlyn Scott and Stanford Kekahuna.

Could you please tell me what is your current position at the Division of Aquatic Resources.

A I am an aquatic biologist at the Division of Aquatic Resources. I've been working there about 29 years now mostly in the freshwater side. I was working in the marine side before.

Q And have you maintained the same position throughout the 29 years?

A Well, when I first started I was -- I shifted over to the State. And I was in the marine side for about ten years, then I moved over to freshwater.

Q So about how long have you been an aquatic biologist in the freshwater systems?

A About 19 years.

Q And in terms of, I guess, your authority there, do you supervise others? Or are you a supervisor? That's the same question.

A Well, I don't supervise other biologists. I work with other biologists and supervise technicians, and I do most of the stream work now for the Division.

Q And is there currently a Director for the Division?

A No, the position is vacant. We have an acting one though, Carty Chang is the Acting Director, Administrator for Aquatic Resources. The position that was I guess last filled by Dan Polhemus is not vacant.

Q Is Carty Ching still the Acting Director given the nomination of Carleton Ching?

A Yeah, he's kind of wearing two hats, I guess you could say, because we don't really have an Administrator, per se. We're seeking one right now.

We also have three acting program managers, so our Division is doing a lot of acting, so to speak.

Q Well, just so I have a clear understanding, if DAR was to make recommendations to the Water Commission in this proceeding at this time, who would have authority to make those recommendations, or at least to finalize those recommendations?

A Well, I guess that was one of the things that was concerning me when I was asked to testify by Dr. Miike, whether I could represent the Division or not.

And our previous Chairperson, which was William Aila, who is also the Acting Administrator for the Division, signed off on that, and says I could represent the Division in that area.

Q So could you tell us today what DAR's recommendations would be for the 27 streams at this time?

A Right.

Q You were here for the testimony of Dr. Parham when he spoke about the 2009 HSHEP report?

A That's correct.

Q So without walking you through everything that we've already covered, I would like to briefly go back to the report summary of each of the streams that were studied.

I believe there were 16 streams, is that

correct?

A Uh-huh.

Q And you heard Mr. Hall review all the conclusions for each stream with Mr. Parham, correct?

A Yes, that's correct.

Q So based on my understanding from reading this and what I heard today from Mr. Parham, would you agree that the only stream of the 16 that are covered in this report that would not experience an increase in habitat units from restored stream flows was Ohia Stream; is that correct?

A Yeah.

Q So in other words, every other stream that's covered in this report, would experience an improved habitat restoration from the addition of streamflow?

A Yeah. Any stream that you have in Hawaii that you put more water back into will benefit from restored stream flows.

Q I would like to turn your attention to page 77. I'm not sure yours has page numbers.

A No.

Q Well, this is right before the General Conclusions of that study. Do you see the section entitled Prioritization of Restoration Efforts?

A Yes.

Q Well, in the second paragraph in that section there's a discussion of what would happen, for example, if water was returned to the top 20 sites, there would be a return of 75 percent habitat units, if I understand it. And the top 25 sites would return 84 percent of the habitat units.

So is my understanding correct that the modeling runs were used to look at how much habitat would be restored if you returned flow to the different sites?

A That's correct.

Q And there were ranges given, for example, if we do 20, like it says here, if we do 25, you'll get this much, and that you folks actually did that with the model?

A Yeah.

Q Were those results ever provided to the Commission on Water Resources Management?

A I think just the ones -- if this is similar what you're talking about with report cards, there was only eight of them worked on. The rest, the other 19 were not worked out.

Q Why is that?

A Timewise, we didn't have time to actually

do all 19.

Q And if you had time, do you have the data in hand basically or available to complete that?

A We would probably have to collaborate with Dr. Parham on actually getting the data he has, and try to arrange it into those cards.

Q So he has some of the data that you don't have or DAR doesn't have?

A Yeah. And then there's also, if you looked at the report cards, there was also a map on the left-hand side which showed where the diversions were, and that was basically provided to us by CWRM.

Q Okay. Well, we'll get to that shortly.

Now I'm looking down on the same page 77, there's a sentence that says, it starts about the middle of the last paragraph.

It states that: "Given the importance of freshwater for human use, using the results of HSHEP to provide guidance in choosing the most effective management actions aimed at improving instream habitat." Do you see that?

A Uh-huh.

Q So in other words, this model was really telling you how much you could restore using the least amount of water available; is that right?

A Yeah, I think it was looking at what was minimally required for the habitat for the animals. This model was really based on over 9,000 animal observations that we had done ourselves from our surveys. And these requirements were actually incorporated into the model.

Q I see. Do you see about two sentences later it says: "This gives DAR the ability to develop statewide management and restoration targets for native animals in Hawaiian streams"?

A Uh-huh.

Q My question is, when it comes to the authority of DAR, does DAR have any authority to control which streams are restored and which are not?

A No. We can only make recommendations to CWRM.

Q And then CWRM ultimately makes that decision?

A Yes.

Q I'm going to turn your attention to Appendix B that was attached to your declaration. This is the letter of December 15, 2009, from Dan Polhemus to the CWRM.

Now my question is, were you a part of creating or developing the recommendations that are

included in this letter?

A We did have input to the letter.

Q When you say "we," who are you referring to?

A Myself, Robert Nishimoto, and Jim and a few of the other biologists.

Q And so how -- if you can explain how you got from the conclusions in your 2009 study, which basically concludes that restoration to all but one stream would result in positive habitat restoration, down to the eight streams that were recommended in this letter, the 2009 letter?

A Well, there was -- again, and I think Dr. Parham had addressed this earlier when he talked about looking at the eight streams that were related to taro production. And this is what we were told by CWRM, that the ones that we needed to look at that was important, so this is where we went.

Q I see. So you're referring to looking at the 19 of the 27 streams?

A Yeah.

Q Now, specifically with this letter, the Polhemus letter, there are only eight streams that are included in DAR's recommendations. And I'm wondering -- my understanding from Mr. Parham's

testimony was that he was not part of picking and choosing the eight streams to recommend; is that correct?

A That's correct.

Q So how did DAR decide on recommending only these eight streams for restoration?

A Again, we were directed by CWRM.

Q You were directed by CWRM to pick these streams?

A Yeah, to look at these streams.

Q And in particular, only the eight of the 19?

A Well, we did surveys on all of them, but we did not direct our efforts towards all 19 of the streams. And we were directed towards the eight streams that they felt we needed to look at.

Q So CWRM actually chose these streams for you to look at, these eight in particular?

A Yeah.

Q Do you know why that is?

A Again, I think it's because of the fact that they're associated with taro production.

Q Just to be clear, these eight streams are not the taro streams.

A These are taro streams as well.

Q No, I know it's confusing, because it's eight and eight, but these streams are actually not prioritized for taro, I'll represent that to you.

A Okay. Well, according to the letter that NHLC and CWRM that I guess these were the eight of the 27 streams that we needed to focus on.

Q Are you looking at something in particular in this letter?

A This line here (indicating).

Q So we're talking about the first paragraph where it says: "NHLC and CWRM staff reached an agreement that efforts would focus on eight of the 27 petition streams"?

A Right.

Q So they're listed right there, where it says Honopou, Hanehoi, Huelo, Waiokamilo, Kualani, Piinaau, Palauhulu and Wailuanui streams; correct?

A Correct.

Q And then it says: "Subsequently, CWRM began deliberation for setting IIFS for the additional petition 19 streams."

Do you see that?

A Uh-huh.

Q And so in this letter it says that the DAR provide recommendation focused on the additional 19

streams.

A That's correct.

Q So my understanding is that when we look to pages 2 through 4, we're looking at streams that are in that 19 --

A That's correct.

Q -- remaining streams. Okay.

So, again, when I look at the eight streams in this letter, my question is, how did DAR decide that they would only recommend restoration for these eight of the 19 remaining streams?

A I think with the HSHEP modeling, this is some out of the 19 streams, these are the eight streams that we came up with.

Q And would this be like minimum that DAR believed was acceptable for habitat restoration to support these stream animals?

A I think it was with the habitat units, it was the most habitat units, probably the higher habitat units in the east of restoration with the criteria for selecting these streams.

Q I understand. You're talking about the consideration that the model took into --

A Yes.

Q And as far as the model, did the model say

to pick only eight of the 19 streams for restoration?

A No.

Q So at some point there was a decision that these eight would be the only ones recommended for restoration?

A That's correct.

Q And was DAR, to your knowledge, given any directive as to how much -- how many of these streams could be restored?

A I don't know. They may have told, they may have told Dan that, you know, he could have done whatever with the eight, or he could have done more, but I wasn't in charge. He was the one who wrote this letter, so he probably would have more information than I would as far as how we went about getting just eight.

Q But as far as the model is concerned, you could have provided -- or DAR could have provided information as to all 19 streams?

A Yes.

Q Do you remember when this letter was submitted to CWRM, on December 15th?

A Yeah.

Q And if you recall, there was a CWRM meeting on December 16, 2009; do you remember that?

A That's correct.

Q Do you know why this letter came out one day before that meeting with these important recommendations?

A Well, at the time I think CWRM wanted some kind of instream flow idea about, you know, which streams could be restored. So I think Dan felt that it was DAR's obligation to provide this recommendation.

Q And you were part of making this recommendation, correct?

A Yes.

Q Well, if we took a look at page 2, the third paragraph down, there's a bolded sentence. Could you read the bolded section for me?

A "Although the DAR understands that some water will continue to be diverted from East Maui streams to meet such needs, the DAR feels that the continuance of the status quo for all but one of the stream diversions as proposed in the current CWRM petition is unacceptable, and therefore, has provided recommendations for additional restoration actions.

Q Could you explain that? Are you able to? Let me see if I can back up.

So your study came out in November of 2009

HSHEP report --

A Uh-huh.

Q -- in which you included, or the collective of authors included recommendations and conclusions for each of the 19 streams. And then at some point CWRM had suggested restoring one stream. Is that what I'm getting from this bold statement?

A I'm not sure that they suggested just one stream or not.

Q Well, the part you read that says, "DAR feels that the continuance of the status quo for all but one of the stream diversions as proposed in the current CWRM petition is unacceptable."

A I guess that's what Dan felt, that they felt that there was only continuances of status quo for all but one, then he felt otherwise.

Q And as part of making this recommendation for the eight streams, would it be fair to say that this was a reaction to the CWRM's proposal restoring just one of the streams?

A I don't know. I can't answer that question, because I don't know how he figured it out.

Q But you were involved in --

A Yeah, I was involved in making the recommendations, but I wasn't -- the final decision

of what he wrote in this part about the one stream.

Q Well, as far as your involvement, how did you come to decide that only eight would be recommended of the 19?

A Again, going back to the HSHEP model with what we went through, you know, based on the amount of diversions on the streams, the amount of habitat that we would gain from each one of the streams that would actually put the water back, these were the ones that we actually came out with.

Q Looking at page 4 of the Polhemus letter, can you read the last sentence before "sincerely"?

A "The above recommendations proposed flow restoration on only eight of the 19 streams under consideration, but would result in restoration of 45.8 kilometers of native species habitat units, out of a total of 67.3 kilometers of habitat units currently lost as a result of the major ditch diversions."

Q And that last sentence.

A "They therefore represent a significant return of ecological function based on a modest investment in flows restoration, and we urge favorable consideration."

Q Okay. So would this be essentially the

biggest bang for the buck theory?

A I think that's probably really what it's indicating, yes.

Q And where it says "a modest investment in flow restoration", to your knowledge was DAR given any indication of what amounts would be considered for flow restoration?

A No, no.

Q So this was based on DAR's assessment of what would be modest and reasonable?

A Yeah, that's based on what we came up with as far as what we thought Dan required.

Q But going back to the 2009 study which was using the model, there were actually different scenarios that were run through that model; isn't that right, as far as how many of the multiple diversions were considered?

A Yeah. I think that they're listed different multiple diversions. And again, I think more of this came out in that following letter in 2010, the one that actually Dr. Bob wrote to Ken Kawahara.

Q That's fine. We can move on to Appendix C to your testimony, the April 1st, 2010 letter.

Is that what you're referring to?

A That's correct.

Q Now, as far as this letter, it includes attached so-called report cards for the eight streams that were recommended; correct?

A That's correct.

Q And so you testified earlier that DAR simply didn't have enough time to generate these same types of report cards for all 19 streams prior to the date of this letter, I suppose?

A That's correct.

Q But if asked, and given the cooperation of Dr. Parham, DAR could generate similar types of report cards for the remaining, or of the 19 streams; is that correct?

A Yes. But then again, no, because right now as far as our stream programs are concerned, in 2013 it ended. So actually any type of funding we have for stream work is not being funded directly from our stream program any more. It's just doing the work as general funds.

Q So does that mean if DAR was asked to provide such a report, that additional funding would also be required to support them?

A That's probably -- yes.

Q But as far as the data that would be

required is generally available?

A Yes, it's available.

Q And similarly, if you look at the tables on the last page of that same Appendix C, I see that the tables also only cover the first eight streams.

A That's correct.

Q And similarly, could these tables be -- could you generate tables to include all 19 streams if asked and if funded?

A I think so.

Q How about all 27 streams, would DAR be in the position to also generate that for those?

A Again, yeah, I think so, with the funding and the help, with the collaboration with Jim.

Q Do you have any idea how long something like that would take?

A I don't have any idea, because he's the one who gets data from the model.

Q Now, looking at the April 1st, 2010 letter itself, there are a number of bullet points which basically, I understand, cover DAR's general position on stream restoration; is that correct?

A That's correct.

Q And beginning with the first bullet point, it refers to DAR supporting minimal viable habitat

flow at 64 percent of median baseflow, you see that?

A Yes.

Q And is it still DAR's position that 64 percent of median baseflow is the minimum necessary to provide the suitable conditions for growth, reproduction and recruitment of native stream animals?

A Yes and no. It depends, I guess, the amount and what stream we're talking about. What we found out from the 2015 report, that I think the 64 percent was close to what the winter flows were. However, the time of the study was not long enough to really conclude whether it was working or not, or whether it was sufficient for all these biological activities to occur. But we definitely found out that for that second bullet the minimum flow was not enough.

Q So as far as DAR's current position, the second bullet point is no longer valid?

A No.

Q And how about the third bullet point talks about seasonal flows. Is that something that DAR is still supporting as a possible restoration effort?

A I think the seasonal flows kind of went out with the second bullet point.

Q And how about the remaining bullet points

in terms of avoiding entrainment, restoring streamflow that reflects the water budget, catchment, avoiding commingling, and restoring a broad range of streams?

A We still support the rest of the bullet points.

Q With respect to the last one as far as a broad range of streams to support the stream animals, were you here when Dr. Parham referred to, or was asked about basically these larvae winning the lottery if they return to the right place?

A Yes, I was here.

Q And wouldn't it be like giving them extra tickets to the lottery the more streams you restored?

A That's true in one sense, but in another sense we're finding out that some of the streams -- and these are under research, we're finding out that some streams are sinks and some streams are sources.

What I mean by sinks and sources is some streams produce a lot of babies, so they actually help the population; and others, the animals go in it and basically there's not enough habitat or water in those areas where they can actually reproduce and provide viable offspring, so those areas are sinks. They just take in the progeny. Once the progeny

grows up to be an adult, then that's it. They don't reproduce in there. There's not enough water or habitat.

Q And in some cases would that not enough water habitat be caused by diversions?

A Not necessarily by diversions. It just depends on the geography and geological characteristics of the watershed.

Q Are you referring to losing stream reaches?

A Not necessarily losing stream reaches, but we have seen intermittent streams that have very healthy fish populations above the intermittent area. So when you have freshets and there's a connection between where the water is and where the ocean is, that dry area becomes wet. Those are actually areas that actually provide progeny for the gobie population.

Q So if I understood what you just said, in some cases intermittent streams still provide suitable habitat?

A They could be intermittent or they could be perennial, yeah. But I was just giving you an example of intermittent streams, because people think that intermittent streams are really not functioning streams, but actually they are because of the nature

and the dynamics of Hawaiian streams with the rain, that that dynamic actually -- the dynamics of the rain and freshets is actually what triggers the spawning and recruitment.

Q So would it be fair to say that losing reaches are intermittency alone would -- could not be alone the factor not restore a stream?

A Yeah. I think the losing reaches are -- the problem with the losing reaches, yeah. It couldn't be a factor alone, but it does prevent connectivity between ocean and upper areas.

Q But in some cases those events, like rainfall events, then connect those areas?

A That's correct.

Q Now, I understand that there wasn't enough time to create report cards for more than the eight streams that were recommended for this April 10th, 2010 letter. But wouldn't you agree that it would be useful for the Commission to have that kind of information as the ones who are making the policy decision about restoration?

A Yeah, I'd say so.

Q Because, again, DAR is not -- has no authority to actually determine which ones, which streams are restored and which are not; correct?

A That is correct. But we were just looking at which ones would be the easiest for restoration purposes, and habitat, habitat gain.

Q And looking at page 2, it's not numbered, of the same letter, there are a number of factors listed, or criteria, I should say, that it says DAR used to reassess the streams recommended for restoration in East Maui. Do you see that? It's on the top of page 2.

A Uh-huh.

Q So where it says -- actually, I should ask you, this is a letter from Bob Nishimoto?

A Yes.

Q Do you know where it says -- were you a part of drafting this letter?

A Yes.

Q So do you know where it says that DAR used several criteria to reassess the streams, is it talking about reassessing the recommendations made in the earlier Polhemus letter?

A That's correct.

Q And in looking at those recommendations, I understand that -- well, it says here that Honomanu and Makapipi were eliminated for consideration after consultation. Is that right?

A That's correct. We were told that they were a -- particularly Makapipi -- we were told that was a losing stream and maybe Honomanu too. That's what Jim was talking about.

Q And Honomanu was, in fact, the number one priority for restoration from the 2009 study; correct?

A Correct.

Q And were you part of the consultation with CWRM, USGS and Bishop Museum that this letter refers?

A Yes.

Q And during that consultation, was it your understanding from input from these other agencies, that restoring water to Honomanu could not basically restore that losing reach that is in Honomanu?

A At the time, like Jim was saying, at the time that USGS told us that it was a losing reach, we weren't aware of that. What he had said later on, that basically they put water back, it may not be losing water.

Q And knowing that now, does that change your -- as far as DAR's position, on recommending Honomanu for restoration?

A It would be something to revisit and look at, yes.

Q How about Makapipi?

A Makapipi, we were told that that was a losing stream by CWRM, so we wouldn't consider that.

Q And just like with Honomanu, if you understood that a losing reach could be reduced or eliminated with the return of stream flows over time, would that also change your position as to Makapipi?

A Again, we'd probably want to revisit that --

Q Are you aware --

A -- that data.

Q Sure.

Are you aware that USGS studied a controlled release of Makapipi?

A No, I'm not.

Q Would that information help to further inform DAR's recommendation as to Makapipi?

A I'm sure -- if I wasn't aware of it, that Bishop Museum, that Jim Parham was aware of it. And I would probably refer to him on whether that would affect Makapipi or not.

Q As far as the modeling?

A Yes.

Q So Dr. Parham actually runs the model and then provides results to DAR, is that how it works?

A Right.

Q Now, if you see number -- where it says fifth, the number and difficulty of modifications for diversions was considered. Do you see that?

A Yes.

Q And in considering the difficulty of the modifications, in other words, is that what informed DAR's recommendation on which points of diversion to modify or not?

A It did come into play in the selection of streams. If you have streams that have three diversions on them, if you can't fix the passage and you actually restore flow, it doesn't make any difference to if the fish can get past the first barrier, if they can't get past the second or third barrier.

Q If you see the sentence that follows, it says that: "Our current assessment of this factor would be improved through consultation with HC&S, CWRM, and other experienced engineers and fish passage experts." Do you see that?

A Uh-huh.

Q And has that kind of consultation happened since the date of this letter?

A No. There were ideas thrown around, but I

don't think we've really brought in an experienced engineer with a fish passage expert to actually look at it.

Q And in reviewing these modifications for diversion, did you ever come across documentation or anything regarding the cost to modify those diversions?

A No, we never got that far.

Q And why not?

A Well, that's a good question. I guess it's just getting the people together, getting the different groups together and trying to figure out what would best work with the different diversions, and it would be something that you couldn't do an overall fix for all the diversions.

Like Jim was saying, some of them are, you know, take the whole stream width, some are on the side. So it depends on the specific diversion were you look at.

Q Sure.

And, however, CWRM did determine that some streams would be restored in 2010, correct?

A That's correct.

Q So for those streams that had some restoration, was DAR involved at all in reviewing or

assessing the modifications to the diversions on those particular streams?

A We looked at the ones that they were -- they had modifications on, but we hadn't done any surveys or anything to find out if they were valid or not.

Q So in other words, DAR has never evaluated the effectiveness --

A No, no.

Q Now, in six it says, we considered the efficient use of water in terms of the rate of habitat units restored of water returned.

Can you explain what that means as far as efficient use of water?

A I think it's referring to specifically the habitat units.

Q As far as efficiency, is that also referring to the biggest bang for the buck theory?

A I guess the most wise use would be a better word than more efficient.

Q The most wise in terms of --

A For the habitat in terms of the rate of the habitat units restored.

Q But that's not the same as saying this is the best for the fish and the habitat, is that

correct?

A No. I think take it in a way when we looked at it, we did consider the best or wisest use of the water returns for the habitat units that were -- where water was returned.

Q But isn't it assuming that you cannot restore at least a minimum level of habitat to all the streams?

A What do you mean restore the minimum habitat?

Q I mean, when it says "efficient use", there's a determination that you're picking and choosing which streams to restore versus providing the information to the Commission on restoration.

A Yeah, probably it's indicating that we were looking at what streams would have the, I guess, the best habitat, efficient use of the habitat restored for water returned for the specific streams.

Q And, again, DAR provided recommendations for the eight streams that it determined should be restored, but did not provide the information for all 19 streams; is that correct?

A That's correct.

Q Now, you see seven, it says, we evaluated whether the stream was commingled with ditch water

and whether to restore there. Do you see that?

A Uh-huh.

Q And in looking through the stream report cards, I noticed that one stream does refer to that commingling, and I believe it's Kopiliula?

A Right.

Q Now, are you aware of the streams that CWRM determined were so-called conveyance streams? Do you know what "conveyance" --

A Yes, I know what that is.

Q I see in the report cards that my understanding -- and correct me if I am wrong -- but Kopiliula was the only stream identified by DAR as having s commingling issue. Do you recall that?

A Yes.

Q And, in fact, as part of this report card, DAR recommended a modification that would address the commingling issue; isn't that correct?

A I don't think it was the only stream that has commingling. Isn't Waikamoi also a stream that has commingling?

Q You tell me.

A Okay, yeah. According to -- yeah, what I was told, Waikamoi was also a stream that has commingling water from another ditch, so there's

actually two of them.

Q And then are you aware that the CWRM also identified Haipuaena and Puohokamoa conveyance streams?

A No, I was just familiar with those two.

Q Okay. So are you aware that in 2010 the CWRM came out with their recommendation of streams to restore -- or the staff, I should say, to the Commission -- and they had decided on five streams. Are you familiar with their recommendation?

A No.

Q Well, of your eight streams, or of DAR's eight streams, the three streams that were left out of the CWRM's recommendation included Puohokamoa, Kopiliula and Haipuaena for the stated reason. I'll represent to you that they were conveyance streams?

A Okay.

Q My question, were you or was DAR ever consulted by the CWRM as to those three streams for that particular issue?

A I think we might have been consulted for commingling streams, and particularly for issues of invasives moving from one watershed to another.

Q And so I see at least from your report cards that DAR addressed that issue for Kopiliula

Stream by making a specific recommendation to the diversion modification.

Do you see that? I'm looking at the third to the last sentence on the Kopiliula Stream report card.

A Uh-huh. I see that.

Q Can you describe what that fix was, I suppose, for the commingling flows?

A It says it would involve a box flume from the upstream area of Kopiliula bypassing the area of commingling of the ditch and stream water and downstream of the diversion wall.

Q So in other, words DAR was aware of the commingling flows, and with this recommendation DAR nevertheless recommended restoration to that stream for 2010; isn't that correct?

A Yes.

Q And had CWRM consulted with DAR about Haipuaena and Puohokamoa, would it be reasonable to expect that DAR could have come up with possible recommendations to address those commingling flows?

A It's possible.

Q But to your knowledge --

A That wasn't done, no.

Q Now, turning to Appendix D, attached to

your testimony, which is a letter of May 17, 2010, were you involved in drafting this letter?

A Yes.

Q Now, again, on page three, if you look at the third bullet point down, it refers again to this biggest bang for the buck concept. Do you see that?

A Uh-huh.

Q So, again, DAR was prioritizing in this letter specific streams for restoration; correct?

A That's correct.

Q And was DAR, to your knowledge, at this time, under any directive from the DLNR chair, I suppose, for what kind of recommendations DAR was expected to provide?

A Basically, on this one, their request was for flow estimates for H_{50} and H_{70}. And at the time that I can recall that, those flow amounts weren't really enough to make a difference.

Q Are you referring to Table 1 on page 5?

A Yeah.

Q So in other words, DAR was requested to provide those flow amounts for H_{70} and H_{50}, even though at least DAR's position was that those were not supported biologically?

A Well, basically, yeah. I mean when we

worked it out, and I think they have H-36 to H_{min} to H_{70}. We did produce some anyway to show the amount of median baseflow, what would be the diversion flow levels for the diversion of the streams.

Q So is it my understanding that DAR does not support restoration at those levels of flow, is that correct?

A No -- yes.

Q Thank you.

So did you have any understanding why the Commission or CWRM staff, as far as their recommendations to the Commission in 2010, were different from DAR's recommendations?

A What do you mean "different" from?

Q As far as -- so you recall that DAR recommended eight streams of the 19 for restoration?

A Right, right.

Q And do you recall that the CWRM staff recommended less than those eight?

A I guess.

HEARINGS OFFICER MIIKE: I think you went through this line of questioning already.

THE WITNESS: I guess if they did, they did. I mean, I don't recall offhand exactly.

HEARINGS OFFICER MIIKE: The testimony is

already you recommended eight, they recommended five. The difference was in commingling in three. But if you want to expand on that, go ahead. But we have already covered that.

Q (By Ms. Kalama): I'm going to turn to the 2015 study, which is Appendix E to your testimony.

So is it -- is my understanding correct that you were one of the ones on the ground for this study?

A That's correct.

Q And earlier in your testimony you suggested the longer term study would have been more useful, is that accurate?

A Yeah. I think the period that we got to do this study, the baseline before the water was restored to, you know, during the water restoration, I don't think it was enough time. I think the fact that you had peculiar weather, climate conditions, we had droughts, we had a lot of rain during the summer months, so it really kind of muddied the water as far as what was happening within the system.

And I think a study of maybe at least five years minimum would probably give you a better handle about what's going on. Because when we looked at the actual figures of what we saw the animals, I mean,

you couldn't tell because what happened in the wet season seemed to disappear in the dry season and showed up in the wet season and then disappeared again.

Q And that's consistent with what Dr. Parham --

A That's correct.

Q And when you say five years, are you talking about five years after the releases begin?

A Yeah.

Q Because this study took four years, correct?

A That's correct. And the reason it was cut short was, again, because funding. We lost our funding for the stream program.

Q And in conducting the study, DAR chose three streams to study; correct?

A That's correct.

Q But were you aware that the Commission amended IIFS's for five streams?

A Yes, but the problem was, again, funding and manpower.

Q And so how did DAR go about choosing which streams to study these restoration efforts?

A If I can recall, we were looking at

accessibility for one, whether we can access the streams. And as it turned out, the lower reaches of the three streams that we selected had to be accessed through helicopter. But all of them could be accessed above the highway, Hana Highway.

And we also looked at the possibilities of doing monitoring sites in the middle, but then again there was a problem of accessibility. Because along that coast, you know, because of the cliffs and everything else, it's really hard to access the areas. So that was one of the problems that really made it hard for us, and I think that's why it got cut down to three streams.

Q And on page 2, I believe, of the Executive Summary, about the third full paragraph in the middle of the page, the part that says, "correlation between return flows, habitat and biota was weak".

A Uh-huh.

Q And it goes on to talk about a number of factors that may have contributed to that relationship being difficult to prove.

Can you talk a little bit more about those factors?

A That's what I was just mentioning about the environmental conditions with the rainfall, drought,

flash flooding. Sometimes we got -- actually, we got rained out because of the waterfalls and the water was just too muddy and too dangerous for us to get into the areas.

So we did monitor these things quarterly, and basically, you know, with the amount of time that we had to go in there, I think we lost one quarter out of all the streams.

Q One quarter in terms of time?

A Time, timewise, yeah. And that's why we think that, you know, four years is not really long enough.

Q That you need five years after flows are restored?

A Yeah. You need a longer time period with more constant environmental conditions.

Q And would it help to have what has been called controlled releases to Honomonu for your study?

A When you say "controlled releases," you're talking about the amounts that they release?

Q I'm talking about, for example, restoring full flow to a stream to evaluate under -- to get as close as we can, I suppose, to more natural conditions?

A Yeah, I guess, controlled releases.

Q That would help inform your study?

A (Witness nods head up and down.) But it depends on whether those controlled releases can be done over a period of time, a short period of time, or it's going to be a long period of time.

Q And these streams have been diverted for some time now, so at other points in your study you refer to possibly a slow change in habitat response or a slow habitat response.

Can you explain that a little bit?

A Yeah, I think what that meant was that even though you put water back in the streams, you may not get animals recruiting right away. It may take some time for the animals to recruit up. So you're not going to see a rapid response right away.

Q Moving down that same page 2, two paragraphs down, there is a reference to using the modeling and the studying within an adaptive management framework. Do you see that part? Second to the last paragraph.

A Uh-huh.

Q So can you explain what that means?

A I think what we were getting at here is to look at the flows and changing the releases just to

kind of get a better idea of adaptive management, not just setting it at this flow and then leaving it, but look at what improves and what doesn't improve.

That's what I think we mean by adaptive management, having enough flexibility to release more water for longer period or whatever, you know, to make a difference.

Q Well, to your understanding, are you aware that there is currently an adaptive management system in place for the streams that have been amended so far for their IIFS's?

A When you say "adaptive management," you're talk about flows or --

Q Yes, that's one possibility with an adaptive management strategy.

A Okay, but you said they're using it now, but we don't know -- we're not monitoring flows. Is CWRM monitoring the flows?

Q That was actually going to be my question, is, if you were aware of whether any IIFS's that were set in 2008 and 2010 by the Commission have ever been changed during the following years after those flows were set, or those instream flow standards were set?

A I think that's as far as we know what CWRM told us, that is what we were going on.

Q So if you knew, for example, that an adaptive management framework may take quite some time before, say, an instream flow standard was amended to adjust as you just talked about, would you, in recommending certain flows to the Commission, would you consider including some amount of buffer to those flows, knowing that an adaptive management framework may not be immediately responsive?

A I think a buffer wouldn't hurt, you know.

Q Did DAR ever evaluate, quantify that?

A No, that wasn't brought up, that there would be a buffer or anything.

Q But DAR's position is that the 64 percent baseflows is generally a guide to what is minimum?

A Well, it was a first set amount of flow to release. And basically, you know, what DAR is supposed to do for CWRM is provide them some amount, because they didn't come up with an amount. You could throw any amount in there, but the thing is, we don't know if it works or not unless you actually monitor it.

Q In fact, those amounts are based on models and estimations; correct?

A Right, right.

Q So actually, if you set it at that amount,

you're hoping it achieves it, but not certain that it will?

A You're not certain, but then that's what the monitoring is for.

Q So the monitoring you're talking about is this adaptive management framework?

A Uh-huh.

Q So you would be able to adjust then what you thought was the correct IIFS amount?

A Right, it's the starting point.

Q The starting point?

A Yeah.

Q And as far as this 2015 study, I heard Dr. Parham testifying, which you may have, that it wasn't clear that the 64 percent standard for the wet season was sufficient, but that he wasn't ready to back away from that as a starting point.

A I think, yeah, that would be a good starting point. And then see, monitor it and see where it goes from there, if that's enough or not.

Q In other words, that amount for the full year, not just seasonally?

A Yeah, I think the seasonality thing got thrown out, and I think even CWRM had set a flow release for the full years rather than having to

investigate during the winter season and the summer.

Q So it's also a management issue as well?

A Yeah, yeah.

Q And isn't it true that if -- would you agree that if you set the minimum flow standard at that 64 percent level, it would require effort and management to monitor those levels to ensure that it actually protects the minimum habitat; is that correct?

A Yes.

Q So, again, if DAR was just faced with providing advice on biological benefit, would you agree that setting -- including some amount of buffer would be prudent?

A It wouldn't hurt.

Q Now, has DAR been asked to provide any recommendation for this current process that we're going through right now?

A Only what we provided in this report.

Q Generally, but not specific to any specific streams?

A No.

Q Now, from your experience in studying the 19 streams at least, do you have any opinion as to whether the reduced stream flows has resulted in more

invasive plant species essentially occupying the space or narrowing those streambeds below the diversions?

A No.

Q You don't have an opinion or you don't agree?

A I don't know.

Q Oh, you don't know?

A No.

Q Do you know any agency that would be appropriate to assess that type of issues?

A I would assume Forestry and Wildlife Divisions.

Q So, again, if I asked you if streamflow velocity would help to clear or mitigate those invasive species, that would also be a question for Forestry; is that correct?

A Yeah.

Q How about in your observations, were these streams -- did they have a lot of invasive species in the streambed?

A I'm not a plant person, so I couldn't tell you.

Q From your observations, were the streams -- would you expect that the streams today, as far as

the streambed available, would it be narrower than it would be under undiverted conditions?

A Would it be narrower? (Witness nods head up and down.) I don't know. It's hard to say.

Q Going back to the HSHEP model, is it your understanding from a biological perspective that healthy, thriving habitat units help to support stream animals, and therefore, also help to support gathering practices in the East Maui area?

A Yeah, I think healthy streams and healthy -- yeah, do actually provide gathering rights and helps the animals.

Q In other words, simply because you observe species in a stream, that doesn't necessarily mean that there's enough for gathering of those species?

A I guess. I don't know. I would defer that question to maybe Skippy, who is more familiar with Maui streams, knowing what would be considered enough for gathering purposes.

I come from Oahu, which, you know, you would be lucky if you find one hihiwai over there much less or Nopili or Lentipes. So when people want to come in there and actually get scientific collecting permits to collect these animals, I say no, because we don't have the population you have

over here on the other islands. So it's a different scenario for each island.

Q But based on your experience with these East Maui streams, is it your opinion that the current population levels in the diverted streams are sufficient for someone to go in and be able to take from those populations?

A If you're talking about the lower ends of the stream, it may be where there's plenty of water and plenty of the animals, because like, again, like Jim was saying, the animals distribute themselves within the stream. So it depends on the species of animals you're talking about gathering.

Now, stuff like Lentipes, 'opae, those guys usually go way up. And when they're coming into the stream on the lower side, they're so small that people aren't going to eat them. Even though the streams are diverted, there is still healthy population of 'opae in the upper areas.

Q But based on the model, on the goal of the model is to look at how many habitat units would be restored to healthy levels?

A Right.

Q And that would support healthier populations of these animals?

A Hopefully it would support the population to be there. But, again, like Jim was alluding to too, there's also natural barriers and also manmade barriers that's going to prevent that habitat from being colonized by the animals.

Q Right. That goes back to the importance of adjusting physical barriers and passage --

A Correct.

Q -- as well as entrainment, correct?

A Right.

Q So and following up on that, even if there is sufficient flows in some of these streams at the lower levels, those barriers and the passage would still need to be addressed for those streams in order to recover more habitat units in those streams?

A If the habitat is above the barriers.

Q Thank you, very much.

HEARINGS OFFICER MIIKE: Ten-minute break.

(Recess taken.)

CROSS-EXAMINATION

BY MR. HALL:

Q My name is Isaac Hall, and I'm the attorney for Maui Tomorrow.

We've been through this, so I'm not going to go through it a lot. But in the 2009 study it was

recommended that 15 of the 16 streams would benefit from restoration; correct?

A That's correct.

Q And what we have been discussing is that subsequently DAR only recommended nine for restoration, right?

A That's correct.

Q And in your declaration in paragraph 24 you talk about DAR supporting this theory that I guess talk about nine streams at that point would be the biggest bang for the buck for habitat restoration, right?

A That's correct.

Q Is the biggest bang for the buck found in any of our State constitution about public trust action?

A No.

Q Is it found in the regulations anywhere?

A No.

Q Is it found anywhere in CWRM's regulations?

A I don't think so.

Q And you say that DAR added that it is more desirable to restore flow to H_{min} flow rates in fewer streams rather than restoring even lower flows in more streams?

A That's correct.

Q That's not what we're faced with, is it?

A No, we think, you know, that restoring -- restoring flow, real little flow in a lot of streams may not make the difference that it would make if you could restore more flow in just a fewer streams.

Q But we can restore the required flow in all of the streams, isn't that a possibility?

A That's a possibility. But, again, what I was talking about when I mentioned earlier about sinks and sources, some streams, you know, even though you restore the flow in them, the animals go up there, if it's not a good stream, there is not desirable habitat, they're not going to do their reproduction and everything else, and that stream is going to be a sink.

Q I didn't see any streams that got rejected on that basis though, did you?

A We didn't look at any, categorize any streams as sources and sinks, because studies are still being done on that.

Q In paragraph 25, DAR would support having an interim IFS in a few good streams. That sounds like a military phrase.

A I wasn't in the military.

Q You were the principal author of the 2015 study, correct?

A That's correct.

Q And in the conclusion it states: "When considering instream flow quantities to support stream animals, it is axiomatic that 100 percent flow restoration to natural undiverted flow would be the best for native stream animals."

A That's correct.

Q So as a scientist, if your focus was really on what's best for the native stream animals, it would be 100 percent flow restoration of all the streams; correct?

A That's correct.

Q And what you say after that is: "While this is a possible outcome, it is not generally the goal when setting instream flow standards."

And you continue. "From DAR's perspective, the management goal for the 27 East Maui streams was to find the minimum amount of water that supported healthy stream animal populations, while providing maximum water available for other uses."

Can you show me anything in DAR's mission, regulations or anywhere elsewhere where it states that your mission is to provide maximum water

available for off-stream uses?

A Well, I think in our mandate, it's to preserve, conserve and manage the resources. So manage is not necessarily preserve it for posterity, and saying that all the water is reserved for the animals.

But then again, it's to manage, and preserve and conserve those animals. But then also make things available for -- like what we have to deal with is fisheries. What Dr. Parham mentioned. And we are dealing with catches and everything like that.

So we're not only managing resources, but we are also managing the take of those resources by the people.

Q And in that instance, however, you're managing the amount of species that can be taken, so the species is protected; correct?

A The species and the quantity of the species, and also have to protect the habitat.

Q And in this instance though, you're talking about only reserving the minimum amount of water to support healthy stream animal populations while providing the maximum amount of water for other uses.

By other uses we're talking about

off-stream uses; correct?

A It could be off-stream or instream uses. It could be for taro or any other use, water use.

Q But there's nothing in your mission, DAR's mission that creates an obligation to provide the maximum amount of water in a stream for other uses, is there?

A No.

Q I would like to go back to Mr. Nishimoto's letter, and the eight, I guess, factors that were considered. I'm still baffled by this.

Is there any -- you know what I'm talking about? It's on the second page of Mr. Nishimoto's letter. Talks about the eight factors that were taken into consideration.

A Uh-huh.

Q Is there any chart or any document that shows how these factors were balanced or weighed so that you came out with any particular result?

A There's no -- basically, these were stuff that we looked at from the HSHEP model.

Q So no one would be able to know, other than the model, which one of these factors you may have given greater consideration to or less consideration to or why?

A I think we tried to give all of them equal consideration as all the factors. I don't think we weighed one more than the others. I think the first one that we did weighed the most was, of course, the habitat units, because those are the areas where the animals have to survive.

Q Oh, the third factor -- no, not the third factor -- let's see. Oh, you say these factors were considered, and you say the number and difficulty of modifications for diversions were considered.

And I'm still -- did you actually look at any? Did anybody present any document to you about showing what it would take to modify any particular diversion?

A No, no.

Q I don't know, you say you took it into consideration. What is it that you took into consideration?

A Well, we looked at the diversions and tried to figure out what could be done for modifications. But we don't have any facts or amounts, dollar amount for how much it would cost, or whether it would actually work.

Q Do you have any document that indicates how many, you know -- say Honopou, how many diversions on

Honopou would have to be modified?

A We have to look at each one of them.

Q Do you have any documentation for what you looked at?

A Probably have photographs. Other than the photographs. There's site visits.

Q You did make a few recommendations. You said in paragraph 24, "DAR is very adamant about the H_{min} flow rates, which should be 64 percent of natural median baseflow and is necessary to provide enough water in the stream for the animals."

Are you still very adamant about that?

A We considered it as a starting point. And, again, what we found out from that final report, we couldn't really say that we would stand firm on that. Probably maybe a little bit more water than that.

Q More than that, okay.

You finish that paragraph saying: "Thus, a minimum flow of 64 percent of natural median baseflow is very important".

A To be a minimum.

Q So that's a minimum. So the minimum is very important, so you may even want more than that?

A It may be considered.

Q What would you recommend then that's more

than that?

A Well, again, she suggested a buffer. You know, maybe that would help. I don't know exactly, because like I said, with our study, we weren't able to determine whether the reproduction was occurring or not.

On the monitoring sites, we found animals recruiting on the bottom sites. We didn't find these animals on the upper sites, so something's happening. They're not getting there. Maybe there's not enough water in between to actually provide a wetted streambed.

Q Okay. And in paragraphs 31 and 32 you address seasonal flows. And you say in 31: "The application of very low summer flows is not supported as a suitable instream flow approach for restoration of native stream animals."

A That's correct.

Q And You continue: "The application of the higher flows appeared to have positive benefits to the instream habitat and will likely result in a positive stream animal benefits over time."

A That's correct.

Q And your final paragraph was: "DAR recommendation that there should be a constant annual

flow equal to the winter flow standard year round to make a difference in habitat connectivity and biota."

That's DAR's recommendation?

A That's what we came up with. That's our findings.

Q Okay. And it says: "Additionally monitoring the instream flow release needs to be performed over a longer period of time to document whether or not improvement to the animal population occurs."

That's still your recommendation to CWRM?

A That's correct.

Q I don't have any other questions.

MR. ROWE: No questions.

CROSS-EXAMINATION

BY MR. YIP:

Q Good afternoon, Mr. Higashi. I am Elijah Yip, one of the attornies for HC&S.

A Good afternoon.

Q I want to talk a little bit about the H figure, like the H_{90} and H_{70}. The H figure correlates to a flow rate, is that right?

A That's correct.

Q And so if we're saying H_{90}, for example, that's the flow rate that would allow the maintenance

of 90 percent of the habitat in a stream; is that right?

A I think so.

Q And so the number, H figure, that's the percentage of habitat available in the stream?

A Uh-huh.

Q Is that right?

A Yes.

Q You have to answer audibly so the court reporter can get it, okay? Thank you.

Now, in adopting the H_{90} figure as the H_{min}, the basic assumption there is that it takes 90 percent of the habitat, the available habitat in the stream, to support essential functions for the stream animals; is that right?

A That's correct.

Q And is it true that that 90 percent figure, or percent of the habitat, can be achieved from a combination of flow restoration, and/or modifications to dam or diversion structures?

A I think the flow, the 90 percent of the flow would be more for the biological functions. The part that you're talking about, modifications to diversions and dams and whatnot, would be more for connectivity purposes.

Q Are you saying that is a distinction between life functions and connectivity?

A No. We said that they needed to have both of them. But, again, if you don't have the flow, and you have the animals moving up to the diversion and they can't get past the diversion and those animals' habitat is further up, then, you know, it's not going to make any difference. They are not going to be able to utilize habitat.

Q I'm trying to understand, because the point of the HSHEP model was to determine the number of habitat units that could be recovered, lost or recovered, due to diversions and barriers; is that right?

A That's correct.

Q And so if we -- are you saying that the H_{90} would correlate to 90 percent of the habitat units available in that stream?

A It should correlate to percent.

Q So if it's possible to recover habitat units through elimination of entrainment issues and passage issues, does that get us to the H_{90}? Does that contribute towards meeting the H_{90}?

A Again, it's the flow, yeah. It's the flow with the modifications.

Q At this point does DAR have any scientific basis for moving away from 64 percent of the median baseflow as the H_{min}?

A Can you repeat the question?

Q Sure.

At this point, does DAR have any scientific basis for moving away from 64 percent of the base median flow, or median baseflow rather, as the H_{min} low?

A Only the results of this study in 2010 -- 2015.

Q The monitoring study?

A Right.

Q Which, according to Dr. Parham, was not set up to be a study in the sense of determining statistical significance; correct?

A Right.

Q And Ms. Kalama discussed with you the possibility of adding a buffer?

A That's correct.

Q Does DAR have any basis at this point for recommending a buffer or a quantity of a buffer?

A No.

HEARINGS OFFICER MIIKE: Can I interrupt this for a moment? "Buffer" is a term prohibited by

the Supreme Court in setting interim instream flow standards. So you either have to talk about a range that is in the IIFS or something like that. You cannot say use IIFS and want to put a buffer in. It's got to be one or the other.

MR. MURAKAMI: If I'm not mistaken though, Dr. Miike, they were talking about a different kind of buffer than what we're talking about.

HEARINGS OFFICER MIIKE: No, because they thought what we did -- which we did not in our final version -- they thought we were putting a buffer in as another way of an interim instream flow standard. But they said if you are going to use a buffer, put it in the interim instream flow standards. Don't leave it out.

So I'm saying, I understand what you guys are saying, but we can't do that. So you can talk about if in this condition done are satisfied, then the interim instream standard becomes this. But you can't leave it vague.

But I understand the discussion going on. I'm just saying, please, don't use the word "buffer," because I'm not going to use it.

MR. MURAKAMI: Just to be clear though, the way we're using it is to accommodate for any specific

individual circumstances in streams that may require more restoration so that --

HEARINGS OFFICER MIIKE: Oh, correct, but there are ways around that. But what you cannot do is say this is the interim instream flow standards, oh, and by the way we're going to put another -- you can't have a formal category called a "buffer". That's all I'm saying.

MR. MURAKAMI: But it can be to recognize differences in the circumstances in streams?

HEARINGS OFFICER MIIKE: Oh, yeah, yeah.

MR. YIP: I'm just using their terminology. I'm well aware of the Waiahole decision.

HEARINGS OFFICER MIIKE: As I said, being an original member of that Commission, we did not use that in the final decision.

THE WITNESS: That's one of the things why I think, you know, when you talk about instream flow and IIFS for each one of these streams, you have to do each one individually depending on the circumstances within that watershed.

MR. YIP: May I continue the questioning?

HEARINGS OFFICER MIIKE: Sure.

Q (By Mr. Yip): Mr. Higashi, I just want to go back to the topic we had began with and touched

on, which is the H_{90} and recovery of 90 percent of the habitat.

Mr. Parham, or Dr. Parham's testimony this morning was that when you calculate a habitat units lost, if you remember there was a Table 13 in the HSHEP study. Those habitat units lost represent either flow diversion or barrier issues; right? Is that correct?

A Yes.

Q So --

A That's if that's what he said.

Q You remember that, right?

A Yeah.

Q And do you agree with that? As a co-author of the study, do you agree?

A Yeah.

Q So my question to you is that, if you're saying you need both flow and you also need the modifications to restore habitat units, how can you tell what you're doing to get to the 90 percent? You're saying H_{90}, 90 percent, recovery of 90 percent of habitat in the area, and a habitat unit could be reduced from either/or, or both, you know, how can you tell --

A I think that's where Dr. Parham was saying

depending on where your diversion is whether you can recover that 90 percent or not. And that's the whole thing is, if the diversion is down on the bottom then, yeah, you need to fix that diversion, because everything past that is not going to be available.

Q So would you agree that -- I mean depending on the stream site, would you agree that there are certain streams and sites at certain streams where you could recover a lot of habitat units with less flow, but modification of that diversion?

A Less flow, but modification of the diversion?

Q Right. I mean is it a trade-off?

A In certain areas it's a trade-off. In the middle areas, I would say it would be a trade-off; but in the upper areas, it may not be.

Because, again, you know, like you gave an example for 'opae. They don't need that type of connectivity that the fish need. They can actually crawl on land and get over that barrier, because they're above all of the barriers right now. I mean, you know, they're making it up there somehow.

So, I mean, it's probably easier if you could modify the diversion so that they can swim up there rather than have to crawl or make it easier for

them to actually access it, you know, and not have the diversion completely across the whole stream width.

Q Now, the H_{min} figure, you say that's the flow level needed for suitable conditions for growth, reproduction and recruitment of native stream animals; right?

A Uh-huh.

Q What are the criteria for determining what constitutes suitable conditions? For example, is the size of the population of the animals one measure of suitable conditions?

A I guess, basically, looking at the different sizes, whether you get recruitment, getting smaller sizes, you getting adults that are actually animals that are growing out, you know, that would show growth. Whether they're reproducing or not.

Q So if we find that post release you have one more animal that is able to recruit, does that constitute suitable conditions?

A Not necessarily.

Q Then, I mean, what's the quantification, or is it possible to quantify?

A It might be possible to quantify. I don't know what the number, the magic number is, just like,

you know. We're trying to come up with what the magic number is for the instream flow. It's something that, you know, you're going to have to look at and determine on how many animals are there, the size of the area that you're talking about.

You're talking about fish. It's really hard to actually see the fish reproduce in these areas. There needs to be males and females for one thing. They need a courting area of a certain size. So, I mean, there's a lot of variables that are involved in that. So I can't give you a number offhand, no.

Q But are there scientific studies that support or that help define what constitutes suitable conditions?

A I think there are studies done on reproduction of the animals and that kind of stuff.

Q Do those studies translate into a quantifiable measure of what constitutes suitable conditions?

A I think you probably could come up with one suitable.

Q You could come up with one, or are there existing studies that DAR relied on in using that standard of suitable conditions?

A For the HSHEP, like I said, the criteria for the distribution of the animals, the habitat, where the habitat is, all of that was based on our own observations, over 9,000 animal observations.

So, yes, it probably could be done from the information in our database. And that's what was used for designing the model.

Q How did DAR arrive at H_{90} as the H_{min} basically, at the level that supports the suitable conditions?

A Well, I guess this was the H_{90}, that was the USGS studies, based on the USGS studies.

Q Are you talking about the Gingerich and Wolff study --

A Yes, yes.

Q -- 2005?

A Yes.

And basically, you know, that was 64 percent of the median baseflow. And that's basically what we were using, close to -- well, we were using -- I want to say we were using probably -- yeah, we were using that number for the winter releases. And even then it might have been on the lower side.

Q But what is the -- where does the

64 percent come from? You're saying it's from the USGS study. But independently, do you know of the basis of why 64 percent of median baseflow?

A No. It was 64 percent of the median baseflow, that's all they came out with.

Q So other than USGS, you don't know of any other reason to use that figure?

A We don't -- yeah, we measure flow, but we don't -- we're not hydrologist. Okay? We just do the biology on it. So based on what Jim got from Gingerich, we put in the model, and we used that.

Q But you are a biologist?

A Yes.

Q So are there any studies that say --

A Again, our 9,000 animal observations told us that you need at least two feet of water for the animals to actually carry on their functions, and growth, reproduction and everything else.

Now, that animal may be in a pool that's surrounded with -- the deepest part may be two feet. The other areas that you probably find it may be only six inches, twelve inches, three inches of water. But that fact that he needs that depth is -- just because you find him in another area, doesn't mean, you know, that's all you need.

Q Okay. But when you're saying two feet of water, that's an absolute number, right? That's not a relative number?

A No.

Q But the H_{90} is relative, isn't it? It's 90 percent, isn't it?

A I guess if that's how they measure the quantity of flow, that's what they consider the H_{90} percentage, then I guess that's what it is.

Q But the H_{90} isn't a percentage of flow, it's the percentage of the habitat available; isn't it?

A I get it as H_{90} was the flow.

Q Wait, let's circle back.

I thought you testified -- correct me if I am wrong -- that H_{90} correlates to the flow needed to achieve 90 percent of the habitat in the stream. Is that wrong?

A I don't know. I'm not a hydrologist.

Q Okay. Could you turn to the Appendix D to your declaration, that's the May 17, 2010 letter.

On page 2 there's a statement in the letter that says -- this is the first full paragraph, last three sentences:

"Thus, it is tempting to assume that H_{70} is only 20 percent less habitat than H_{90}, therefore

result in only 20 percent less animals. Similarly, H_{50} is only 20 percent less than H_{70}, and therefore only an additional 20 percent less animals. This conclusion is not supported by the DAR."

Do you see that?

A Uh-huh.

Q Do agree with that statement?

A Uh-huh.

Q So DAR stands by that statement today?

A Yes.

Q Based on the logic of that statement, is it also true that the fact that H_{95} is five percent more than H_{90}, doesn't mean that H_{95} would result in five percent more animals than H_{90}?

A I guess you could say that, yeah.

Q Do you know what the incremental benefit is between H_{90} and H_{95}?

A No, I don't.

Q Or H_{90} and H_{100}?

A No, other than the straight 10 percent or five percent, but as far as that, that's it.

Q Percentage would relate to the amount of habitat available, correct?

A If that's what H_{90} refers to.

Q Did DAR consult with EMI in making

diversions -- sorry, modifications to diversion structures for connectivity purposes?

A We talked about it.

Q Did DAR identify sites where modifications were to be made?

A We looked at it with them, and we discussed it.

Q Did you make recommendations on which sites --

A We talked about, you know, what we thought would be good fixes. But, again, we didn't go back and we didn't monitor. We didn't see if it was working or not. These were ideas that we were throwing out and, you know, EMI actually went ahead and did these modifications.

Q And so DAR -- does DAR know whether those modifications have been made? I know you say you didn't go back to test whether they work.

A We have gone back when we visited the streams and we seen the modifications.

Q Do you know which sites were modified?

A Honopou -- let's see what else -- Waiohue.

Q It's not meant to be a memory test. I'll throw out a couple, and you can tell me. You mentioned Honopou?

A Yeah.
Q Honopou at Haiku Ditch, does that ring a bell?
A Yeah.
Q Honopou at Wailoa Ditch?
A I'm not sure.
Q If you don't remember, that's fine.
A I don't remember.
Q Hanawi at Koolau Ditch?
A Yeah.
Q Waiohue at Koolau Ditch?
A I think so.
Q East Wailuaiki at Koolau Ditch?
A I think so.
Q And West Wailuaiki at Koolau Ditch?
A Yeah.
Q Who designed the modifications for these diversions?
A EMI.
Q But in consultation with DAR, correct?
A Yeah.
Q And after the modifications were made, did DAR inspect the modifications?
A We looked at them.
Q Did DAR, for any of these sites, did it

tell EMI you did it wrong, you should redo it?

A No. Again, you know, I mean they put the effort to actually do the modifications, however, we don't have the manpower to actually go up there and monitor them to see if they're working or not.

Q Were modifications at additional sites considered by DAR?

A Not that I recall.

Q How did DAR go about choosing the sites for modification?

A Well, we were looking at basically the streams they were monitoring for one -- we were monitoring. And the other ones when we went to do a site visit, we looked at the different streams, just looked to see if it would be easier to modify or not without doing major reconstruction of the whole diversion.

Q Are there additional sites in the 27 streams that you think could be modified to regain additional habitat units?

A I don't know. I would have to look at the east diversions.

Q But in selecting the sites for modification, with the ones that were made, was that meant to be an exhaustive list?

A No.

Q If you could look at paragraph 13 of your declaration. In that paragraph you say that:

"Native animals that occupy the streams have evolved around the annual variation in flow."

Do you see that?

A 13?

Q I think it's 13. Maybe I'm wrong.

A Wait a minute. Okay, I found it.

Q How have native animals adapted to annual variations in flow?

A Okay, during the winter months we have rain, we have freshets, we have high flows. During the summer months you have the lower flows.

Q And how do they adapt to that?

A They adapt to that by their spawning, recruitment.

Q So they time their life activities based on the various --

A Uh-huh. And they basically -- that's what the idea with this summer-winter variation. We were trying to mimic, to start off with something, you have to model a flow for streams. You're going to look at what occurs naturally and see if you can mimic that. If that doesn't work, then you try

something else.

Q How long does it take for these native stream animals to respond to changes in flow?

A I've seen them respond pretty quickly. It depends on where they are. If they're holdup right in the stream and they notice the flow change, they will respond.

If they're recruiting to the stream from outside the plankton area, I think it takes longer for them to respond.

Q And could we get a sense of range by -- when you say "pretty quickly," are you talking days, weeks, months? How long of a range?

A I couldn't say. I'm not sure. I mean I've seen them respond, and I'll give you an example. I've seen them respond on most diversions.

There was a diversion that was actually plugged up. And it was Papio Stream. And we actually unplugged it. And as soon as we unplugged it, all the animals that were down below started coming up, climbing over the diversion.

Q Instantaneously?

A Instantaneously. But see, they were in the stream and waiting for this thing to occur, so, you know, if you're talking about if they're not in the

stream, then it's going to take them awhile to actually pick up the signal, get into the stream mouth, metamorphosis from the planktonic stage to the stage where they're not swimming around in the mid water column, and then have to go up.

Q How long does that stage take, metamorphosis stage?

A That one, I don't know, maybe about a week, week -- I don't know, probably Skippy Hau would have a better handle on that.

Q Would it take a month? Would it take that long?

A I don't know if it would take a month. I mean, when they come in, yeah, they come in as JEAN clear hinana, and they look like slivers of glass and come in and wait around in the lower reaches until they start developing chromatophores and color and that kind of stuff, then move up.

Q In paragraph 11 of your declaration you mention the research stations in Hilo where DAR staff created their own stream and that recruitment occurred very rapidly. Do you see that?

A Uh-huh.

Q Could you tell me a little bit more about the experiment, maybe starting with the purpose of

that experiment?

A That one was done by Dr. Nishimoto. Basically, this is his comment from -- my testimony was based on what was said at that -- I think it was May 2009 or so -- testimony. And I guess they were working with seeing how quickly the animals were responding, to climb to water, coming in the tank, and, of course, the animals right there, it's going to happen right away.

Q Do you know what species were involved in that study?

A I think it was an awaous, nakea, but I'm not sure. It might have been nopili or lentipes.

Q These would have been native stream animals?

A Native stream animals, right, correct, the ones that climb.

Q In that experiment, was there variation in flow introduced throughout the experiment?

A I don't know. I don't know the details of the experiment, whether it was in flow. I think it also had to do something with water temperature.

Q Okay, let's turn to the -- well, I'm going to talk about the monitoring report, but we don't need to turn there right now.

In the report there were comments made that perhaps results were skewed by rainfall events, do you recall that?

A Environmental, yeah, conditions, yeah.

Q Okay, fair.

Is there a log somewhere of when, for example, rainfall occurs such that it might skew the results?

A It would be nice to get a rain gage up there in these areas. And I know I had talked to CWRM about it, and some of the areas have, some of them don't have. It came into play, and it was something that, yeah, we were looking around to see if we can actually get that information.

Q So when you say there were environmental conditions and reported that in the study, that's based more on anecdotal or observational --

A Yeah, but it was something that we didn't actually have time to gather or find out if we could, you know, get.

Q Sure. How long after a release -- let me restart that question.

Was the surveying done consistently after a release? In other words, were you consistent in the number and duration of time after a release before

you went out and did surveys?

A It was done on a quarterly schedule, so it was done every three months. And once we set the schedule, we made it exactly on the calendar at three months.

Q But were the survey dates, were they correlated to the releases?

A Some of them correlated before the release and some of them, others after the release.

Q Was it always consistent as to how long before -- after release the surveys were done?

A Let's see, if it runs three months, and it goes once before, I assume that it would more or less fall into the same time period. I'm trying to think of a year calendar. And then we started, we did January, March, you know, down the line.

Q My general question is: How long after release before the surveys were done? Was it a week, a month, two months? Probably not two months, because quarterly, but I'm trying to get a sense of how long after release was made.

A The release was in May for the summer releases. And then we did -- I think we did one in June or July. We did one in August, September. And then the next one came around November, the next

release.

And then, so I would say, you know, two to maybe a month to three months or four months or even within that six-month period, at least two of them were done.

Q In observing the conditions or observing the animals in the summer seasons, there was -- you heard Mr. Parham testify about how there was very few or absence of animals in those pools.

I would ask you a very layperson question, because I'm just trying to understand how you went about doing that. I guess my first question is: You didn't tag these animals, right? When you observed the animals, you didn't tag it with ID or transmitter or anything like that, right?

A No, no.

Q So if you didn't see an animal in a pool in the summer months, how can you be sure and reach the conclusion that there's no recruitment or there is no recruitment occurring? I mean, this might sound silly, what the if the animal has gone upstream? How would you know?

A You wouldn't know, really. But then recruitment, depending on what stream you're talking about. If you're talking about East Wailuaiki, the

mouth is closed. So as far as recruitment, the whole four years we were there, I think it was open -- we documented it being opened only once, but it may have been open more than that. So this is going to determine your recruitment.

Q For that stream?

A The other streams you could probably see 'em within the area, the small ones. And then if you go back again, you know, three months later, you may see some small ones, but then you may see some bigger ones. To me, the telltale of whether they're moving upstream would be to get a middle site or the upper site.

Now, at the upper site, in one stream in particular, like Waiohue, we saw the same pair of adult alamo'o up there for the whole study period. And I mean that was all that was up there. There was no new young fish coming up there.

So, you know, I mean that may be a bad case, example, but evidently there was not any recruitment going on in that upper area.

Q One more question. In the monitoring study, some of the photos show a caption that say "gate closed".

A Right, right.

Q What does that mean? What gate is that?

A That was the flow, the restored flow. It was during the summer months.

Q The diversion gate?

A Yeah.

Q So if it's opened, then that's a release?

A Yeah.

Q Thank you. I have no further questions.

HEARINGS OFFICER MIIKE: Let me just ask -- first, just a comment.

Back when the Commission was considering these issues, I think you guys, as well as the staff, were put in a bad position. You were being asked to provided policy choices, which was not your role. And I think I said that at the Commission meeting.

So that's the kind of questions that you were being asked. I'm glad to see you folks are now adamant that you're scientists, basically scientists.

On the issue about the $H_{90,}$ BMQ_{64}, I assume then that there is a threshold that you have to reach before reproductivity and biological functions can occur in a stream?

THE WITNESS: That's correct.

HEARINGS OFFICER MIIKE: And I would like to get into how do you arrive at threshold, but I

guess that was more like the Gingerich types of studies that decided, but I would guess that you hit 90 percent because those streams are basically V-shaped, so you can get rapid filling, but then you reach a point where the return of additional habitat comes at the cost of a lot more water, because you're at the top side.

So to go from 90 to 100, you might take as much water as it took to get to 90 depending on the stream?

THE WITNESS: Right.

HEARINGS OFFICER MIIKE: So my guess would be that's the reason.

The other thing is that when you talked about seasonal variation with the winter flows and summer flows that the Commission had previously done, that was done at the time where both off-stream uses and instream uses needed the water the most, which is in the summer. And I will say that the Commission chose to favor off-stream uses in that instance.

One thing that I'm not sure about is that you have said, again, like I think Mr. Nishimoto had said way back then, that seasonal variation, which is the wet season one and the dry season one mimics natural conditions, because you have variation in

streamflow. But that isn't true, is it? Because what we're talking about in these restoration efforts was you had a stream that was basically dry. You put in water for wet season flow and in the summertime just enough or estimating enough for connectivity. But in the natural situation, that's not all the water that's in the stream, correct?

Because you're dealing with a stream that is still being diverted, and you're putting amounts of water below the diversion. A natural condition would be leaving the stream as it is and having the natural wet season/dry season variation happen; correct?

THE WITNESS: That's correct.

HEARINGS OFFICER MIIKE: I just wanted to get that clear.

One last thing. I want to remind you people is that as the Na Wai Eha case said, stream life is not the only instream uses that I have to consider. There's a whole list of things. Okay.

Any follow-up questions?

MS. KALAMA: Just a few. Not very many, I promise.

-OOO-

RECROSS-EXAMINATION

BY MS. KALAMA:

Q Thank you.

Earlier you were asked by counsel for HC&S about the stream flows and 64 percent value that has been stated by DAR to be the minimum threshold as Dr. Miike talked about to support full functioning of these stream animals; correct?

A That's what we think, yeah.

Q And you're not a hydrologist?

A I'm not a hydrologist.

Q But in working on this report, the 2009 report and the 2015 report, you in fact partnered with Dr. Parham, who is a hydrologist as well as a biologist; correct?

A Correct.

Q So is it your understanding that Dr. Parham considered the USGS numbers for flow and what that meant in terms of his model; is that right?

A I think Dr. Parham looked at the USGS figures, and he felt that it wasn't enough for biological functions.

Q In terms of the 64 percent of the baseflow, median baseflow?

A I don't know whether it's with the

64 percent of the baseflow or not, but he just mentioned that to me.

Q So when you say he thought that the USGS figures were not enough, you're not quite sure what he was referring to?

A No, no.

Q But, in fact, the amount of restoration using the model was that 64 percent level?

A Yeah.

Q And DAR was asked to come up with specific flow levels to recommend for the streams it recommended restoration?

A Right, right.

Q And earlier when I asked you about this 2015 study, do you recall we talked about the conclusion that the results of this work are intended to be used in an interim process, it says for setting the flow standards within an adaptive management framework. Do you remember that?

A Yes.

Q And we talked about what we've mislabeled as a buffer, I should say, but based on the 2015 study, you had answered Mr. Hall that it's possible that the 64 percent level set by USGS may not be sufficient?

A Yes.

Q And, in fact, USGS did provide additional flow levels at H_{95}, H_{100}, as Dr. Miike mentioned. Do you remember that?

A Uh-huh.

Q So if the 64 -- is it fair to say that DAR supports restoration levels that range at a minimum from 64 percent up to 100 percent?

A Yes.

Q And so in recommending actual amounts of flow, if DAR's opinion is that that 64 percent may not accomplish, say, the two-foot minimum depth required, would it be fair to say that DAR could recommend flows somewhere above that 64 percent level?

A Yes.

Q But you would need to consult with others?

A Yeah. And then we would also have to look at the data that we have. One of the things that we didn't do for this study, because we were trying to finish it up as soon as possible for this testimony, was when we put together the data for the surveys for the animals, we did note for particularly the crustaceans and the mollusks on the lower side of the streams, the 'opae that lives in the estuary, as well

as the hihiwai, and hahawai, we did recognize, and we noted down whether the animals were rabid or bearing eggs or had egg capsules on their shells, that kind of stuff, because it's easy to see, it's easy to observe.

When we went up to look at the fish, the fish was a different story. Because basically we were not seeing the fish doing courtship up there when we go do our survey. We're not seeing the gravid females.

And like I said, on Waiohue Stream, we just saw two, two pairs. The one pair, and it was adults, but they weren't courting or anything.

So, again, if we want to go back, and let's say, if we want to redo this again, I think that's something else that we need to look at to incorporate in the monitoring is whether this thing is actually occurring, the reproduction part of it, besides the growth.

But again, you know, I think because we only had those two sites, we don't know if the animals are getting up to the upper site.

Q And you mentioned earlier that there is no longer funding for your freshwater streams program?

A No.

Q Is that for the whole program?

A For the whole program.

Q When did that happen?

A 2013, just before Bob retired. They cut the DJ funding for the stream program, and it just -- there is no Federal funding now.

Q DJ, what are you referring to?

A Ding le-Johnson, which is a Federal Fish and Wildlife program that uses taxes on fishing equipment, fishing gear, and all that stuff to support states in providing funding for recreational fisheries.

So it's three-to-one match with the Feds. So the State puts in $1, and we get $3 from the Federal Government.

But when he retired, you know, there was talk in our Division that basically native fish didn't come into recreational fisheries, so they discontinued the program.

Q So that state funding is no longer there either, is that what you're saying?

A Yeah.

Q So when you say that the IIFS's that are set need monitoring, DAR would not have the capability to do that?

A No.

Q Is that what you're saying?

A Yes.

Q Who else would have the expertise to do so?

A Well, within the state, I guess you would have to get a private consultant.

HEARINGS OFFICER MIIKE: Any followup? Okay, we'll end the session. Thank you.

(The proceedings recessed at 4:08 p.m.)

CERTIFICATE.

STATE OF HAWAII)
) SS.
COUNTY OF HONOLULU)

I, JEAN MARIE McMANUS, do hereby certify:

That on March 16, 2015, at 9:24 a.m., the proceedings contained herein was taken down by me in machine shorthand and was thereafter reduced to typewriting under my supervision; that the foregoing represents, to the best of my ability, a true and correct copy of the proceedings had in the foregoing matter.

I further certify that I am not of counsel for any of the parties hereto, nor in any way interested in the outcome of the cause named in this caption.

Dated this 16th day of March, 2015, in Honolulu, Hawaii.

_____
JEAN MARIE McMANUS, CSR #156

Civil No. 19-1-0019-01 (JPC)

Defendant A&B/EMI's Exhibit AB-110

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