Federal Agency Facilitated Discussion

TOM ANNEAR: I gave you plenty of encouragement before we broke for lunch to think deep thoughts and come up with great questions, ideas, suggestions, alternatives that you might do that build on what we heard our speakers talk about this morning. So again I want to remind you that this is the part of the program that belongs to you guys. This is the part where, if there are questions you need answers to, information you want to know, or information that you want to share with others, please don't be shy. Get up to either of the mics and we'll just go back and forth from mic to mic and let us know your thoughts. We have about one hour. It would be great if we use that whole hour.

When you speak, it would also be nice if you state your name and mention who you work for, so that when we convert all this to text and write up the proceedings of the workshop, when we're making our interpretations we'll be able to add perspective to the questions and comments we hear this afternoon and we can get some sense of where these different pressure points are coming from and uncertainties.

So, with that, does anybody want can be the first to either of these mics and ask any of our presenters including Dr. Gunderson any question you like. Try and keep your questions relatively short because there are a lot of people here that might like to talk, so short pointed questions and short answers guys if you've got them. So, over here say your name and who you work with.

STEVE KUKAS: I'm Steve Kukas with the Portland Water Bureau here in town. I'm going to direct this mostly at Dudley but I think in the spirit of starting a panel, this could go to any of the panel and it can go to anybody in the audience. So, I heard a couple of things this morning about uncertainty. I heard also that when you change

flow in a river, it automatically changes the ecology, which I believe deeply.

So, looking at the Susitna Project in general I looked at those slides with some interest and looked at those complex habitats and those lateral habitats. And I think that with our science and 2-D modeling and all the other tools we bring, I think we may – the scientists – come up short especially in regards to projections of channel morphology through time. That project is interesting to me; it's been discussed for a long time. It may or may not happen obviously; you're in a two-year cycle for research now. I think a lot of projects that we look at what the habitat is now, what the habitat may be with various flow regimes on top of it, we make resource decisions, we wrestle with the uncertainty, but I am going to assert that oftentimes we miss the mark with how that habitat will change through time when we put a big hardened feature on it. So, I would just throw that out there as a starting point and get a reaction to it, please.

DUDLEY REISER: I'll do what Dave did at lunch and say, "Next question." [Laughter] No, that's a good question. I don't think there's a clear answer to it. I'm not sure, Steve that you were actually asking for a definitive answer on anything like that. I think those are the $64million dollar questions or even more than that.

About the best we can do, and you touched on it, is the models, you know, you develop these models; you try to make the models as realistic as they can be. You have to then inject common sense into those models so it's not just "Let's listen to what the models are telling us and believe everything they say." I think that's been my view all along in all the models that have been developed, is that all too often you end up getting model output that people make

decisions on without really looking at what are they telling you and questioning the outputs of the models.

So, in this case, in this particular project, I think there's some very what I would consider state-of-the-art models that are being developed. They're not in a position or a place where they're functioning correctly. There's data that needs to be gathered yet and so I think we're a ways away from saying that we've got a set of models that we can at least begin to try to understand what the river is going to do, you know, channel-wise and fish habitat-wise.

That's sort of the beginning of answering your question is reliance on those models but then you have to bring in your own opinions and professional judgment and your scientific knowledge of how this river is going to respond. I will say that in this project, and this is the last thing I'm going to say, is that at the end of this project the best science I think will be brought forward, at least that's the goal. But then there's going to be hard decisions made in terms of the resource, agencies, the state of Alaska, you know, people, the stakeholders, they're going to have to make decisions because there will be tradeoffs that are going to have to be balanced. There's no way that you can put a hydro project of that magnitude in a system, on a regulated system, without there being impacts. Just the river, you know, the dam itself and the inundation of the river itself and flooding backwaters, that's a major impact.

So, that's going to have to be thought through very carefully and mitigation plans developed, protection and mitigation and enhancement plans developed. Good question, I don't have anything further to say other than the models are just the starting point, in my opinion, from which to base intelligent answers on, but then you have to bring other factors into it. And I would agree

in many cases we come up short in trying to really understand what's going on, and that brings in adaptive management and monitoring and adjusting and et cetera, et cetera. Would anybody else like to comment on this?

STEVE: You did it.

DUDLEY: I did it? Put him to sleep very quickly.

TOM: All right, with 235 people here; there's got to be at least two more questions.

DAKUS GEESLIN: I got one, Tom. My name is Dakus Geeslin with the Texas Parks and Wildlife Department. My question is for Chandler Peter. Chandler, in our experience in dealing with projects within the southwestern division, the various districts Tulsa, Fort Worth, Galveston districts, we've seen some inconsistencies in interpreting corps of engineer guidance documents. I'm wondering what you would recommend for us as state resource agencies in addressing some of those in our comments – or what's the appropriate form to bring to light some of those inconsistencies we've seen in the various reservoir projects that are planned in Texas?

CHANDLER: What they say about the regulatory program is the only consistency is our inconsistency. Obviously southwest division with the districts that you mentioned has the final say or the responsibility to ensure that the districts within the state of Texas are implementing in a consistent fashion. Guidance obviously is written in a way that tries to be specific but flexible, and as soon as you add that flexibility you start getting the inconsistency.

So, depending on the particular topic that the agencies have identified for inconsistency, one of the key things is I would suggest having a working knowledge of our regulations and what regulations actually come to bear on the topic, what's the specific

guidance that goes along with it, is there any case law that goes along with it, as well as if there has been historic implementation within that division's and/or district's area of responsibility which we could contrast and say, "Hey, we really are being either arbitrary and capricious or highly inconsistent which draws the attention of somebody to come in and say, 'We need to change or we need to do something or we need to come up with another document to get us on the same page.'"

MARTYE GRIFFIN: Another question for Chandler. I'm Martye Griffin with the Wisconsin DNR. I just had a question about how the Corps reviews projects with regard to purpose and scope. At lunch, we just saw about looks like the proper way to solve a river problem, for instance an erosion control problem.

So, if you get a project that suggests to fix an erosion control problem like placing hard armoring along the stream bank where there may not be the best case, is the Corps in a position to look at the project purpose and scope and sort of say, "Hard armoring isn't good here, maybe you should consider a different way to control the erosion"? Or do you just look at the project at hand and make an assessment on how the particular project impacts the resource and not sort of act as a consultant to a better choice?

CHANDLER: It depends on the kind of project, the impacts, and the type of permit that's being utilized to evaluate the action. Most bank stabilization projects are covered under what's known as a nationwide permit which are evaluated in Washington DC on a five-year cycle. There's a declaration that says those projects have to result in minimal adverse environmental effects individually and cumulatively, and the fact that there might be other methodologies that can be employed on a project-specific or case-specific basis, we don't have the ability to go in and take a look at what the

purpose, the need, and then the scope of the project is under those types of permits. So, they're actually built to get things through rather quickly. However if we're unable to conclude that the impacts will result in minimal adverse impacts individually and cumulatively, we have the ability to execute what's known as discretionary authority which then kicks it up into the individual permit review process.

That's where we do take a harder look at the need for the project, defining the project purpose, and then we start taking a look at other alternatives. Then we get into practicability issues and how things are associated with the regulations where we could conclude that a more sensitive, less damaging option might be available.

But it doesn't necessarily mean that we end up going there. One of the things with Dave's [Rosgen], slides that he showed is that when trying to get those floodplain pipes incorporated into various developments, the first reaction from an applicant such as, for example a county road department, is the cost. At this point I'm starting to argue in engineering terms and I'm a biologist, so I'm pretty much out of my league in a hurry. And with my workload, again as I indicated earlier, we do everything with nothing nowadays. We're running. And in the full grand scheme of the potential impacts of the issues that we deal with, we're making risk-based decisions all the time to say, "Do I have the ability to go ahead and kick this into something more complex?"

One place that we had this bank stabilization issue come to fruition as a problem was on the Yellowstone River. I mentioned earlier, we got sued because we were issuing multiple nationwide permits and cumulatively on that river, the impacts were concluded to be a major problem. We went to court, the court ruled in the plaintiff's favor, and that's why we ended up into doing [unintelligible] and

came up with development of design strategies associated with that particular stretch of river.

So, those kinds of strategies can occur but on a day-to-day basis if nationwide permits have been declared, here's the conditions. And if we don't put regional conditions on, then armoring is an accepted practice even though it may not be the least impacting.

KATIE KENNEDY: Hi, I'm Katie Kennedy with the Nature Conservancy. This question is for the panel but also for the IFC and the audience as a whole. It's related to Professor Gunderson's presentation, and specifically the concept of policy as hypothesis, the original I guess design or thought process behind adaptive management. I'm specifically thinking about the regulatory framework of hydropower licensing and perhaps at a broader scale. Is the current regulatory framework adequate for dealing with uncertainty and instream flow in hydropower? And if so, how do we adequately account for that uncertainty and making the best decisions we can in that regulatory framework? And if it's not adequate, what changes can we promote, the Conservancy or the IFC in general, to ensure that we incorporate uncertainty, we address it and ensure that whatever decisions we make are up to a 50-year license, maybe even 70 years if there's a proposal for it to be 70 years. How do we ensure that we make these good decisions dealing with uncertainty in the framework we have or in an alternative framework?

TOM ANNEAR: It's too bad we don't have somebody from FERC here. Dudley may be about as close to that as we get. [Laughter] As for an IFC perspective, I'm not able to provide that as I'm one of 30 of or so IFC members who might give 30 different answers to that. Hal [Beecher] would probably provide as good an answer as anyone from the IFC as he's had a lot of experience working with FERC.

But the thing that has struck me over the years is that the ability of FERC to address uncertainty of instream flow with hydro projects is pretty closely related to the commitment and involvement of the state Fish and Game Agency as they're the primary agency with authority to provide information on related fish and wildlife. There are situations where state agencies tend to be more silent and others where the state agencies tend to be more aggressive. And so the degree of addressing uncertainty is a variable one; "it depends" is certainly one answer. Hal, you look like you want to get up and talk.

HAL BEECHER: Yeah, I just wanted to go back to sort of add to what you said and say not only the state Fish and Wildlife agencies, but what Larry [Wasserman] said this morning, the tribes have – where they participate – have tremendous influence too.

SPEAKER: So, one thing is a friend of mine, a sociologist, she wrote a book with a wonderful title and it was "Getting to Maybe" rather than "Getting to Yes." In a lot of these cases, I think that may be an important distinction. But the interactions between approaches in adaptive management and regulatory framework have not been particularly synergistic. I mean, they pretty much are examples of folks dealing with TMDL limits and you're not quite sure what they are but the regulatory community doesn't want to experiment with it, so they won't do it. A lot of times that comes from the environmental community and they don't want that kind of uncertainty, businesses don't want that kind of uncertainty, they want a kind of certainty. So, in some ways, it's kind of an agreement that takes a lot of trust to see about whether or not you can. You know we don't know what the answer is, there's a lot of "maybes" here, and could we resolve that through time in terms of how we design and operate whatever these systems are? That's sort of the gist behind the adaptive management approach.

But, you know, so we got to have that kind of flexibility and trust in the community to move those forward. And the sort of litigious background that a lot of you I think deal in, that doesn't really foster that. I think that's one of the big issues in the Everglades is sort of people can't get over this sort of adversarial relationship in terms of wanting really different things out of these systems. And so without that, they're not willing to even get to "maybe" in terms of trying these things.

The other thing I'll say is that the consequences of an experiment or a policy probably have a big role in this in terms of, you know, is it a really important decision and costly and all those kinds of things. But that oftentimes the strategy is taken in these things of being failsafe, that is, the previous presentation about the original structures of just building levies and the idea being that they're not going to fail, and if they do, well, then you just build them higher and stronger, right? That's the Katrina in New Orleans example.

But what you see, and again I defer to the last presentation at lunch, the evolution of approaches on this were really towards more safe to fail strategies – that is, you can deal with a wider range of change in environmental conditions rather than these kind of failsafe approaches. So, a part of it is in sort of whether or not you can innovate and get to those kinds of policies.

And the other thing, and I'll go ahead and say it in this room, is that I think most of the organizations we work for now and perhaps even our society has made it so costly for individual failure. So, a lot of decisions that we make are really about "one strike and you're out" basically. So, I have to watch what I say in class or I can't take on a really difficult subject and talk about, even though I have academic freedom. So, in some ways, it's a less forgiving

world, it's a less forgiving society, both in terms of people's career as well, and the kind of institutions. So, yeah, it's not easy.

SPEAKER: Just two competing answers to your question. So, the existing – we've been involved with a couple of FERC relicensing issues. Obviously the biggest problem we have is at the base, issue of baseline. So, if a fishery has been wiped out, that's part of the baseline; it's hard to deal with that. But most recently, maybe within the last three or four years, we had a relicensing agreement with Puget Sound Energy. I think the cost was about $350 million, no litigation. I'm going to go back to what I said earlier; there was uncertainty on all sides. We just litigate the issue, challenge the permit, leave it to FERC; we really didn't know what the outcome would be. And so we built in some monitoring programs, some requirements for Puget, given certain answers, and we had the latitude within the license agreements to do the kind of adaptive management or monitoring that it was to everybody's advantage rather than getting a hard and fixed rule by a third party on FERC and then have the next 10 years of litigation still with uncertain outcome. So, I think at least in the instance of the two relicenses that we've had over the last 15 years and a new one coming up, I think smart negotiating and shared sense of uncertainty provides opportunities that didn't exist when this operation relicensed the first time.

SPEAKER: Yeah. And I would just echo that too, just based on sort of stepping outside of the Susitna framework here and thinking about how relicensing has taken place over the last 10 to15 years or so. I've seen more flexibility, at least thinking about more flexibility being brought to the table, in particular associated with settlement agreements that are worked out. So, it's not so much FERC going forward and making their determination, but it's the parties working together with the stakeholders and the agencies and the

applicant to identify perhaps areas where there is uncertainty, and if you can—economics is always a big condition for the utilities that are involved—but if you can, build flexibility into how that facility might operate and then monitor and make corrections. That can possibly be worked out through the settlement agreement process probably more so than the more regimented FERC process.

BOB DEIBEL: I'm Bob Deibel of US Forest Service National Hydropower program manager and National Instream Flow coordinator. Following up on this question that Katie raised, it seems, you know, we're hearing a lot of science about uncertainty and what is achievable and then in the FERC world where you may have a series of dams and reaching those ecological outcomes. It's just not going to happen unless there's massive intervention of gravel inputs or something. So, one thing I'd like to hear from the panel is if you can't achieve certain goals and maybe it's under the settlement agreement, looking at compensatory measures, how does one go about achieving those compensatory measures? What triggers would you use where you have a series of projects even like under FERC or other permitted projects? You're just not going to get to these attributes of the flow regimes and stuff, so the issue of compensatory mitigation, either onsite or offsite, how might one go about that? Are the studies or methods that we have now adequate? Are there things we should be thinking about? Because when you've got a facility that's got a certain turbine size, the odds of changing that in a regulatory framework, you may never get to get to some of these ecological goals. So, I'll just leave it, you know, the issue of compensatory mitigation.

SPEAKER: Well, I just have one project in particular comes to mind, again it's tied up in the northwest with the city of Seattle, and I don't know if there's anybody from the city of Seattle here or not. The Seattle Public Utilities, they are very environmentally conscientious in

terms of their relicensing activities, but the boundary project is the one that I'm thinking about. You had a situation as part of the relicensing that the city was, you know, load following or a picking mode, I mean that's what that whole facility was based upon, and for them to want to get off the dime and shift over from a load following or a picking mode to a base project, base load project, would have been extremely costly. So, they were, through the settlement agreement process, able to hold on to that process. Now that involved a lot of environmental work, working with the agencies, the tribes, and identifying the major impacts associated with the Pend Oreille River, bull trout were an issue, you know, endangered threatened species.

So, that had to be taken into consideration, but when all was said and done, they worked out an agreement, a compensatory agreement, protection and mitigation and enhancement that had to do a lot with tributary improvement, tributary enhancement. I can't even begin to tell you all of the pieces that went into that but it was very significant expenditure of dollars for resource protection off-site and some of it within the same watershed to hold onto those particular, like you say, you're not going to get there. Some of these projects, the existing projects anyway, you're not going to be able to shift over; at least they're going to be very reluctant to shift over. So, you have to have that willingness to look outside of that if you can and then identify what can be done and work out some package on that. But that's just, I agree with you, I think there's some, that protection mitigation and enhancement element and the FERC processing is very key to -- in the end you all have to feel good about a project, in my opinion, you know, the relicensing. You've got to protect the resource as best you can but you realize there's going to be some residual effects on that project, and so how do you achieve a package where you feel like you've done

enough here now? You've got a lot of, you know, measures that are going to be in place and a good protection mitigation enhancement plan. So it's not easy, not an easy solution to that at all.

CHANDLER PETER: Relative to the Corps regulatory process, for most existing facilities we don't get involved with those and how they may be modified. One example of those is one in the city of Denver where they're modifying the dam which has a FERC license on it. And FERC has their process, we have our process; they have their rules, we have our rules. We have compensatory mitigation rules that came out in 2008 and well, again, the same thing, my response to Dakus earlier was the fact that they are written in a way that requires certain things but then there's flexibility and latitude and we try to negotiate with the agencies, but the applicant has a lot of say into what they may offer up.

And so there's a lot of negotiation that can go on amongst the applicant and the agencies, and the Corps ends up as a final operative relative to compliance with the regulation. Whether we stick to what the outputs from the models are indicating or we want to do more, or we look at replacing with things that are out of kind or off-site or some other form or fashion, that's still all on the table. We still have to follow through on a particular process, but there's still that negotiation. The question that follows on that is does the mitigation actually work? That's where the question of adaptive management comes in because we may say, you know, on the front and how much more do we spend time doing analysis, trying to figure out the stuff out and trying to figure how to mitigate. Maybe we take some shortcuts on the impact analysis because the applicant's gone ahead and said, "Hey, I'm going to go ahead a make a commitment under a worst case scenario assumption and we're willing to go ahead and mitigate for

whatever the numbers may come out to be what we can negotiate with the agencies just because the courier process is taking so long." Those are all things that can be -- try to be accommodated. However, we also can conclude that after mitigation and if an action to the regulations results in significant degradation, we have no choice but we have to deny the permit then.

KEITH CLARKE: It's interesting because in Canada we've been living with compensation for probably 20 years, 25 years. It's written, it was originally written into our act that to compensate there was a policy and for us to compensate or if we at released authorization for any habitat degradation, yeah, the corollary of that is that we have to compensate for that degradation. In the previous version of the act, it would be mostly like-for-like habitats so you try to replace habitat like-for-like. Try to do that on any kind of medium to large scale hydro project, guess what, you're not going to find it. So in the new process, it's actually called offsetting now, which is an interesting change in terms. But offsetting is actually designed to be a lot more flexible and allow some of these offsite things. We've just, I personally went through a fairly large review for a hydro project [unintelligible] it's about 2500 megawatts on a fairly monstrous river. The compensation project, to be fair, is actually I would say the biggest adaptive management experiment we'll ever do in the province by far.

And the proponent actually signed onto adaptive management in that case under the environmental assessment of that particular project and they signed on for a 30-year monetary program. The reason was basically even though we had the best science we could have, the community in the area really didn't believe the science all that much and they pushed pretty hard inside the environmental assessment process, because it was a recommendation of the environmental system panel, and we're the regulator. So when we

accepted all the recommendations of the panel, it becomes tied to the relicense – not that I ever expect to see it used. They actually have a bit of a stick that they can go back on, make sure that you're doing their adaptive management. So we actually have over 20 years of experimentation with these things in large projects, in large hydro projects. Almost every time we do it, it's a new experiment as you probably thought of it almost that way.

TOM: We have a question here but before we get to that one, I want to encourage everybody to participate but I know there are several students in the room and people who are perhaps new to the instream flow business. I really encourage you to step up and ask a question if you have it. Those questions can be refreshing and enlightening and help the panel and others in the room see things that we're just totally biased on already. And so you've got 20 minutes here still to come up with questions. It doesn't have to be the smartest question in the world, because they're all good questions. So, next question.

RON TONY: Hi, I'm Ron Tony from the BC Ministry of Environment of Victoria. This is a fairly simple, straightforward question for Dudley. So when I looked at your slides, Dudley, on your Alaskan stream case, I'm reminded of some of the work I've been involved with in that same general part of the globe on the Iskut River which is another sediment-rich system. So the question is, given the sediment-richness your instream case, what's the life expectancy of the dam or dams?

DUDLEY: Well, I can plead somewhat ignorant on that, in the sense that I'm not the engineer that has put forward the designs, but I've been told to the best of my recollection that it's 100 years or more. The sediment—and again I would defer to the folks at Tetra Tech and some of the other study leads who have looked at the sediment

issues on that project in a lot more detail than I have—that a lot of the sediment that's coming out of the Susitna in the dam location is actually not -- it's moving through the system. That's a small percentage of the actual sediment load that's being brought into the Susitna River system. So I would defer to, you know, the specialist in that arena to answer that in more detail. They wouldn't be looking at this project if it was like a short-term project, 25-year, 50-year. I think they're looking much longer than that in terms of operational efficiencies.

TOM: Standing in line over here.

JAMES CASEY: James Casey, WWF Canada. I guess I'll start by directing this question to Keith Clark but maybe others have their thoughts on it as well. Coming from coastal BC, I'm interested in flow standards in regard to estuary function and I'm wondering if estuary function was considered in the guideline that CISA has provided or if others in the panel could direct me to resources relevant to that particular question. Thank you.

KEITH CLARKE: Thanks. That's an excellent question. Yes, it's come up a lot. In our particular process, estuary function was not involved. But there was a process out of Quebec. How's your French? [Laughter] There was a process out of Quebec under Romaine River Hydroelectric Project. It's actually been published, and I know their big issue is estuarine and juvenile fishes, especially for the project and crustaceans like crab and lobster species. That was actually the biggest issue. Another place that you may want to look, if you're interested in that type of stuff, is James Bay Project. You might have to dig again through some Quebec literature, but the James Bay Project had a huge amount of information collected on it and it actually did go right out to the estuary, which was interesting. I saw someone over the Alaska Project talk about

downstream effects. They found mercury effects 100 kilometers downstream. So it can happen. It's one of those things that can pop up and we don't expect it. But in those two places, estuaries have been a big issue also in the lower [unintelligible] but we have no information right now [unintelligible].

TOM: Over here on the right.

ROBERT VADAS: I'm going to ask a question as if I was still a student, hopefully not too naïve and granola-headed.

TOM: Give us your name, Bob.

ROBERT: Oh, yeah, Robert Vadas Jr., and I work for Washington Park Fish and Wildlife. So the question is, you know, we talked over the last couple of days, there've been real a lot of good stuff about, you know, impacts of flows and dams, and it's kind of directed towards Dudley but more general. You know, the end game when you're building a hydro power dam is the electricity and not necessarily the dam. And so, you know, there's technology now where you can put turbines in the river without doing a dam. I know there's been a project, I don't know how far it got along, in the mid-Columbia where that was the proposal. I mean, if you can put turbines in places like rapids, why do you need a dam at all? Obviously you're going to get less electricity but you're going to have less costs and environmental review and installation and stuff. So what am I missing?

DUDLEY: Well, I'll try to shed a little bit of light on that, although I really don't have the answers other than I'm sure there's been economic studies done and engineering feasibility studies that have been done repeatedly on this river system as you saw that in the 50s, in the 70s and the 80s and now contemporary looking at it again. Even in Alaska, my understanding is in the Yukon River system there are some of these in-river small hydro project developments

that are being tested. I think perhaps some of them are actually functional. Maybe Joe Klein from ADF&G would comment on that if you want to. I think that's the case. It's really a matter of those are not going to meet the demands. It comes down to energy demands. And you have to have, from what I understand, a very sizeable structure to meet the demands of what the State of Alaska may be projecting out 100-plus years. And so putting in small scale in-river type turbine systems in a river system like that would probably, you know, give you a little bit of energy. There's also, if you look at the state of Alaska, you're looking at solar, you're looking at – well, not so much solar in the winter time but you're looking at wind generation for sure. That's been something that you'll notice as you're coming in to Anchorage. There's a lot more wind generators in the system.

So I think it comes down to economics, you know, and the stability of the project. You want something to be permanent. I think there's probably a lot of maintenance that would go on with those types of things, but it's the capacity I think is the big issue.

KEITH CLARKE: Hydrokinetic turbines are an interesting kettle of fish. Actually we've evolved with our view a few years ago on those in [unintelligible]. They're not completely environmentally inert. They do have an effect. There's a project on Hudson also using those things and there are some interesting – but, you know, I mean, Dudley is right; they're not going to produce enough energy to meet demands. The other thing, if you talk to electrical people, especially in the hydro industry, they really like hydro because of the storage. Storage is a big issue. We can't store any amount of energy in any case, anywhere. Everybody likes wind, but wind doesn't have storage. It doesn't blow, it doesn't work, and you can't pick it. I'm involved with an international hydro project out of Norway and they always try to develop wind with hydro. So

they're developing two side by side and basically they look at hydro as their batteries. And that's one of the reasons you're not going to see these hydro kinetics take over hydro any time, soon anyway, maybe in the future.

CHANDLER: I'd like to clarify one thing. It was from a regulatory perspective. I was thinking about the presentation that Dudley had done. With the level of analysis that's going on at least in that one basin and for us, we're going to be looking in other locations to be building the facility. So if there's other basins in the area that could generate whatever the need is that's been identified by the applicant that they're trying to address, we're looking at it from a NEPA perspective. We have to treat the alternatives consistently as the amount of analysis that's going on for the one. We'd also want to be looking at relative to the other because under our regulations we can only authorize the least environmentally damaging practical alternative which FERC doesn't necessarily have to be too concerned about.

But it definitely is a distinction between their regulations and process versus ours and it can create some consternation associated with the applicant trying to figure out what process they've got to go through. We've worked with the National Regulatory Commission as well relative to our process and even asked them, "When you guys do your NEPA process and licensing, do you put nuclear in the purpose statement?" They said no. Because when they're looking for base loading they're also looking at opportunities, whether it's nuclear, whether they might be able to deal with it from methane, or whether hydro power might be a part of it. Because if they put that in the purpose statement, then those other options kind of get screened out immediately and aren't considered with the NEPA process.

DIANA: I'm Diana Fosbery with GSI Water Solutions in Portland. I'm going to go out on a limb right now and assume that everybody agrees with the following statements that fresh water is a finite resource and that our earth systems are fundamentally interconnected and need to be managed as such. And based on those two statements, I was wondering if you could speak to the traditional decoupling of managing surface water and groundwater as if they're two separate beasts. Is the subsurface on IFC's radar? I'm a hydrogeologist, so the world revolves around groundwater for me.

TOM: Is that a question for me or the panel?

DIANA: This is for the panel.

TOM: Okay, good. [Laughter]

SPEAKER: I can speak just a little bit on Washington State, the laws that were developed in Washington under state law, where they separated groundwater and surface water. Surface water started to be regulated around 1917, I think, and groundwater around 1945. What we've seen over the last 20 years is recognition in most of the basins, the hydrological connectivity between surface and groundwater, and much of the work that we're involved with the USGS and others is identifying, demonstrating, trying to quantify that degree of interrelationship between the two because they really can't be separated. So, even the terminology was different; it used to be diversion for surface water, withdrawals for groundwater. We're really seeing them being managed, at least the state of Washington, as a connected entity, and we know that in many lower elevation streams, sometimes stream flows are driven entirely by the groundwater. There's no more snowpack; we don't get a lot of rain in the summertime. So I think we've seen an

evolution, at least in my neck of the woods, of recognizing them as a single integrated resource.

TOM: As far as the IFC is concerned, yes, it's on the radar. You know, you go to the books that we've produced and in there it clearly recognizes the need to understand the degree and kind of connectivity between surface water and groundwater. And it's really important to at least say you recognize that connectivity exists at some level because you have a variety of relationships between surface water and groundwater. You have gaining streams, losing streams, losing to shallow groundwater, losing to deep groundwater that may not come back.

When you get to the "so what" part of it, once you acknowledge that there is a connectivity, sometimes and in some places, it can vary over space, it can vary in the same place over time. The "so what" part of it varies from state to state whether connectivity is recognized in state law. For example in Minnesota – Ian is not here right in front of me so I can speak about him freely I think, as long as nobody tells, the issue of extracting groundwater and the effects on surface water is a really big deal. They've spent a lot of time addressing that issue.

In other states like Colorado, especially Northeastern Colorado, groundwater users have been shut off because of depleting surface waters, and a really complex water balancing is going on. Other states such as Wyoming have in essence turned a blind eye to it even though they might have legal capacity to address the connectedness. So it's one of those things that, you know, there are so many areas to keep an eye on that, you know, it's hard for one or two instream flow managers or fishery managers to keep track of and document when there's a problem or need to call for some kind of regulation. In many situations, like in Wyoming, the

connectivity of surface water and groundwater is an issue on private land. In places like northeast Colorado the issue can pit one water right holder versus another water right holder and fishery managers aren't involved at all. So you have this spectrum of surface / groundwater interactions and regulatory responses and consequences. So, yes is the answer.

Gary, you have some things to add? Please step up close to the mic and try to be short – we're getting a bit short on time.

GARY: My name's Gary Smith and I suppose I don't work for anybody anymore. I'm retired from California Fish and Wildlife. Anyway I'd like to clarify this groundwater issue. In California, we have surface flow, underflow, and deep aquifers. So it sounds to me like when you people are talking groundwater, there's a direct connection between the river and the groundwater or underflow. In California, we do regulate the underflow or the shallow groundwater. We do not regulate deep aquifers, but there is a movement towards doing so. So when you say groundwater, I think you need to clarify whether you're talking shallow or deep.

TOM: Yeah, and that's where I was getting at when I was talking about the variety of relationships between surface and groundwater and the variety of connections between them, so a good point of clarification. And every state does address the management of groundwater a little bit differently. Now we're over here.

RACHEL: I'll try and be quick here. My name is Rachel Lovell-Ford. I'm with the Oregon Water Resources department, and we very much enjoyed working with California on groundwater issues and the claim with them – I'm sure that will continue. So, my question for the panel, start with Lance and then a follow-up question for Larry: Lance, I was really intrigued by the idea of the windows of opportunity that you pointed out. I was curious what actions you

see agencies failing to take to prepare for those windows. And then as an example, Larry, I was hoping you could comment on ways that Swinomish has prepared and then been able to take advantage of those uncertainties as you call them. But I think they may be similar to those windows of opportunities that Lance was pointing out. Thank you.

LANCE: Yeah, thanks. That's not easy. I remember talking to Kylie about that, and he hated the idea that you would actually think about changing something after a disaster or after some crisis, whether it's natural or social. But in the history of these systems, there seems to be two basic strategies. One is, there actually are those ideas floating around there and they come out at group meetings like this that are really not constrained by the current economics or agency mandates or those kinds of things. Really you're thinking at the limit in terms of, if I were the king of the forest, if I were, you know, Chief Poobah for a year, what would I do? We need to ask those kinds of questions in terms of people. For example, the 1947 flood control project that sort of set the framework for the Everglades, that was really based upon soil conservation society set of discussions that had gone on about 10 or 12 years or earlier than that.

So those things do happen, but it relies on this institutional memory and sort of long-term projections. I think that one or two speakers today have already said that, you know, generally you're so busy with the present it's hard to think more broadly about those kinds of things. I see those kind of ideas coming from the edge. Referral groups are groups that you can suspend or get out of, you know, are we doing things right versus are we doing the right things – can we ask those kinds of questions and answer them?

The other strategy during these windows of opportunity is to make it up on the fly. So, for example, the water management institutions of the state of Florida were really invented over a weekend workshop after a big drought, you know, in terms of those kinds of things where people come together and do it. Yeah, it's really an interesting question.

LARRY: I think your question is how to be prepared to seize the opportunities when they come up. The two approaches we have, -- we have a staff of about 20 just on the Skagit River and as a result, in the species act we needed to develop with the state and other partners' recovery plans. So we have a shin up recovery plan that identifies very specific actions that are not required to be done. There's no force of law to implement the recovery plan. We're in the midst of doing one for Steelhead as well. So for example if there are parcels that we want to buy, we've identified them up front, these will be great parcels near the estuary critical reaches, so that if a land owner expresses an interest we know where our priorities are. But the real opportunities we find, for example on the whole water issue I talked about earlier, it was one of the city of course, it's a downstream city, one of these changes in point of diversion. That was the opportunity that we said hold on. And that opportunity where there was a permit available that would open the door for a very large suite of changes to take place, because we knew enough to know what kind of changes we wanted to see and that there was a linkage between this opportunity through non instance permitting issue to implement some of those changes. So I think to some degree you need to know where you want to go and then push on an open door.

TOM: Question over here.

KENZI: My name is Kenzi Hoffman, I'm graduate student at Virginia Tech, and so being in a university setting, you think a lot about the interconnectedness between the five elements of a river system. And then coming here I have thought so much about, again, interconnectedness between the science, the policy, the institutional framework and the education and the public outreach. And I guess this is to everybody, but do you see a piece of the puzzle that might be the most important thing to focus on in the future of for a young person like just starting to enter this world of instream flows? And you can't say all of them. [Laughter] Do you see one that might be worth our focus?

TOM: I'll start with any of you guys.

CHANDLER: She said I was assertive so

TOM: I thought it was aggressive.

CHANDLER: That too. From the co-regulatory program perspective, my experience is the hydrology, is getting the modeling straight and getting everybody on the same page and looking at what needs to be assessed, how to assess, because there's so much variation. The example I gave were just the three entities within one basin and they all modeled that one basin differently and they all came up with different answers. And so they've invested so much money and time on how they view their system in relation to that, that when you start talking about potentially changing it, it's very defensive.

And then when you get into other arenas, such as where I'm at in Texas now, where the state has a mandated process with what needs to be looked at and it's not really to address, to be looking at the environmental consequences and the impact analysis but more from just strictly a water rights perspective. Something comes in, you want to start modifying or changing that, they get really

defensive and think you're attacking the state system. So from just my narrow pointy headed view, I would say hydrology and the modeling would be number one.

TOM: Well, I'd like to jump in here, to I make sure I get in. You know, the science is always important. You always have to have the best science, but I've thought about this an awful lot, Kenzie, and to me the most important thing is really the people. You know, laws are advocated for by people – and while we say they're written for rivers, they're really written for people. So if you're going to work or focus on people, you have to understand what motivates people and you have to develop relationships and those are what make a lot of things happen. Larry talked about it this morning. Opportunities don't always happen on your schedule. Relationships take time, and it's always worth your time to invest in developing relationships with people, understanding people and motivating others to join you. I talked about the "power of one" in my presentation yesterday. It all starts with one person and that one person can advocate for a particular study with Chandler and one person can assemble a group of like-minded people and advocate for a law. Every one of the elements is important, but to me it begins with people, long-term relationships and understanding how to motivate and communicate to people. Perhaps the one thing that we all in this room generally like to deal with is fish and water and we all generally don't like to deal with people. Maybe I'm just personalizing too much. [Laughter] People are hard but it's the thing that gets things done a lot of times.

LANCE: I kind of get the same question all the time from students. So I'll wave my arm here and say that the question reflects a failure of higher education, in that what we do is we teach students and graduate students how to do research, some of which is applicable,

but it doesn't get at the practice. That is, everybody in this room has learnt probably more through the practice of their field. What I'm saying is that I think in higher education there has been this rift between theory and practice in terms of the kinds of incentives that academics have for developing, well, not developing but by testing theory. Now here are practitioners. And I think that that rift has been growing. I kind of use the metaphor that in many places of higher education, there are theoretical and practical equivalents, so law and political science, physics and engineering, biology and medicine. And so, my question is always "What is the practical equivalent?" And why are there no schools doing it?

TOM: I think that's a very good point. And, Dudley, I know you've got something to add but I'm going to shut you up because I have one question. [Laughter] And then we got to quit. This is really for you, Dudley, Chandler, and Keith, in as few words as possible because I think we're up against the break here. But we're all looking, when we talked about in-stream flow in projects, we're all looking downstream. What about the lakes and what about upstream of the lakes? Dudley in your situation, Chandler when you're permitting dams, Keith when you're looking at the presumptive principle, how do you quantify lake benefits or effects, or do you? And I'll just leave it at that right there. Because lakes are the thing we have forgotten about for a long time but I think we have to think about in future. Do you look at this in your situation? And how do you quantify it?

DUDLEY: Well, I can address that. I'm not sure real short but I'll try. I'm not going to use the Susitna Project, but I think lakes are very important. I would use, I would go down to the Klamath basin and I would say that from a water right standpoint, we do sort of always look at the riverine systems as being the keys pieces and that's where a lot of the methodologies have been developed. But

in the case of certain projects and certain situations, lakes are very important and in the case of the Klamath Lake, the water rights there, the lake level became very important and so we very carefully worked with the tribes. We were working with the Bureau of Indian Affairs and looked at how you would craft a water rights claim for a lake. It evolved around the needs of the tribe, what their native species were, the sucker species in that case, and then looking at habitats of that lake and how those habitats changed in the littoral margins of the Klamath Lake and then trying to come up with a regime, in addition to water quality. Water quality was a big issue on that. But I think lakes in the short answer, yeah, they're very important. They don't fit into the same mainstream thinking as we have with in-stream flows but they're definitely an important aspect that I think warrant additional consideration.

TOM: I'm looking for some "how do you do it" stuff here, Chandler.

CHANDLER: Part of it depends upon what's being inundated as well as what's being modified downstream, if there are potential opportunities to do resource trade off, and part of that depends on what part of the country you're in. When I got down to Texas back in 2013 after working in Colorado, one of the things that we were looking at was because the lake was being created mainly in an upland area, I wasn't going to look at it from a functionality perspective of being a parking lot, where we'd say, "Hey, there's nothing there." Colorado Division of Wildlife definitely saw value to it and so did the recreational and other uses associated with it. However, the resources we deal with in eastern Texas, you know, [unintelligible] Highwood Forest is a completely different animal. And if you're losing significant existing aquatic resource ecosystem components and replacing it with a flat water lake, can you do the trade off? I actually queried multiple districts around the country.

And as I said earlier, sometimes the only consistency in the program is our inconsistency. But there was a lot of consistent input from the districts I talked to that basically said they take a look and maybe knew that the inundation of a creek, a free-flowing stream to conversion to a standing water system is a complete loss. And therefore they are going to have to replace the complete loss of that stream system. However, how they look at the open water is really variable and what goes on with it. And there's still a lot of debate also about the [lateral] system and how do we go about trying to measure that. A lot of people sit there and presume, "Well, we're going to have X amount of acreage of wetland generating along the fringe," when in reality, particularly out west, that isn't the case. However, down in eastern Texas, it is the case. There are going to be some substantial wetlands and riparian zones that can be induced due to the creation of the lake. And so trying to measure that and how to trade it off all, I would say is that the Corps has, at least through our HEC folks out in Davis, something called EFM that's trying to get its head wrapped around it.

KEITH: Now I have to be really quick because everybody wants a cup of tea. Lakes are very important in my neck of the woods. Actually they're probably among the more productive areas in the watershed. It's interesting because I live in a place where we only have three or four species at most and all of them use lakes. So the salmon production is actually out-bended quite a bit by lakes. So I was trained, 20 to 25 years ago, I was actually trained as a limnologist. There are definitely ways that we can incorporate similar type analysis on lakes, especially if we're doing impoundments or we're modifying lake levels or we're looking at dried out, there's lots of marbles out there that actually can look at lakes. I think the biggest thing is you got to start talking in the same currency. And that's where we can start to integrate lakes

back into our ecosystems. Because they're all flowing down, so the lakes are just big parts of the river in a lot of cases.

TOM: Well, I think the overall conclusion here is if you want to know how to quantify impacts in lakes, you call Keith [laughter]. But really let me remind you that one reason why we're all here is to develop networks and connections. Now you know somebody who knows something and hopefully you'll find somebody else who knows something and build on that. I thank you all for your questions. I want to thank you all for being here. Really thank our speakers; they just did an outstanding job. [Applause] So go grab some coffee and come back and we'll do this again with the states.