U.S. ARMY CORP OF ENGINEERS

Moderator: Courtney Chambers
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Sarah Miller: So today our speaker is (Jock Conyngham), as I mentioned. He's a research ecologist in the environmental laboratory of the Engineer Research and Development Center here, in the environmental lab. He's also based in Missoula, Montana primarily. But with specific relevance to today's topic, (Jock's) specialties include multi-scaled assessments, restoration, and monitoring of watersheds, streams, and rivers, riparian zones, and aquatic populations. (Jock) has experience in and has provided technical support for dam removals, for fish passage projects for ecosystem restoration, monitoring and adaptive management, and also for environmental benefits assessment.

Prior to joining ERDC in 2002, he was Director of Watershed Assessment and Geomorphic Restoration for the National Office of Trout Unlimited, where he worked for nine years. He received his bachelor's degree in anthropology and environmental studies from Dartmouth College and a master in forest science and a master of philosophy from Yale University's Department of Anthropology and School of Forestry and Environmental Studies.

So again, I want to welcome everyone to today's program and here is (Jock Conyngham).

(Jock Conyngham): Hello everybody, and it looks like I have control.

(Courtney Chambers): There you go, (Jock).

(Jock Conyngham): (Courtney), all I have is a blue screen. Is that - there we go.

(Courtney Chambers): All right. Yes, we're seeing your opening slide.

(Jock Conyngham): Okay. Thank you all for being here. I know it's a very busy time of year and I'm impressed we have as many people as we do. I'm a little bit stunned that you've been given the opportunity to watch this again and again, even with your family at home if you so choose. We have a lot of material to cover so we'll get started.

Monitoring in the greater community of practice and within the Corps has increased in importance and profile recently. And that's the real reason for this presentation. I'll be talking about the problems and needs, definition and applications of monitoring. What the current guidance is in reference to WRDA 2007 and within upcoming WRDA there may be further changes and I urge you to stay tuned. And then it will move to really more technical and operational issues of monitoring.

So, what are the problems? In large measure (unintelligible) towards increased monitoring has come out of a larger series of criticisms of the success and larger social and economic benefits, ecological benefits, of river restoration. I don't know how many of you are aware of the NRRSS -- the National River Restoration Science Synthesis -- that was done by, led in large part by Emily Bernhardt and Margaret Palmer.

There was a series of publications there but it really, it was a pretty sobering assessment of the response -- and in particular biotic responses -- to river restoration as practiced broadly. I'm not referring only to the Corps but river restoration practices internationally.

And in some measure there was explicit criticism of an attitude and assumption of doing good. And the fact that monitoring to observe responses and measure benefits was either not done at all. It was poorly done, or if it was done it was not really integrated into adaptive management protocols that could be used to really optimize benefit. So with some prompting from O&B and voices, opinions within the Corps and its partners, WRDA 2007 very significantly expanded utilization and permitted time periods and economic and labor resources to be allocated to monitoring.

And there was also recognition that the Corps works in many different ecosystem settings and does many different types of projects and different skills. And we had to really use monitoring and adaptive management to maximize the benefits of individual projects and programs in aggregate.

What are some of the broader categories? Well there's large scale -- and when I say large scale I mean both temporally and spatially -- monitoring that really is targeted towards prioritization in project selection and design at a meta or larger scale, setting national or regional baselines and discerning trends. The program scale monitoring is used at sort of that mid-level, but what I will be talking about more is really in the ensuing bullets.

There is short-term monitoring that is important to make sure that your project is being implemented and constructed according to design and according to Corps standard. And more explicitly, it is - this talk will address monitoring to assess and maximize project performance and to support adaptive management. And I hope that many of you who are on this presentation were able to watch Craig Fischenick's talk last week, and if you haven't I urge you to go to the archives and watch it.

And incidentally, the guidance that came out addressed both restoration and mitigation, but this talk will focus on restoration. I'll refer just briefly. If you did watch Craig's talk and if you follow this field more broadlier [sic] or if you're a restoration practitioner or planner, you've probably observed the increased use of conceptual models, and monitoring is also quite important for validating and when needed refining the conceptual models that really undergird a lot of our restoration efforts.

What are the general objectives of monitoring at the project scale? Again, I threw in that first one but I didn't bold it because that determines larger needs, really. But one is to support adaptive management, as I just discussed; to assess and investigate and justify individual component expenditures within a project; to minimize cost, maximize benefits; to be efficient and to increase the efficiency of restoration activity.

To determine ecological success which is an important criterion that's addressed explicitly in the guidance memos; to document it and to communicate it to our project partners, the public, and the media; and to advance our state of practice, to get better at what we do.

So, two different guidance documents came out of WRDA 2007. 2039 addressed ecosystem restoration and 2036A addressed mitigation. And if you for search for those -- can I go back -- if you just do a search on those they would come right up.

(Courtney Chambers):(Jock), right quick. Let me just remind all our participants to double check that your phone is on mute, just to minimize our background noise. Thanks.

(Jock Conyngham): How is monitoring defined within the Corps? The guidance documents describes it including the systematic collection and analysis of data; providing

information for assessing project performance; weather success as ecological success that's been achieved; weather adaptive management may be needed.

So to get into Section 2039, the meat of it a little bit more -- and this is a summary, I urge you to go back to the original memo -- it applies to the continuing authorities, to specifically authorize projects, and other programmatic authorities. It mandates the development of a monitoring plan, which will be initiated during plan formulation. And that monitoring plan needs to focus on key indicators of project performance, and I'll talk about that focus a little more later.

And there is a set in - the memo contains a set of required components of the monitoring description that goes into the document: rationale, metrics, relationship of those metrics to performance standards and objectives, description of the specific uses of the information and delineation of organizational rules and responsibilities.

(Unintelligible) characteristics, duration and periodicity of monitoring, the disposition of monitoring data and analyses derived therefrom, costs and responsibilities all must be elucidated. Scope and duration -- and this is important guidance -- it should include the minimal monitoring action necessary to evaluate success.

And for simpler projects, monitoring doesn't have to be very complex. It needs to be scaled to the individual project, and I'll talk about some of those criterions. But you don't need a bone-crushing monitoring program for every project. The plan will be reviewed. And it commences immediately upon completion of construction and continues until restoration, ecological success has been documented formally.

This is determined by an evaluation of predicted outcomes versus actual results. The financial and implementation responsibilities must be spelled out specifically in the PPA and the cost share component is not to exceed 10 years. Now, and that represents an expansion from the previous figure, which as I recall was three years. Now monitoring can go on longer than that, and in many cases, in some cases should go on longer than that but at that point it will be 100% non-federal responsibility and will be conducted by the project partners.

We tried to make each of these individual talks complementary but also somewhat freestanding, so this slide will address adaptive management briefly. A plan is required for all projects -- even if it indicates a very elementary or conditional adaptive management plan -- again, it has to be appropriately scoped and explicitly scoped to project scale. Rationale and cost have to be included.

There's further guidance on what happens when required physical modifications are identified and identifies cost responsibilities for those modifications. And then just to move quickly, there are a few more requirements spelled out about 2039 and adaptive management as practiced in ecosystem restoration projects.

Now, monitoring for mitigation is similar but (unintelligible) in a few key aspects. And again I urge you to go to the original documents. But again, monitoring has an increased role in mitigation just as it does in ecosystem restoration as defined by WRDA 2007.

So what are the take-home points about these guidance documents? One, policy has been established now. Profile use and importance of monitoring has increased with those guidance documents in WRDA 2007.

(Courtney Chambers):(Jock), one moment. Excuse me, if you're on the line please take a moment and mute your phone. We're hearing some shuffling and some background conversations. Thank you.

(Jock Conyngham): That change in the profile of monitoring may lead to an increased operational role with your project partners. Ecological success is the central criterion, I should say, not a central criterion. And requires precise definition, and I'll be getting into that in discussion of objectives and metrics later in the talk.

And finally, monitoring is not research and not for research. And if you watch (Craig's) talk on adaptive management he talked about it having the process of adaptive management being quite valuable. That's less true of monitoring. It's not true of monitoring. There are lots and lots of projects that I've seen in which the project implementers -- and again, I'm talking about the broader community of practice -- but they buried themselves in data, sometimes without analysis and often without application.

It was really monitoring for monitoring's sake. And most of those projects would have benefited quite dramatically by appropriately scoped but far more elementary monitoring and greater allocation of resources to data analysis, data communication, and development of a process for acting on those data and those analyses to support adaptive management.

These 10 elements essentially describe the restoration process and monitoring plays a central role in seven of them. Problem definition; the development of objectives; the conceptual model; the developing restoration hypotheses; choosing these target parameters -- and really another word for metrics or

specific goals and objectives -- evaluation and testing of hypotheses; and then supporting adaptive management.

In terms of principles, what are the central principles for monitoring? They have to be - monitoring has to be able to support timely and in many cases fairly rapid, cost-effective corrections and improvement. And by AM I mean adaptive management. I think many of us -- and I'm speaking in large measure as a former staff member of an advocacy group -- we assume that others will recognize the value of our ecosystem restoration activities. And that's somewhat hubristic. Really we need to be able to prove to people and communicate to people precisely what benefits we are achieving.

And finally, restoration in many cases is tough. And the Corps has a formal commitment to being a learning organization, and we recognize that we need to -- like all practitioners of ecosystem restoration -- we need to be getting better, and that will not happen without monitoring.

What are the characteristics of an optimal program? It is first of all clear goals and objectives; appropriate temporal and spatial scaling; and allocation of human and fiscal resources for data collection, management analyses. QA/QC procedures, which can include peer review. Flexibility, when flexibility is indicated where dealing with ecosystems which are notably dynamic in some social and economic settings, which often are.

It has to be reasonable in cost for the benefits achieved of the monitoring, and often when you're putting together a monitoring plan you put a bunch of specialists and a bunch of agency counterparts and maybe some public stakeholders in a group and they produce this giant laundry list. And the specialists in particular want everything under the sun.

Scientific people like me want everything under the sun monitored, and that is usually not (unintelligible). Because of the need for rapid feedback, the monitoring has to be efficient in implementation and it needs to be reportable to audiences who speak different technical vocabularies.

Now, when we measure lift from our ecosystem restoration activities, it can be measured through changes in ecosystem structure, function, and a subset of functions being ecosystem services. Those functions provide clear and direct measurable values to society. And here are some definitions for those categories.

To get more specific about categories, we often have hydro geomorphic objectives for restoration activities. And this table describes, defines specific elements in hydro geomorphic or biochemical or biotic systems, socioeconomic systems, and then just throws some sample benefits and services out as examples.

And those benefits can range from very measurable, quantifiable examples like de-metrification rates of riparian flood plans and riparian wetlands to more amorphous but in some cases important issues of say environmental justice or esthetic pleasure benefits that you see in that (unintelligible) on the bottom right.

What are some techniques for setting objectives? (Gregory and Keaney) have a nice publication. There are some individual sets that develop a broader list, begin to synthesize that broader list and general concerns into more specific and succinct goals and objectives, organizing them by category and teasing out sub-elements and implications and benefits from each of them.

In many cases when you're setting objectives, you may be restricted to using existing data sets. These have their benefits and their weaknesses. You need to assess them for quality and for compatibility, scalability; there are often some apples and oranges issues. The advantage is they're out there; many of them have a significant time series that you would not otherwise be able to develop. And in many cases they will continue to be supported and fed into the future.

Again, conceptual models play a strong role here. Developing one and communicating it to everybody establishes a common vocabulary and a shared understanding of how the system works, how your restoration activities can be expected to produce goals and support your broader objectives.

And then another common technique is the reference-based approach, which is to use comparative ecosystems or settings or drainages or even river reaches to help refine and quantify your goals and objectives. And (Sarah Miller's) got a nice publication in our EMRP publication list on the use of the reference-based approach and the issues that sometimes crop up.

How do you evaluate objectives? That should be done not once but iterably by the PDD, PDT, and its partners. Objective sets have some qualities that are important to address: comprehensiveness, clarity, non-redundancy, flexibility, congruency -- they should work together -- and broad acceptability. They act in many ways in the same way that a conceptual model does in establishing clarity for project purposes among all participants.

Objectives shouldn't not be the same thing as metrics or alternatives. In many cases people will want to say, "We want to see enhanced ecosystem integrity." Well, that doesn't mean much. If you begin to refine that to community structure that is observed or identified in your reference ecosystems, and then begin to break that down to specific guilds and population age structures and

other kinds of measurable metrics then it becomes a useful and verifiable exercise.

There may be thresholds for achievement of ecological success. Benefits don't always accrue in an (arythmatic) fashion. And that is a separate topic. We have a publication that's currently in the system now that'll be out soon, and actually a brand new work unit on variability in which threshold issues will play a significant role.

Objectives can contain dependencies. In some cases some objectives will not obtain without the achievement of others and those need to be articulated. And finally, they reside in a larger hierarchy that should be considered.

Often they're multiple - more often than not they're multiple objectives. And metrics are really the measurable properties by which you assess objective, the degree to which you're addressing them. Here's a flow chart. I won't go into it but it's a technique on how to start choosing and refining your metric set. And here are a couple of different project examples that Kyle McKay in a publication used to identify desirable metric properties, and I refer to that lower list, lower right, those being relevant metrics unambiguous, comprehensive, direct operational and understandable.

Those are described further in this table. The primary point is that your metrics need to be mapped directly both to objectives and to your restoration actions. And they need to be chosen with an eye toward all the complicating factors that take place in abiotic but particularly biotic response to our restoration activities. And they need to be communicable, and I'll leave you to get further into the descriptions in this table.

Now metrics, as I said earlier, should be complimentary both in terms of comparison for choice and for aggregation. There are a set of techniques that we've listed out here on ways to both refine and use them together. Narrative description, (arithmetic) combinations are commonly used but we're now moving into more sophisticated techniques like MCDA -- Multi-Criteria Decision Analysis -- and rigorous algorithms for looking at interdependencies that each of those could be an individual talk, and we've got publications that are either out or will be out soon on those subjects.

In terms of evaluating those comparisons and aggregations, here is a short set of goals on really betting your metric selection and aggregation technique. Moving past - now how do these - the putting metrics and objectives together into a whole monitoring plan and kind of summarizing and moving forward here. Here is an 11-step process, including adaptive management -- broadly -- that is a good checklist for chronologically moving through the development of the monitoring effort.

I wanted to give some time here to technical challenges. First of all, the field has moved away somewhat from fiscal or form-based restoration techniques towards more process-based techniques. And those two broad categories require varying techniques and they've got some varying issues. If you're focusing on say a process-based issue of returning say large woody debris transport capacity to a system, you may not be able to measure increased transport of wood through your system until you get that 10, 15, 20-year, 30-year flood recurrence flow event. And that may not come, of course, in 10, 15, 20, or 30 years. It may take longer. It may all happen in one year. In that case, you should probably look towards direct assessment of alteration of transport capacity and system supply.

Many of our projects really are pretty narrow in scope and goals. And your monitoring project and monitoring component in that case can be significantly reduced and mapped directly to your restoration actions again. It's got a big complex project, then you've got to look at hierarchal, multi-scaled approaches. Again, your metrics must be map-able to the restoration action.

The signal must follow the action. And they cannot be influenced -- or at least you have to account for the influence -- of elements that were not part of your restoration program, like unpredictable hydrology or unpredictable climate, the natural range of variation. As I said, there may be nonlinear phenomena. There can be complicated elements of the ecosystem itself -- its disturbance regime, (rolostokyesthicity), (hysteresis) which is defined here, and then moving into some more quantitative issues and QA/QC issues.

Here are some factors in choosing the intensity. The size of project; how high profile it is to the broader public; consequences for failure/success; again, project and ecosystem complexity; and including the disturbance regime and parameters of natural variation. And if it's - the final bullet refers more to programmatic scale issues.

Just a kind of a placeholder slide that - the Corps works in varying ecosystems and each of those have different drivers and structural and functional characteristics, and so setting specific monitoring has to address those variations.

Some common monitoring design categories, before and after your project is sort of the simplest, more powerful technique is before/after control impact. If you've got a control site that you are not modifying with your restoration actions, that could be a good way to parse out, say, natural variation or those exogenous influences. I discussed those a slide or two ago.

Let's say you have a big project with a lot of sites. You don't need to necessarily monitor all of them, of course. You may choose to do so in the extensive approach but you may choose to intensively monitor a subset of them and then, of course, that subset must be analyzed for representational characteristics. And in some cases you can, in those bigger projects, you can take a staircase approach where you're not going to get all (unintelligible) sites over a project that may take multiple years, and the sites that you're not dealing with immediately can help back the (unintelligible) controlled.

Now there are a lot of statistical tools -- and again, this is its own talk -- the main one I want to point out that there is an important tool, a power analysis, that can help determine duration and number of sampling sites and frequency of sampling in a quantitatively robust way. Again, for your smaller, simpler projects, you may just go with descriptive before and after statistics, and that can be a defensible choice.

Here is sort of a long laundry list of commonly used monitoring protocols and measures: a rapid bioassessment procedure; hydrogeomorphic method; habitat evaluation procedures; fish index; biotic integrity; a set of water quality measures. There's big literature on these and I'd be happy to answer specific questions on strengths and weaknesses and ways that those individual metrics can complement or introduce you to one another.

Okay, here's a quick case study. I'm going to move through very quickly. CERP -- the Central Everglades Restoration Project -- here is a link that describes their monitoring plan and adaptive management plan. They had ten criterion for monitoring component selection, and I'm not going to read these out but I urge you to look them over.

The really robust, thoughtful approach to structuring a monitoring plan. They wound up choosing over 75 spatial abiotic and biotic elements. And I was involved with this, Tim Lewis at the lab was heavily involved in this, but you can compare -- and we just got word today from Igor Linkov of a publication by his team at ERDC, which is currently in press, and it's for the Greater Everglades Ecosystem Restoration Project.

And they chose one metric -- water depth -- for their entire project. Now note they may expand it, but they don't really predict it at this time. They think they may instead expand their monitoring network for that one water depth metric.

(Courtney Chambers): (Jock), just a heads up. We've got about five - if you could shoot for about five more minutes.

(Jock Conyngham): And I won't take that long.

(Courtney Chambers): Great, thanks.

(Jock Conyngham): Just for further reading, here is some central peer reviewed sources that some of which I referred to earlier. Two Bernhardt publications are central in that (unintelligible) effort that I spoke of and some other commonly used peer reviewed publications on monitoring that are excellent, in my view.

And then here are a list of central federal publications. (Ron Toms) monitoring guideline publication for IWR, a set of other (unintelligible) publications including the guidance documents for WRDA 2007. And then the Four Service Rocky Mountain Research Station has an entire series on aquatic monitoring that you may find useful.

I want to thank the Watch program in EBA and EMR, (unintelligible) programs that all supported development of individual sections to this talk. Some of it also came out of the ecosystem restoration focus area effort, which was an EMRP supported effort of about five, six years ago. And Kyle McKay and (Jan Rascus) helped develop big portions of this talk and I want to acknowledge them, and (Sarah Miller) stewarded it through a painful genesis.

So there is the recording length. Note on the next presentation in my contact information if you'd like to follow up later on. And at this point I'll take any questions. And (Courtney), I'll go back to the...

(Courtney Chambers): That's great. Thank you, (Jock). Yes, we can still see that final slide with contact information as well as the chat feature. So at this time participants, please feel free to ask any questions you might have. Remember to take your phone off of mute so we can hear you or feel free to type your question in the chat box and send to everyone.

(Jock Conyngham): Well I see that (Ellen Cummings) already put one in. And yes, absolutely, objectives have to be identified prior to design a project or mitigation. It is - it never works in the other order, and if I had suggested that it was an unintentional mistake on my part. Any other questions?

(Debbie Sherno): This is (Debbie Sherno) from headquarters.

(Jock Conyngham): Hi (Debbie).

(Debbie Sherno): Hey. So first of all, thank you for mentioning the Quality Assurance Oversight team in your slides there. I was (unintelligible) involved in the setup of that. And I just wanted to mention that that is a good place to go if people are not sure how to do standard operating procedures for biological monitoring. You

did a lot of work on that, and it's very key to doing before and after comparisons.

(Jock Conyngham): Well that's terrific, (Debbie). Can you send (Courtney) and myself a link to...

(Debbie Sherno): You have it on there. The slide, a few slides back for the QAOT.

(Jock Conyngham): Good for me.

(Courtney Chambers): (Jock), in this interface if you want to go back and let people catch that...

(Jock Conyngham): Yeah. I (unintelligible) that.

(Courtney Chambers): You should be able to use those - there you go. You got it.

(Jock Conyngham): Boy, it's low. Can you do this more quickly?

(Debbie Sherno): Right there. You just passed it. Go back - there. That link there for the Robust QA/QC program for the Everglades. QAOT Quality Assurance Oversight Team, it has some examples of SAPs for biological monitoring, everything from fish collection to how to collect cotton strips out in the marsh.

(Jock Conyngham): Yeah, it was really an extraordinarily robust effort and that's why I chose it as a case study. So thanks for your work there, (Debbie).

(Debbie Sherno): You're welcome.

(Marvin Hubble): This is (Marvin Hubble), and I have a question.

(Jock Conyngham): Yeah, (Marvin).

(Marvin Hubble): I was wondering, you had referenced the (unintelligible) initiative from WRDA 07. And coming from OMB and headquarters requiring increased monitoring, and I was wondering if you could talk to what their expectations are from actually using the outputs of either adaptive management or just general monitoring as we report back to them on our success?

(Jock Conyngham): Well, I think it varies somewhat by the source of the directive but to respond quickly, I think there is a general desire to both optimize and essentially prove benefits to the Corp's restoration activities and be able to demonstrate that to Congress and the public more broadly. Certainly that was OMB's motivation, and there was - OMB took the Corps and other agencies to task for not really documenting the benefits of the ecosystem restoration activities, and everyone wants to see the benefit per unit dollar and per unit hour maximized.

But as I say, there were various study teams and in fact Emily Bernhardt and Margaret Palmer and other people and the scientists in the academic community and elsewhere that I referred to sat on groups with us. This was - everything I've described here is the Corp responding -- and in some cases almost presciently and certainly a lot earlier than a lot of the broader restoration community -- to suggestions for improving the state of practice of ecosystem restoration.

If you look at that one - both at NRRSS and the 2011 publication that was eight papers that Emily Bernhardt) and Margaret Palmer put together in ecological applications, they identified what they thought were a reasonably representative list of projects. It had robust monitoring and frankly, there

weren't that many benefits. And in some cases there was ecosystem degradation that could be linked to the restoration activities.

Now again, that's the whole community practice. I don't recall if any of them were Corps projects, to be honest. But it's a remarkable set of papers and it's nearly 100 pages in aggregate. If you want to contact me directly you can order that publication, that 91-page publication, directly from the Ecological Society of America or you can just get it through the Google Docs or our electronic library. But it's well worth reading.

(Courtney Chambers): (Jock), with that said would you go on back that final slide with your contact information?

(Jock Conyngham): Of the contact?

(Courtney Chambers): Yes. And we've got a few more minutes if anybody else has got a question.

(Ellen Cummings): This is (Ellen). I just want to follow up on (Marvin's) question, because I think the mitigation monitoring was probably, I would suspect largely -- because nobody believes that we've actually been doing mitigation -- although we have been.

(Courtney Chambers): Thank you, (Ellen).

(Justin McDonald): Hey, this is (Justin McDonald) in Mobile district. I enjoyed the presentation. I appreciate, you know, your time. I've got a quick question. Do you have a feel for -- and I know this varies project to project -- but a feel for cost for implementing a monitoring adaptive management program project to

project? Percentage-wise of project costs? I mean 5%, 10%? I know it's going to vary but is there kind of a rule of thumb?

(Jock Conyngham): You know, I don't know if (Debbie), you've got some numbers for something as large as CERP. It varies, in my experience it varies by orders of magnitude. If you have a (unintelligible) project and you remove a passage block effectively -- in other words it's not a small modification, it really replicates hydraulic pathway metrics from elsewhere in the channel system -- all you have to do is measure one fish from a reach where they were formally absent. You can do a presence absence approach which is one electro fishing cast.

So it can be from hundreds of dollars to hundreds and hundreds of thousands, which I'm sure the CERP and large projects like the lower Columbia and upper (unintelligible) and so forth have spent very large figures on monitoring. So it...

(Debbie Sherno): This is (Debbie), and I'll say that he's right. It does vary quite a bit. When I'm a reviewer up here and when we review projects we mostly look to make sure that the monitoring plan makes sense, that there's critical thinking behind it, and that it's not somebody's research program. And then, you know, a lot of times we have other agencies that want us to measure something and we've got to show how that shows the success of the project, not just because they want us to measure it.

(Justin McDonald): And that's really kind of where I was going with that. I serve as the lead project engineer for civil works in Mobile district and working on the Mississippi coastland (unintelligible) program we have the Barrier Islands restoration project, which we received $439 million a couple years ago to construct.

So we are developing this monitoring adaptive management plan for that right now, and we're looking at - once all the resource (unintelligible) weigh in we're going through this routine right now, but I mean this is going to be several million dollars' worth of monitoring adaptive management in this plan.

So I was just trying to get a feel for, you know, if there was any -- and I guess I already knew the answer to that somewhat -- but if there was any sort of rule of thumb, you know, no more than 10% of project costs or five or one or two or whatever, you know, just to kind of see if we're in the ballpark.

(Ellen Cummings): I don't think there is such -- this is (Ellen Cummings) again. I would say that in the long run, if the mitigation (unintelligible) is populated properly, it includes the cost of the mitigation. You know, we might eventually have data that could, you know, give some ranges at least of what it (unintelligible). But right now I don't, you know, other than going by project by project, you know, asking people what it was.

(Jock Conyngham): I think you have a lot of company in those seven-figure projects (unintelligible).

(Justin McDonald): Yeah.

(Jock Conyngham): (unintelligible). And they are justifiable in some settings and for some projects. They can make or break the success of a project.

(Justin McDonald): I appreciate it.

(Courtney Chambers): Thanks for sharing, (Justin). Do we have any final questions? All right. Well with that we'll begin our wrap-up. (Jock), we want to thank you very much for sharing with us today. And a reminder to our participants, this webinar along with Craig's from last week on adaptive management that (Jock) referenced earlier in his talk will be posted on the (Watts) Web site, which you can see that on this final slide. We want to thank you all for taking your time to join us today.

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