DUDLEY REISER: The presentation that I have today is one that really speaks to the previous discussion, the uncertainty aspect of things and also data adequacy. Just the organization of a project like the Susitna-Watana Hydroelectric project is something that I think rather than just a case study example to everyone here, although it certainly is that, but would hope that there are some take home points that would be applicable to other projects, other complex projects that are ongoing throughout the country and the world. And the certainty and data adequacy issues and the organization and logistics and all of those things discussed in the earlier presentation come into play.

So, my presentation is focused on the Susitna-Watana project (Slide 1). First off, I want to mention, that there are a lot of contributors to the work I am going to report on today so it's certainly not just me standing up here at the podium as the only one who has completed the work. There are lots of organizations and entities involved (Slide 2). Foremost, the Alaska Energy Authority is the funding agency behind this and they have been instrumental in getting the project studies up and running. There are a litany of contractors that are involved in the Project as indicated by the list on the left and on the right, and as well a whole group of people and organizations and state agencies that are involved. The Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, National Marine Fisheries Service and many other agencies and stakeholders have all been involved in this project up to this point in time.

So, I'm going to do a little spoiler alert here and touch on several things that you should be looking for in this presentation as we go forward (Slide 3). And I think one of the key things to keep in mind when you're looking at large projects is that you really need to have the end game in sight right at the very beginning. This will help you to understand the context of the project, what you are doing and why you are doing it. That's one of the key elements in my message today. Other important items include planning and scoping a project, and identification of resource issues that involved many stakeholder meetings. It is also important to develop an analytical framework from which you are going to be able to address project effects types of questions. Another important point is the development of resource study plans, and the application of appropriate methods, which may include some of those Tom mentioned in the Instream Flow Council book. We've used that book many times on other projects as well as this one in looking at techniques that could be applied for evaluating project effects. .

And then dealing with uncertainty, I'll touch on a couple of different types of uncertainty that we have considered on this project that involve some type of decision support system. This speaks to the “end in sight” discussion that addresses how you are going to take the information that you have, bring it all together, and then actually formulate some decisions about how a project—in this case, a hydroelectric project—might be operated?

So let's begin with the “end in sight” issue which in this case, involves the FERC licensing of the Susitna-Watana hydroelectric project (Slide 4). This involves a focused, organized and schedule-heavy process called the Integrated Licensing Procedure (ILP) that carries with it a set of very regimented schedules in terms of study plan development, study implementation, and study report completion. However, there is always that uncertainty that comes into play that may shuffle the schedule around. That’s the process that the Susitna-Watana Hydroelectric project is undergoing right now. So the “end in sight” target is the acquisition of a FERC license.

Now, in that sense, there are a lot of projects where you have an existing hydroelectric facility (Slide 5). This slide depicts projects in Montana, the Kerr Dam, the Clackamas system from Oregon, a project in Tennessee, Alaska, and California. So there's lots of these projects that get involved with FERC relicensing. And that's a common, process that hydroelectric projects go through.

So what's different about the Susitna-Watana project? Well, you can see from the picture (Slide 5) that it's an unregulated system and the project would involve construction of a new dam that would first require acquisition of a new license. So in that sense in and of itself, it's much different than what we typically see in the lower 48, for which hydroelectric projects are generally involved with relicensing. You also have some features about this project and its' physical setting that are unique, one of which is its' remoteness and another is the ice situation (Slide 6).. Once you become familiar with the system and look at its channel form, you begin to understand that ice plays a big part of the formative template of that river system. So understanding and considering ice as part of project operations is something that's a little bit different in this project versus some of the others that you might have in the lower 48.

Now, to give you a little bit of a road map on where we're headed on this presentation (Slide 7 ) I want to give you a little bit of an overview of the project, the scale of it, its' potential operations, how it might influence the unregulated system, a bit of its 'history, and some of the challenges in conducting the studies. I also want to briefly discuss the site selection approach and study approach that we used. And I'll just go through these different elements and will end with decision support.

So a little bit on the scale of the project, to give you a perspective on the physical setting (Slide 8). And here we are, the Susitna River watershed roughly encompasses about 19,400 square miles of drainage area. And you put that on top of where it lies in the state of Alaska and then you put Alaska on top of the United States, and it gives you a perspective on what we're talking about in terms of the sheer size of the watershed and the size of the State of Alaska.

Now, looking at the river in a little bit more detail (Slide 9) and laying out some features on it, there is Mount McKinley within Denali National Park. The Susitna River is depicted in three different color codes to differentiate reaches we've used in characterizing the river. The green color corresponds to the lower reach, the middle reach is in blue, and the upper reach in red.

The three rivers confluence is also marked on the slide, which is the confluence of the Susitna River and the Talkeetna River and the Chulitna River. There is also the Yentna River, which contributes approximately 40 percent of the flow coming into the system. The location of Devils Canyon is also shown, which is an important landmark as it serves to not only consolidate flows in a narrow canyon and provide kayakers with extreme excitement but it also poses as a natural impediment to fish passage for the majority of salmon species using the upper Susitna River watershed. And then there's the proposed dam site. So the proposed dam site sits at the upper end of the middle reach above Devils Canyon, which is an important aspect relative to its potential impacts on salmon. –

Shifting over to the video clip of the river - This is the Susitna River coming in at the upper end of the frame. We're at the three rivers' confluence, and we're going to pan over to the Chulitna River so you can get a sense of the complexity of the channel once you get to the lower river. Now we're moving upstream in the middle river, and you'll see a variety of off channel habitat areas such as side channels and sloughs and in the main channel which is a single thread channel for portions of the river intermixed with mid- channel islands along with split channels. You'll also have a number of sloughs entering the river; here's what we call Slough 8A coming in on the right of the video frame; this slough has been shown to be very important from a fishery perspective. Moving upstream toward Devils Canyon, I should note that the flows that occurred when this video was taken (September 11, 2012), were about 12,000 cfs , which is a low flow condition for that time of year. Now we're looking at Devils Canyon and you can see all of the water that comes down the Susitna goes through this relatively narrow channel. That's Class 5 white water that consists of a series of falls and cascades that extend throughout its approximately six-mile reach of river. The video is now showing the upper portions of the river above Devils Canyon close to where the dam would be located.

This next slide (Slide 10) shows the longitudinal profile and the gradient of the river over its184 plus miles from the dam site to its mouth in Cook Inlet.

I also think it is important for you to get some perspective on the flow contributions to the Susitna River (Slide 11) which varies widely due to large inflows from a number of rivers. At the point in the river system where the dam would be located, you have about 16 percent of the average annual flow contribution occurring at that location. The flow contributions from other rivers are substantial, as depicted in the slide. Thus, the Susitna River increases dramatically in size as you progress downstream. The average annual flow in the Susitna at Gold Creek is around 9,700 cfs, at Sunshine it is about 24,000 cfs, and at Susitna Station where you have the Yentna River comes in the average annual flow is around 48,000 cfs.

There is an extensive hydrologic database of the Susitna River, which will be used in completing an IHA (Indicators of Hydrologic Alteration) and EFC (Environmental Flow Components) analysis as described by The Nature Conservancy.

Shifting over to the fish resources, which are a very important part of the river, you have all five Pacific salmon species present (Slide 12). You also have other species including, white fish, grayling, Dolly Varden, rainbow trout and a number of others so there's quite a variety of species. The fish are used both for sport harvest, subsistence, and they certainly contribute substantially to the commercial harvest. Now, where you have fish you also have bear which just serves to highlight that there's an abundance of wildlife species associated with the project. There are caribou, black bear and grizzly bear, moose, and many other species so there's a wide variety of wildlife species.

Concerning the distribution of fish (Slide 13), this is an important part of the project and fishery resources were studied extensively in the 1980s and have also been intensively studied as part of current investigations. Now, this slide is set up similar to the flow distribution slide but it depicts the distribution of Chinook relative to the river and tributaries. I mentioned Devils Canyon—which serves to limit the distribution of anadromous fish into the upper watershed. The historical information indicates that somewhat less than a half a percent of the Chinook salmon using the Susitna River watershed make it above Devils Canyon, and no other species of anadromous fish have been found above the canyon.

Because the Susitna River is heavily glacial fed, a lot of the anadromous fish species head to the tributary systems, and the off-channel lateral habitats in the river since they provide clear water habitats that the fish are seeking for spawning and rearing.

Of course, the river provides an important recreational resource in the area (Slide 14), not only for sport fishing, but also for white water rafting and boating, big game hunting, and wildlife viewing.

(Slide 15) I want to provide a bit of history related to the project since it helps to put the current studies into perspective. So this project has been looked at numerous times commencing back in the 1950s when the Bureau of Reclamation began looking at it. In the ‘70s then, the Corps of Engineers completed field investigations of the project that could have lead toward acquisition of a FERC license, but they never officially pursued it. Then in the ‘80s, the Alaska Power Authority gave serious consideration to the project and developed a concept for a two-dam configuration including an upper Watana Dam and a downstream dam located near the lower end of Devils Canyon called Devils Canyon Dam. The lower dam would have served as a re-regulating facility. The project was never constructed and was tabled due to shrinking oil prices.

And then in 2012, actually a little earlier than that, the Alaska Energy Authority began the pursuit of a FERC license for the project that was centered around a one-dam configuration, the Susitna-Watana Dam, which, as depicted earlier, would be located just above Devils Canyon. So that’s a little bit of the project history. Importantly, the 1980s work resulted in the completion of five years of detailed studies (Slide 16). So, one of the things that was completed early on in the current studies was the compilation and review of that information, which definitely helped in the planning process.

Concerning the current project (Slide 17), if you go to the AEA website, there is an artist’s rendering of the Susitna-Watana Dam (Slide). Some relevant statistics concerning the dam; 1) it would be a single dam configuration; 2) it would change the hydro graph seasonally, as many hydroelectric projects do, so that you would have lower summer flows when water is being stored, and much higher winter flows when flows are released to meet increased power demands; 3) flood flows would be reduced in terms of magnitude and frequency. Load following is also something that's being considered for the project as a means to meet the daily power demands. With load following, there could be daily changes in flow that range from around 3,000 cfs up to around 10,000 cfs during the wintertime. In terms of flood frequency (Slide 18), this gives you a quick view of the types of changes that you would expect with a project like this; a two-year flood becomes something like a 10-year flood, with that offset a result of the storage of water and regulating the flows. There has been a lot of hydrologic analysis already completed illustrating these different types of potential impacts.

Concerning the potential impacts of load following (Slide 19), via the development of a HECRAS model (Open-water flow routing model) we will be able to look at potential project load following effects both in the open water period and under the ice conditions. The slide depicted shows preliminary results from the Open-water flow routing model; the under ice flow routing model is still under development. In terms of the open water period, you can see how project operations might influence both the magnitude of the daily flows and the frequency of fluctuations. This particular slide is showing results for what is called the OS1 scenario, which represents a maximum load following condition that would likely never occur under normal operations. It was looked at as a worst case example from which to begin to understand load following effects. AEA will be looking at other more realistic operational scenarios from which to base project effects.

Now given the same three reaches of river that I mentioned before (Upper, Middle and Lower)(Slide 20),from an operational and resource impact perspective, the major effects of project operations would be associated with the middle reach of river indicated by the blue segment on the map. Of course in the upper reach there are concerns related to inundation since there would be a 40+ mile long reservoir. That's another separate issue that will need to be addressed, but in terms of project operations and resulting flow changes, it's the middle reach that would be affected the greatest and therefore is of primary concern. As you move downstream and the river receives inputs from bigger drainages such as the Chulitna and Yentna and others, the effects of project operations become less pronounced due to flow attenuation. This next slide (Slide 21) gives you some perspective on that. On the left panel of the slide shows the Pre- and Post- project (using OS1b scenario) flow patterns at Gold Creek which is located something like 43 miles down from the dam (Project River Mile 140). Then on the right panel you have the flow conditions on the Susitna River at Sunshine (Project River Mile 50-60), and you can see the pulses in flow become tempered and are almost imperceptible. This is why the studies related to defining project effects have concentrated on the middle reach of the river.

Shifting over to some of the challenges that you have with a project like this (Slide 22). First off, the physical setting of the river is remote; there are no roads that lead parallel the river so you're limited to helicopter and boat access, as well as snow machines for use in the wintertime. Field camps were established in several different locations to allow field crews to base their work out of. And of course, you have safety issues dealing with swift water and whitewater conditions, bear encounters, helicopter safety, and all kinds of things that you don't normally take into account.

Another challenge relates to the sheer number of ongoing resource studies. The ILP is under a two-year field season program, so you've got multiple resource studies that are ongoing simultaneously that requires a high level of field coordination. You literally have several hundred people out in the field at any one time in different locations. And then perhaps one of the biggest things that we often don't have to deal with and that is there's no flow control. So you're really at the mercy of the river and trying the best you can to gauge when to conduct your studies, especially when you are trying to target a specific flow condition. And then there are land access issues; you've got multiple land owners both private and public (Slide 23), and that's just a whole other layer of challenges that had to be dealt with on this project.

(Slide 24) Now let's get into the heart of this a little bit and talk about some of the key biological questions that this project faces. And so, part of the early scoping process involves meetings with agencies and other stakeholders to identify what are the key issues that will need to be addressed some of which are listed on this slide. With the importance of the fishery resources in the Susitna River some of the obvious issues relate to how the project may influence important spawning, incubation, fry emergence, and rearing habitats both during open water conditions, as well as under ice cover. We know for example that the load following component of the project will influence winter time conditions which happens to correspond with the time when eggs are incubating in the lateral habitats. So the concern is whether and the extent to which those habitats are going to remain wetted throughout the winter or become periodically de-watered, and as well how may the incubation conditions be altered (for example via temperature changes). So this list includes just some of the issues that have been identified that will need to be addressed.

During the study planning phase of the project, there were monthly or bi-monthly meetings held with the agency and stakeholder members that included several site visits (Slide 25). These served to orient the agencies as to the project setting and in the case of the one shown in the slide, were used to go out and demonstrate the types of studies being considered for implementation in different habitat types of the river. Planning and scoping, and stakeholder consultation are a key part of this project.

This next slide (Slide 26) depicts the analytical framework that was developed early on to help focus the work that was going to be done. The figure is pretty much self-explanatory but starts with the reservoir operations model which provides the output from the dam and serves as input into the flow routing models. These models then serve as the primary engines that are linked with the different resource models, some focused on fish habitats and others on riverine processes that are used to translate project operational effects into resource specific effects. Ultimately, other resources such as wildlife, recreation, etc.. will be brought into a decision making process regarding final project operations. So getting some type of an analytical framework developed early on in this project was important for helping to define study components that were needed to address key questions.

The next few slides pertain to the stratification and site selection process used on this project (Slide 27). One of the initial questions that needed to be answered was how do you actually set up and sample a river of this size. So obviously there was a stratification procedure that was developed and used. As an initial step, the process applied in the 1980s was reviewed and proved very helpful in guiding the stratification procedure that was ultimately used in the current studies. The stratification began with geomorphic reaches and proceeded to finer and finer spatial scales leading to first a variety of macrohabitat types and ultimately to the mesohabitat scale that was used in some of the more detailed habitat mapping studies. We ended up with a similar type of classification system as used in the 1980s in terms of what were the key habitats, the main channel habitats, the split main channel, and off-channel habitats.

In terms of habitat mapping (Slide 28), this slide shows some of the differences in methods between what was applied in the 1980s versus during the current studies and clearly highlights the advancements in technologies that are being used with the current work.

The next series of slides provides additional views of different portions of the river. Much of the upper Susitna River (Slide 29) consists of single thread channel without a lot of habitat complexity. You start getting into the middle Susitna River (Slide) and you pick up a little bit more complexity; the flood plain becomes a little wider and you begin to see more channel complexity with the addition of island complexes and lateral habitats. Below the three rivers confluence the river channel widens tremendously (Slide 31) with some segments over 5 miles wide.

Now, let’s take a closer look at the middle Susitna River (Slide 32) and explore the lateral habitats which have been shown to be important for fish. These lateral habitats consist of side channels, side sloughs, and upland sloughs and represent key areas that are used by a number of salmon species in the river system. This next slide (Slide 33) is a graphical depiction of these different habitat types; incidentally, this graphic was adapted from an earlier version developed in the 1980s.

Many of these lateral habitats (Slide 34) contain areas of groundwater upwelling and are used by sockeye and chum salmon for spawning and egg incubation. Because these areas are on the fringes of the river channel, they are susceptible to flow changes so there is a need for understanding how these habitats may be affected by project operations including load following.

In terms of study area selection (Slide 35), we considered a couple of different approaches. In one approach you could turn the groups of scientists, geomorphologists, water quality specialists, fish biologists, riparian ecologists, loose and let them independently design and conduct their studies. In that case, the studies wouldn't be tied together or integrated in a way that would provide an overall understanding of how project operations may affect the resources.

The other approach is to bring all the resource entities together and select sites based upon particular areas (focus areas) within the river that are known to be sensitive to these types of flow changes and that are biologically/ecologically important. This approach which we called the focus area approach is what is being applied in the current studies.

This next slide (Slide 36) shows the 10 focus areas that have been selected for the study within which each of the resource disciplines are concentrating their studies. The studies and modeling efforts are coordinated between the resource disciplines so that in the end we should develop a good understanding, of what's going on within those areas, and then scale that information up to other areas in the river. So the 10 focus areas are distributed within the different geomorphic reaches denoted as MR in the slide.

This slide (Slide 37) lists the major resource disciplines that are involved in focus area studies. These include fish and aquatic habitats, riparian habitat, fluvial geomorphology, groundwater, water quality and ice processes. And beyond these, there's a full complement of fish and aquatic studies that are working in parallel but they're more focused on the biology of the different species and their distribution, periodicity and relative abundance.

This map (Slide 38) illustrates the interdisciplinary nature of the studies being conducted at the focus areas, with the different colored lines and symbols indicating sampling locations used by different resource studies. Now, early on in the process, since we are dealing with multiple resource models, one of the things that was important was identifying the individual model dependencies (Slide 39). That is, defining the parameters that one model is expecting to get from other models. For example in order to be able to compute spawning habitat, it was necessary to identify what are the data needs for that particular model so that the other modelers, the other resource disciplines knew in advance what type of data from their models was expected so they could gauge their data collection and model outputs to meet those needs. This is an ongoing process as there is still a lot to do. Officially there has been one year of data collected so there would need to be another year of data collected.

The next slides (Slides 40 - 41) illustrate some of the techniques that have been applied in conducting the studies. So at the core of the analysis in each of the focus areas is the development of two-dimensional hydrodynamic models. The focus areas span anywhere from half a mile to over a mile and a half in length so when we are completed, we will have more than 10 to 12 miles of river for which detailed two-dimensional models will have been developed. During the open water period, SRH2D is being used for developing the 2D models; River2D is being used for the under ice period. There is also a suite of 1-dimensional models including both an open water hydraulic model (HECRAS), an under ice model (River1D), and several bed-evolution models.

The following slides (Slides 42-45) provide several snap-shots of the 2D development process that has included the collection of thousands and thousands of data points from each of the measured focus areas. And then some examples of preliminary model outputs focused on breaching flows, surface/groundwater interactions, and salmonid rearing habitat. Clearly there have been significant technological advancements made since the 1980s studies that are being applied today.

In the lower river (Slide 46), a more traditional one dimensional-PHABSIM modeling approach is being applied on strategically picked tributaries of known importance to fish. These models will provide a means for understanding the hydrologic connections between the tributary and mainstem and how habitats may change in response to project operations.

There has also been a lot of work completed on habitat suitability criteria development. This slide (Slide 47) depicts the distribution of sample sites up and down the middle river segment. Our initial efforts focused on reviewing the library of HSC information developed in the 1980s. Based on that and via discussions with stakeholders and agencies, the field effort has concentrated on collecting as much site specific data as possible for as many species as possible (Slide 48).

This slide (Slide 49) depicts the sampling regime we have used for collecting the suitability data, and in this case we were looking at both availability and utilization as far as developing suitability preference criteria. And rather than looking at it from a traditional univariate (Slide 50) approach which covers single parameters that are then multiplied together to develop overall suitability curves, we are applying a multivariate analysis by bringing in a variety of factors such as temperature, substrate, groundwater upwelling and turbidity into the mix.

This a more robust approach (Slides 51-52) that can be used in a predictive sense to determine the likelihood of a chum salmon adult or other species and life stage of fish for which sufficient measurements are taken, of using a particular area. Additional work is needed before HSC curves are finalized and ready for application.

In terms of other studies, understanding fish use and behavior during winter-time conditions is especially important since the project would substantially modify flow characteristics during this period (Slide 50). Winter studies have focused on HSC data collection as well as measurement of ice thickness and under-ice hydrology, and defining stage – discharge relationships under different ice conditions.

This slide highlights another study that is being completed that relates to river productivity (Slide 54). And so the question this study is attempting to address is what will happen to the Susitna River which is a glacier-fed system, when you put a dam on it and the waters become clearer. What will that do to the overall productivity of the river.

The next couple of slides (Slide 55) highlight some of the fluvial geomorphology studies that in addition to looking at potential channel changes and sediment transport characteristics that would be part of project operations, are also considering changes in floodplain formation and how that might affect riparian ecosystems (Slide 56).

Groundwater is also important and being intensively studied. This next slide (Slide 57) illustrates one of the water table maps that has been developed with the goal of linking this information with the effective spawning habitat analysis. There's also a series of time lapse cameras (Slide 58) that have been established in different locations within lateral habitats as a means to visually document changes under different flows and seasonal conditions. The goal is to ultimately be able to establish locations of groundwater upwelling and understand how those areas may respond to project operations (Slide 59).

(Slide 60) Water quality is another resource area that is being intensively investigated and there are several water quality models that are being developed to understand potential project effects. From a fish habitat perspective we need to be able to understand how project operations may affect water temperature (Slide 61), as well as dissolved oxygen, pH and several other constituents.

I mentioned ice early on in the presentation (Slide 62) and there is a lot of ongoing work that is designed to understand and be able to model ice processes under pre- versus post-project conditions. This applies also to riparian ecology (Slide 63) and there are a series of studies underway that will be looking at how project operations may influence the riparian corridor along the river. Some the studies are looking at project effects on seedling establishment, changes in sediment transport and flood flows, groundwater/surface water interactions and of course ice processes and how they may influence riparian community structure (Slide 64).

In closing my presentation I wanted to shift back to the theme of the IFC conference on data adequacy and uncertainty and briefly discuss how those are being handled in the Susitna –Watana project (Slide 65). This project is a big project with a minimum of two years of study. So the question is - how do you determine if you have enough data? As biologists I think it is safe to say that we are generally of the mind-set that more data are always better. Now in the 1980s they collected five years of information with a rationale that was loosely based on the five-year lifecycle for salmon. So they wanted to study five years and get some sense of the natural variability that occurs in the river and how that might affect fish and aquatic habitats. Under the ILP process there is a requirement for two years of study and so there have been questions raised regarding whether sufficient data can be collected in that time to be able to evaluate project effects. And I believe the answer is yes, provided you've collected sufficient and appropriate data to populate the models that you're using to assess potential project impacts. So I think it is doable under a two-year frame. This brings up the point I raised earlier about having the "end in sight at the beginning" so you can develop a program that meets study objectives and that can be completed within defined schedules.

Related to this is a process we have called "proof of concept" (Slide 66). So it's one thing to outline and describe to the stakeholders and agencies the studies you will be conducting and models that will be applied to address the key questions, but another to actually demonstrate that the models will successfully work and are reliable. And so AEA has sponsored a series of meetings where each of the modelers presents some preliminary results to demonstrate the utility of the models for addressing resource-specific questions. The next slide (Slide 67) provides an example of a flow chart that was used during the proof of concept meetings to show each of the data inputs used in computing effective spawning habitats. Similar flow charts were used to describe other resource models.

Moving on to the topic of uncertainty (Slide 68), there are several ways to address this. You can either live with it and just say that's the way it is; you can apply some standard statistics such as variance, confidence intervals etc, which will certainly be done on this project; and/or you can also rely on model calibration details which I think is part of dealing with uncertainty – that is you have to make sure these models are properly calibrated. I also highly recommend integrating a statistician into the whole project as a way to not only help with the development of statistically robust sampling designs but also being able to identify areas of uncertainty and developing ways to address it. There are many relatively new tools available to help with this including things such as Bayesian belief networks (Slide 69) that can be used to address uncertainty and conduct sensitivity analysis. The issues surrounding uncertainty are things that I think will be discussed tomorrow in a little bit more detail.

However, there is another kind of uncertainty that goes beyond the data, and that is the uncertainty that can occur with project funding, the uncertainty that can occur related to the FERC decision process, unexpected weather conditions and logistics, etc. With large scale projects, you really have to be prepared to deal with the unexpected.

(Slide 70) So how do you take all of the mixed resource information gathered over the course of the studies and the resulting model outputs and bring that together with other information that pertains to economics and power generation, recreational resources, and other interests to formulate an acceptable project operational plan. One of the ways this can be addressed is through a decision support type system that is designed to bring in all key resource elements into a common analytical framework. There are different ways of looking at decision support including some sophisticated modeling approaches. This next slide (Slide 71) is a quote from Greg Auble of the USGS regarding the purpose of decision support which is to “reduce the complexity of information and focus attention on tradeoffs.” Beyond that, (Slide 72) the decision support process can also help to evaluate benefits and potential impacts of different project operations, and as well, focus attention on attributes considered to be highest priority in terms of evaluating project effects; for example – the importance of the fishery resource in the Susitna River. There are several approaches to decision support that can be applied (Slide 73) -including among others, a manual matrix method, the USGS Visual Basic modeling approach that incorporates decision support and for which you can make operational changes and see what the effects are, and Bayesian belief networks. Because of the timeframe for this project, we're looking to apply more of a matrix method approach (Slide 74)), which essentially puts all of the resource areas into the evaluation mix, and then you're able to run different operational scenarios and see what the effects are on the different resource metrics (Slide 75).

This last slide (Slide 76) provides some take home points that I believe have already been messaged during my presentation and so I don't need to go into any detail on these – just wanted to provide them in summary format.

Thank you (Slide 77) and I am open to questions.