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2 FEDERAL ENERGY REGULATORY COMMISSION

3 Loup River Public Power District  
4 Project No. 1256-029-Nebraska

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10 Loup River  
11 Hydroelectric Project  
12 (FERC No. 1256-029)  
13 Study Results Meeting - Day 2

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P A R T I C I P A N T S

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1 (Whereupon, the following proceedings were  
2 had, to-wit:)

3 STEPHANIE WHITE: We're going to get  
4 started this morning. We're a couple minutes late,  
5 but I think that's probably to our benefit.

6 I'm going to let Matt Pillard walk through  
7 the results slides for hydrocycling. We're going to  
8 overlap a little bit with the data, the information  
9 we presented yesterday. We have some new folks in  
10 the room, and I think we'll probably have a little  
11 bit of discussion before we move into objective two.  
12 So with that, Matt.

13 MATT PILLARD: Thanks, Stephanie. I'm  
14 going to cover the results from the hydrocycling  
15 study that we got to yesterday, and so the first  
16 slide here is slide 220. And this is the results  
17 for objective one, and I'll just read these, and if  
18 there is some more discussion, Pat will have to help  
19 us out because these are his slides. He didn't want  
20 to stand up and sit down.

21 Objective one, the difference between the  
22 maximum and minimum daily water surface elevation is  
23 larger under current operations than under the  
24 run-of-river condition.

25 Similar differences for the run-of-river

1 condition over several weeks. Largest difference  
2 occurs for a dry year. And downstream differences  
3 less than in the project vicinity, and the average  
4 annual difference in water surface elevation is  
5 typically less than one foot.

6 Those were the results from objective one.  
7 I have to find the results for objective two.

8 This is the -- objective two is the nest  
9 inundation study. Slide 232. And these are the  
10 results for the entire objective.

11 So in review of all years for both  
12 species, there were no instances where current  
13 operations exceedance could have been avoided under  
14 a run-of-river operation.

15 Normal seasonal flow events during the  
16 nesting season, you know, we're creating the  
17 potential for nest inundation. And project  
18 operations did not cause any exceedance of a  
19 benchmark flow. So those were the results from  
20 objective two.

21 Are there any questions on either the  
22 first or second objective?

23 JOEL JORGENSEN: I have some questions  
24 about objective two. I guess I would like to --  
25 yeah.

1 MATT PILLARD: If you want to go back to  
2 some slides, I sure can, just let me know.

3 JOEL JORGENSEN: How about 226.

4 STEPHANIE WHITE: For those of you on the  
5 phone, we've moved back to slide 226.

6 JOEL JORGENSEN: So in the analysis I  
7 understand that the benchmark flow was derived prior  
8 to the April 27 period, and that's pretty rigid,  
9 so -- but -- so like in this slide I understand the  
10 benchmark is that one peak way over there, but in  
11 reality, is it more likely that the bigger flow to  
12 the right there, the biggest one is more likely to  
13 create habitat that's going to be used by the birds?

14 MATT PILLARD: That's a good question.

15 JOEL JORGENSEN: Does the bigger flow  
16 create bigger sandbars? That's apparently the  
17 assumption of your analysis, you just have a limited  
18 time frame.

19 MATT PILLARD: The analysis wasn't  
20 predicting whether this flow was creating a bar that  
21 high.

22 JOEL JORGENSEN: I understand that. But I  
23 think conceptually we can all understand that a  
24 bigger flow is probably going to create bigger  
25 sandbars, right? I think that's a fair statement.

1           Another thing that I wonder about this  
2 analysis too, I wonder about the 25 April date which  
3 was sort of set in stone. I think that's a  
4 reasonable date to sort of use as the beginning of  
5 piping plover nesting, but we don't go to bed on the  
6 25th of April, wake up the next morning and have a  
7 piping plover nesting. And that's the reason --

8           MATT PILLARD: Sure, they don't have  
9 boarding passes.

10           JOEL JORGENSEN: I think that's a sensible  
11 thing to use as a start date. However, the analysis  
12 seems to overall be plover centric, because you do  
13 mention accordingly that interior least terns begin  
14 nesting later on in season, but both species -- if  
15 habitat is not present in the system, they don't  
16 necessarily have to begin nest initiation early. So  
17 if you don't have habitat in the system when birds  
18 are arriving, they may delay initiating nests.  
19 Particularly for interior least terns. And so you  
20 have a habitat forming flow event in May before  
21 terns show up, that's very important, because that's  
22 likely to create the habitat that those birds are  
23 going to use. So on this slide in particular that  
24 big peak there probably going to create the  
25 habitat --

1 MATT PILLARD: This one?

2 JOEL JORGENSEN: Yeah. -- that terns are  
3 going to use. But the analysis sort of fails to  
4 avoid -- you know, recognize that.

5 MATT PILLARD: We did look at -- we did  
6 consider looking at, you know, picking a second peak  
7 after the birds arrive. I mean, there are different  
8 ways to look at it. This now becomes your peak for  
9 the rest of the nesting season. So, yeah, there are  
10 other ways to look at later flows that would set a  
11 new benchmark.

12 JOEL JORGENSEN: Right, but you didn't do  
13 that. Even though you could say that, but if you  
14 have a subsequent peak flow after that 25 April  
15 date, there would likely reset the system and create  
16 bigger sandbars and the birds would more likely use  
17 after that flow event occurs. That was not  
18 considered in the analysis, right?

19 MATT PILLARD: No, but that is something  
20 you could do. Obviously in this year that peak  
21 would not been exceeded for rest of the season, you  
22 could then assume if this created habitat that  
23 was -- and the birds nested at that -- at an  
24 elevation associated with that flow, the rest of  
25 that season that flow wasn't exceeded and you could

1 assume if birds were smart and nested high enough,  
2 there wasn't enough event for the rest of the season  
3 that they would have --

4 LISA RICHARDSON: Well, and I guess, Joel,  
5 and, Matt, correct me if I'm wrong, but I think that  
6 the slides are showing piping plovers, but we did  
7 the analysis separately for terns and used a  
8 different date.

9 JOEL JORGENSEN: You used a different date  
10 for the analysis, but not necessarily when the  
11 initial part -- the input, the -- for the benchmark  
12 flow.

13 LISA RICHARDSON: Well, the benchmark flow  
14 was the highest flow that occurred between  
15 February 1st and whatever the date was for the  
16 species.

17 JOEL JORGENSEN: Right, for the analysis,  
18 but in reality for a bird, if the benchmark flow  
19 occurs on the 27th of April, and it's 2 million CFS,  
20 the birds are going to use the habitat created by  
21 that flow, not the 11,000 CFS that happened in  
22 March.

23 LISA RICHARDSON: Right, that's true, but  
24 I think the end result is that the analysis  
25 regardless of when you set your benchmark, the



1 analysis is still the same, that the current ops  
2 don't exceed any more than run-of-river exceeds.

3 JOEL JORGENSEN: Well, I would argue that  
4 if you -- if your benchmark flow is set lower,  
5 you're more likely to have that result. If you  
6 consider a higher benchmark flow, that's less likely  
7 to be the case, particularly when I talk about maybe  
8 another thing I want to talk about here just a  
9 moment.

10 MATT PILLARD: Joel, one thing to  
11 consider, when we look at -- I have to go back to --  
12 let's see what slide. Not methodology, but, you  
13 know, there were a number of years where that  
14 pre-nesting season was never -- was not exceeded  
15 during the nesting season, so we did have to pick a  
16 date, and we completely understand that in  
17 nesting -- nesting season flows might affect chances  
18 for re-nesting and new habitats.

19 What we're simply showing here is the  
20 benchmark that we picked is these years show that  
21 the benchmark that was established prior to nest  
22 inundation was not exceeded for these three years  
23 and those two years, so in some years it didn't make  
24 a difference.

25 JOEL JORGENSEN: I understand that.

1           STEPHANIE WHITE: I want to make sure for  
2 those on the phone that we're on slide 228. George,  
3 I want to give you a chance to speak and then we'll  
4 come back to you, Joel, and then I'm going to jump  
5 over there.

6           GEORGE WALDOW: George Waldow, HDR. What  
7 I sense here is we're getting away from the results  
8 and we're talking about the study plan. And I think  
9 it's important that we go back and remember that the  
10 study plan was agreed to. The nesting dates were  
11 provided to us, correct me if I'm wrong, Matt, but  
12 it was in coordination with Fish and Wildlife, Game  
13 and Parks.

14          MATT PILLARD: George, I think the point  
15 is the dates that we use --

16          GEORGE WALDOW: Let me finish, please.  
17 And I wasn't intimately involved in it, but I'm just  
18 stating that fact that we're here to discuss the  
19 results, not the approach, because what -- I think  
20 it's important to state that what we're looking for  
21 and what we were looking for in developing the  
22 approach is a tool to look at the incremental effect  
23 that hydrocycling may have on nesting and nest  
24 inundation. And there was a lot of time and  
25 discussion that went into that. And when you --

1 Joel, when you talk about but in reality this might  
2 happen or that might happen, we don't dispute that  
3 at all, but there was -- collectively we could not  
4 come up with a better -- a better approach to  
5 address this question, and I think we have addressed  
6 it. The results may be worthy of discussion  
7 certainly. We aren't able to go back at this point  
8 and change the entire study, so that's --

9 JOEL JORGENSEN: Well, I think when you're  
10 talking about study methods, I mean, some things may  
11 sound good, but once you actually do it and sort of  
12 compare what was actually done with something, and  
13 it may not make sense, so I don't know how you  
14 discuss results without the potential considering  
15 the methodology that went into it.

16 So I recognize what you're saying, George,  
17 but, you know, again, once maybe this model has been  
18 completed and we sort of look at what actually  
19 occurs in reality, it may be useful to go back and  
20 look at some of the methodologies, maybe some more  
21 corrected measures can be taken.

22 I'm going to sort of try to touch upon a  
23 couple other things.

24 JEFF RUNGE: Joel, before you do that, I  
25 would like to ask what extent can there be

1 modifications to the study, since we're on that  
2 topic?

3 LEE EMERY: Typically we do not -- you  
4 know, we get the results and then we go from there.  
5 If something weather wise or beyond nature's control  
6 made the data bad, then you might -- in fact, we had  
7 to delay the first time because of rainfall, but  
8 otherwise I think we just go forward with what we've  
9 got, make the interpretations from that.

10 JEFF RUNGE: So as far as a major  
11 restructuring of these methods, that's going to be  
12 limited?

13 LEE EMERY: Yeah.

14 JEFF RUNGE: I'm sorry, Joel.

15 JOEL JORGENSEN: I guess in the report  
16 where it talks about the assumptions, the following  
17 assumptions were used for this analysis.  
18 Essentially a key assumption of this analysis is  
19 that you're considering nest distribution is a  
20 uniform distribution. There is a single volume  
21 where nests are distributed both to the sandbars,  
22 but also where the nests are located in regards to  
23 elevation.

24 But in reality, the distribution of  
25 nests -- and you sort of admit this in this

1 assumption, that nests can occur below and above  
2 that. So in reality you don't have a singular body,  
3 you'll have a distribution. Probably a normal  
4 distribution depending on some spread. We really  
5 don't have that information. So if you have -- you  
6 go back to this one slide that --

7 MATT PILLARD: Two twenty-six?

8 JOEL JORGENSEN: That one, yeah. So if  
9 you have a peak flow regardless of what the  
10 magnitude is, somewhere below that peak you're going  
11 to have a distribution of nests. We don't really  
12 know what that distribution is. So it's really not  
13 an all or nothing game.

14 You have a distribution, and so the  
15 subsequent high flow events are going to sort of  
16 come up on that distribution somewhere, and this  
17 happened in 2008 and 2009. In 2008 -- you know,  
18 another key point here is the birds didn't initiate  
19 their nests right away. Our first nest in 2008  
20 wasn't initiated until the 16th of June. So, again,  
21 a high flow event occurred early in the season, and  
22 most high flow events do occur in May or June.  
23 Birds did not initiate nests until June, and they  
24 use that habitat that was created, and then there  
25 was a subsequent high flow event in July, out of

1 about 75 nests, one nest was inundated. So it  
2 caught the very -- that subsequent peak caught the  
3 outlier of that distribution.

4 In 2008 or 2009, the high flow event that  
5 occurred in 2008, that was the dominant habitat  
6 form. The same sandbars that were created in 2008  
7 were used in 2009. We had about 311 nests on the  
8 system in that year. We had a high flow event,  
9 which you guys I'm sure are -- know very much about  
10 these high flow events that occurred in 2009 in  
11 about mid June. We had about 60 nests that were  
12 inundated. So, again, that flow event worked up on  
13 that distribution, you know, that distribution on  
14 your Y axis there of being something you can place  
15 right on there. So it wasn't an all or nothing game  
16 such as this analysis shows. So I guess I see those  
17 subsequent peak flow events. If current operations  
18 are higher than the run-of-river, then hydropeaking  
19 does have an effect on inundation. We don't need to  
20 run a separate analysis, that shows it right there  
21 that hydropeaking will have an effect on inundation.

22 MATT PILLARD: Yeah, there is no dispute  
23 that the current ops has a higher peak than  
24 run-of-river.

25 JOEL JORGENSEN: Right. And so the

1 probability of inundation is greater.

2 MATT PILLARD: It's picking that range.  
3 Obviously we say we know it's not an all or nothing,  
4 it's not black and white where the birds might nest.  
5 You know, that is what the study looked at is it  
6 picked a date and analyzed subsequent events  
7 compared to that flow.

8 You know, so if the question is, you know,  
9 could we look at putting a larger distribution or a  
10 buffer on these flows to see what might have  
11 happened, you know, plus or minus a certain  
12 percentage of a flow to see how subsequent peaks  
13 would affect that, yeah, that's something that could  
14 be looked at.

15 JOEL JORGENSEN: Well, I think we can just  
16 look at 2009 at that peak flow event that occurred  
17 in mid June of 2009, and we have data that says  
18 inundation occurred. And if that peak flow event  
19 was greater for whichever one, you know, then we  
20 would have an effect. I think the question is just  
21 how does that translate into an average probability.  
22 That concludes my comments. I want to thank you for  
23 the audience and facilitating me to say a few  
24 things. I'm all glad you guys were able to do it.  
25 Again, I think we can provide some additional

1 feedback about this analysis, and, yeah, we'll be  
2 able to do that.

3 MATT PILLARD: That would be great, Joel.  
4 Thanks. Good comments, really.

5 I'm going to skip ahead to results from --  
6 let me get the objective up here. Pat went through  
7 these pieces yesterday too. So, you know, objective  
8 three --

9 STEPHANIE WHITE: We're on slide 233.

10 MATT PILLARD: Objective three was to  
11 assess effects, if any, of hydrocycling on current  
12 operations on sediment transport parameters.

13 So yesterday Pat went through a number of  
14 tasks associated with sediment transport relative to  
15 hydrocycling. And those tasks were sediment  
16 transport calculations, sediment transport  
17 indicators, channel characteristics and a regime  
18 analysis.

19 And I'm going to skip to the results of  
20 that, and, Pat, if I really stumble here, you're  
21 going to have to save me, or you can choose not to.

22 LISA RICHARDSON: That's it right there.

23 MATT PILLARD: Slide 247.

24 So summary results for objective three,  
25 run-of-river operation would carry less sediment



1 than current operations, and channel area would  
2 be -- would likely be smaller under run-of-river  
3 operations.

4 Pat, are there any other results you would  
5 like to summarize on that?

6 PAT ENGELBERT: No.

7 JEFF RUNGE: One comment here. This is  
8 Jeff Runge. Run-of-river operations would carry  
9 less sediment than current operations, but, again,  
10 too, since this is -- this is coming out of the  
11 tailrace, this is sediment free water so it's at  
12 higher capacity, but that capacity -- that higher  
13 capacity is not being fed by sediment.

14 And I know, too, I know the past  
15 discussion about the supply that's already in place,  
16 but it sort of feeds that deficit. The current  
17 operations sort of feeds that deficit. But  
18 admittedly a very small amount, though,  
19 proportionately.

20 MATT PILLARD: We just started to get --  
21 getting into objective four yesterday. We stopped  
22 halfway through, but we did get through one of the  
23 tasks anyway, and that had to deal with the  
24 literature review for terns and plovers.

25 Objective four was to identify material

1 differences in potential effects on habitat of the  
2 interior least tern, piping plover and pallid  
3 sturgeon.

4 And one of the first methods that was  
5 looked at was the literature review in comparison to  
6 other rivers.

7 LEE EMERY: Two forty-nine.

8 MATT PILLARD: And slide 256, the results  
9 of the literature review in comparison to other  
10 rivers for terns and plovers, what we really found  
11 is it's really difficult to compare this system to  
12 other systems, because there is so many differences  
13 between, you know, the operations and the size and  
14 the magnitude of the river systems.

15 Changes in -- we did find that changes in  
16 Fort Randall operations had shown that some flow  
17 releases at higher rates during early nesting had  
18 encouraged the birds to nest higher.

19 Other portions of the literature review  
20 showed from Leslie, et al. 2000, daily hydropower  
21 operations were not found to be affecting the  
22 birds --

23 LEE EMERY: Two fifty-seven.

24 MATT PILLARD: -- whereas subjecting  
25 habitat to periodic high flows prior to nesting was

1 beneficial.

2           And I guess the final conclusion is  
3 project operations -- this project does not have the  
4 ability to control large flood flows. Project's  
5 effects from daily hydrocycling on sandbar formation  
6 are small, minor compared to effects from large  
7 flood flows.

8           Were there any -- yes.

9           RICHARD HOLLAND: Your results from  
10 Leslie, et al., what beneficial results did you get  
11 subjecting habitat to periodic high flow?

12           MATT PILLARD: I'm going to ask Melissa to  
13 answer that. She helped me a lot more with the  
14 literature review portion, so, Melissa, can you help  
15 answer that?

16           MELISSA MARINOVICH: I'm Melissa  
17 Marinovich with HDR. The Leslie, et al. what they  
18 actually found was that it regenerated the habitat  
19 basically. The same thing that Joel was saying that  
20 that large flood flow was actually forming more  
21 habitat for the species. And the year following  
22 that large flood flow actually created more habitat  
23 and had a greater number of birds nesting.

24           RICHARD HOLLAND: You're not talking about  
25 the daily hydropower operation?

1                   MELISSA MARINOVICH: No. They looked at  
2 that in the study, and they found that that actually  
3 was not having an effect on bird populations, and  
4 what was, was this dam was releasing large flood  
5 flows, and that was actually having a greater effect  
6 on species, and it was proving to be beneficial.  
7 That's what that study found.

8                   MATT PILLARD: So I think that moves us  
9 into -- Scott, how far -- do we have some result  
10 summaries for pallid that we got to before Peters  
11 and Parham?

12                   LISA RICHARDSON: Yes. The slide right  
13 before that.

14                   MATT PILLARD: We'll do the slide right  
15 before you'll start. These two slides maybe would  
16 be your results slides.

17                   LEE EMERY: Slide 261.

18                   SCOTT STUEWE: In the determination or  
19 once we looked at the information that was  
20 available, we looked at -- the results showed that  
21 pallids are collected in all channel types.  
22 However, they do seem to prefer sand and fines,  
23 particularly within the Platte, but have been  
24 collected over gravel and cobble areas, which seems  
25 to be more indicative during their spawning response

1 times. And they seem to target revetment areas as  
2 well as studies with USGS have shown.

3 Stream bottom velocities have ranged  
4 anywhere from zero to 4.25 feet per second, with an  
5 average of 2 foot per second. Again, the Platte  
6 falls within that regime from .6 to 1.9 is what  
7 Peters and Parham is showing.

8 Depths ranged from 1.9 to 45 feet where  
9 they were collected. Again, the 45-foot depths and  
10 so on are indicative of the Missouri system.

11 They also have a wide range of temperature  
12 tolerances, anywhere from 32 to 86 degrees. They  
13 tend to move out of those systems when it gets  
14 higher than that.

15 Turbidity that they were collected in  
16 ranged anywhere from 12 to 64 NTUs.

17 Again, we looked at the different dams and  
18 their effects. Quickly again, Gavin's Point and  
19 Fort Randall are hydropower facilities, also ones  
20 used for -- oh, wrong one, my apologies.

21 Slide 262. Okay. Recent spawning has  
22 been recorded, however -- and that is on the  
23 Missouri system. However, on the Platte there is no  
24 concrete evidence of spawning, however, they did  
25 collect Scaphirhynchus species, and it's hard to

1 find if they are either pallids or shovelnose. And  
2 other evidence of spawning has been observed along  
3 the revetments below the Gavin's Point Dam on the  
4 Missouri.

5 Pallid captures have been on the rise on  
6 all the rivers. However, increases also coincide  
7 with hatchery supplemental stockings. And as we  
8 found out yesterday, the Platte has been stocked at  
9 different times.

10 The pallid sturgeon often are captured in  
11 areas with sandbars or sandy substrates, along with  
12 the shovelnose sturgeon. And there is no direct  
13 evidence providing a link between hydrocycling and  
14 reproductive behavior in pallid sturgeon.

15 Many theorize that the indirect effects of  
16 altered flow do induce spawning behavior, however,  
17 from the hypolimnetic releases, there is a decrease  
18 in temperature.

19 DeLonay theorizes that with a rise in  
20 temperature and a rise in flow, this induces  
21 spawning response.

22 Okay. Slide 264 we're going to go in the  
23 methodology. We worked with Peters and Parham  
24 methodology as the study plan determination said we  
25 should. The equation, once we got into looking at

1 the study, unfortunately was not correct. Once the  
2 district looked at and tried to run the equation,  
3 the equation itself was right, but the coefficients  
4 were wrong. Contact was made with Dr. Parham, and  
5 he made some adjustments to those coefficients,  
6 which then he agreed that there was mistakes within  
7 the report, but it came back, and the -- with those  
8 adjustments, our numbers coincide with his numbers.

9 Also, the -- on the shovelnose, though,  
10 there was -- we never could get the numbers to work  
11 out exactly right. There was a zero to 2 percent  
12 difference, correct, Lisa?

13 LISA RICHARDSON: Right.

14 SCOTT STUEWE: And -- close, but just not  
15 exactly right.

16 LISA RICHARDSON: So we didn't include any  
17 analysis of shovelnose in this -- in the report,  
18 because we couldn't replicate the numbers from  
19 Peters and Parham, but we did include the pallid  
20 results.

21 SCOTT STUEWE: Now, however we can say  
22 that the numbers didn't really jive, but in  
23 actuality the results basically follow what -- you  
24 know, what would be expected as you go down the  
25 river.

1           So what we did is we looked at the  
2 analyzed daily percent suitable habitat for pallid  
3 sturgeon based on the minimum, maximum and average  
4 discharges.

5           We evaluated for current and run-of-river  
6 operations. And in the evaluation, we looked at wet  
7 year, 2008; a dry year, 2006, and a normal year of  
8 2009.

9           These are the sites that were looked at.

10          LEE EMERY: Slide 266.

11          SCOTT STUEWE: The results of the study  
12 showed that during current -- with current  
13 operations, there are higher max flows, which Pat  
14 showed yesterday, and also lower minimum flows. And  
15 this was exacerbated in the dry years.

16          March and June -- or March through June  
17 showed that there was the highest percentage of  
18 habitat that was available. July through October,  
19 which you would -- you know, you would probably  
20 guess is when the lowest habitat percentages because  
21 you don't have the flows that are available earlier  
22 in the year.

23          Habitat increased as you moved downstream,  
24 as you would expect, because of the increased in  
25 flows from other tributaries into the Platte, and



1 this would -- and this would also increase for the  
2 wet, dry and normal years across the board.

3 This is -- I'm going to show some of  
4 the -- some graphic, and this is 268. And we look  
5 at -- as we go down the river from the gages, as you  
6 can see, this is based on a dry year percent  
7 suitable pallid sturgeon habitat. Blue is maximum  
8 flow. So here as you go down the river, you can see  
9 the habitat becomes -- increases. Now, that's --  
10 you know, as you get an influx, of course, you get a  
11 rise, and this happens daily.

12 Again, the minimum shows lower, but the  
13 average still comes out approximately the same as  
14 you would see with run-of-river. And yet you still  
15 have the increases with maximum flow and with  
16 minimum flows across the board. Very similar.

17 This is based on a wet year. Again, you  
18 see we have the increased levels of the percentages  
19 are, you know, 20 to 27 percent. Again, your  
20 minimums and your average. Pretty much coincides  
21 with run-of-river.

22 On a normal year, pretty much mirrors what  
23 we saw even with the wet year, and follows what  
24 we've been saying from the beginning. Run-of-river  
25 less change, but the same amount of habitat is still

1 available.

2           On this slide what we want to show, and  
3 Pat kind of had this the other day too, it shows  
4 that we have the lower -- the lower levels for the  
5 minimums, this is with current operation minimums.  
6 This is run-of-river minimum, and, of course, you  
7 can see there is less between this, and there is  
8 more from the minimum to the maximum with current  
9 operations. However, the median still pretty darn  
10 close. But as you go down the river from the gage,  
11 you can see those -- that change is less farther  
12 down the river than up in the stream itself.

13           This is another one. This is for wet  
14 year.

15           LEE EMERY: Slide 272.

16           SCOTT STUEWE: Kind of interesting how you  
17 go here and there is such a large change here,  
18 however, the mean is still about the same.

19           And then in August in a dry year, very  
20 little habitat availability even with the changes  
21 that we have with run-of-river and with current  
22 operations.

23           And then during a wet year, August, again  
24 we see that we have, you know, the wide fluctuation  
25 with operations closer to the tailrace area, but the

1 problem we have here is that even during what we  
2 would call a wet year, your habitat percentage is  
3 still about the same, but it's still less than what  
4 you would expect with higher flows. But then being  
5 August, the flows that occur in August are less than  
6 what you would see in the spring or late in the  
7 fall.

8           So the results, current operations exhibit  
9 higher percent habitat during maximum flows and  
10 lower percent habitat during minimum flows. That  
11 was indicative of those last graphs that we had  
12 shown.

13           Under both run-of-river and current  
14 conditions, the habitat above Ashland is considered  
15 marginal anyway.

16           Effect of hydrocycling appears to diminish  
17 as you move downstream as we showed on the graphs.  
18 The area between the maximum and minimum became less  
19 overall.

20           Also even with large fluctuations of  
21 discharge, there are deeper plunge pools that can be  
22 available, are utilized for short terms for refuge.  
23 We have cross sections, we'll look at those in a  
24 little bit.

25           During drier months, pallid sturgeon

1 naturally move out of the warmer, oxygen depleted  
2 tributaries.

3 Richardson and Cross stated that the lower  
4 part, the lower 30 kilometers of tributaries are  
5 available for habitat. This is reflected as well  
6 within the Platte itself.

7 When flows are available and conditions  
8 are conducive, pallid sturgeon will access the  
9 available habitat. This was quite indicative of  
10 what happened this last year with the higher flows  
11 where, you know, pallids actually -- you know,  
12 pallids collected up above the Elkhorn confluence.

13 Even with run-of-river or with current  
14 operations, habitat is limited above the Elkhorn  
15 confluence and above the Ashland gage.

16 LEE EMERY: Slide 277.

17 SCOTT STUEWE: This is a slide of the  
18 cross section again. What we're going to show was  
19 even with the median flows and water surface, you  
20 have deep water areas which pallid sturgeon will  
21 access when available. So you have, you know, about  
22 three foot of depth available here, and over here we  
23 have, oh, approximately four foot of depth.

24 And this shows -- you know, this  
25 correlates to those collection sites that Peters and

1 Parham had where they were collecting fish anywhere  
2 from 2 feet to 5.9 foot in depth.

3 Here's another example of cross section  
4 three further down. Again, we have water depths of  
5 5 foot and of approximately 6 feet.

6 Most habitat is found below the Elkhorn  
7 confluence, and this is what has been collected and  
8 studied in the past as well. The greatest habitat,  
9 of course, occurs in the spring with rain -- with  
10 increased rainfall and melt.

11 University of Nebraska-Lincoln, their  
12 research provides evidence that pallid sturgeon  
13 prefer the lower reaches. They have split up their  
14 study into two sections. In 2009 they had a  
15 little -- they couldn't get in in the spring because  
16 of water flow -- of increased flows, so the  
17 collection that they had was basically in the fall.  
18 But the one thing they did do was they weighted  
19 their collections in 2009, where they do 20 sites on  
20 the lower versus ten sites on the upper section,  
21 which is basically was split at the Elkhorn  
22 confluence.

23 In 2010, they went in. They decided not  
24 to weight it, so they would have ten selection sites  
25 or ten above and ten selection sites below, or 20

1 or -- I can't remember exactly what it was.  
2 However, they ran into collection problems again  
3 because of high flows, but the numbers do reveal  
4 that in segment one, which is the area below the  
5 Elkhorn, there are more collections for both years.

6           Again, here for segment one in 2009 was  
7 eight and segment two was one. They used different  
8 collection methods using both trammel and trotline.  
9 Primarily what this shows is right now if they can  
10 get back in and look again this next year, this was  
11 the main thing they were wondering is primary spring  
12 utilization with some fall utilization.

13           So as you see here, even though they  
14 couldn't get in and get the collection like they  
15 wanted, segment one still had eight fish in the  
16 spring. This kind of goes against the grain,  
17 because they collected ten fish or 16 fish in the  
18 summer, which doesn't equate real well with what  
19 happened in 2010, but then again they couldn't  
20 access the river like they wanted to. So it's an  
21 ongoing study, but they are showing that other fish  
22 that they are collecting, the majority of those fish  
23 are fish that have come from stockings, however,  
24 there are still some wild fish out there that  
25 they've been able -- haven't been able to identify

1 as to any other source. So it's easy to say that  
2 even though we can't detect exactly what these fish  
3 are doing within the system, they are utilizing the  
4 Platte. And as long as we can keep minimum habitat  
5 for those fish to continue to use, they will  
6 continue to be around and use this system as they  
7 would require.

8 We then looked at the evaluation for --  
9 you know, we evaluated PRRIP for water management  
10 activities. Basically what the conclusions for that  
11 came from were percent habitat has a relatively high  
12 rate of change for flows ranging between 4,000 to  
13 6,000 CFS.

14 Changes in habitat areas as a result of  
15 100 or 500 CFS releases have negligible influences  
16 on the lower Platte River.

17 Pat, do you have anything you want to add  
18 to this?

19 PAT ENGELBERT: This study was done for  
20 the Platte River program to evaluate central Platte  
21 water management practices on the -- relative to the  
22 effects of the habitat in the lower Platte. And  
23 just what the slide says, discharges coming out of  
24 the central Platte, any modification to those would  
25 have a negligible result on the habitat in the lower

1 Platte.

2 It was a project that was done -- the  
3 project team consisted of HDR and the Platte water  
4 group, Musser Engineering and Dr. Mark Pag  
5 (phonetic) who's doing a lot of research for the  
6 pallid sturgeon. So it is available I think as  
7 one -- is it one of the attachments or just  
8 referenced?

9 LISA RICHARDSON: It's just referenced.

10 PAT ENGELBERT: It is referenced. So if  
11 anyone would like a copy of the report, it's  
12 probably out on the website, or we can get it.

13 LISA RICHARDSON: Yeah, we can.

14 PAT ENGELBERT: It's on the Platte River  
15 program's website as well.

16 SCOTT STUEWE: Further, increases in  
17 discharge, they don't move the conductivity,  
18 turbidity, temperature or dissolved oxygen outside  
19 the typical range that a pallid sturgeon would be  
20 trying to access.

21 And large changes in discharge may have  
22 the most effect on pallid sturgeon when flows are  
23 around 4,000 to 6,000 CFS.

24 LEE EMERY: Slide 282.

25 SCOTT STUEWE: Two eighty-two, I'll let



1 Matt Pillard take over.

2 JEFF RUNGE: I've got a question, if you  
3 could back up to 281, please. The analysis that was  
4 conducted looked at percent change in habitat, but  
5 the relative high rates of change in flows are  
6 between -- that metric is in CFS. How does the  
7 change in habitat relate to 4,000 -- or how does  
8 4,000 to 6,000 in that change in CFS relate to  
9 change in habitat? It didn't look as if the report  
10 addressed that.

11 SCOTT STUEWE: At 2,000 CFS there is -- we  
12 know that habitat is negligible for pallid sturgeon.  
13 So any increase from 2000 on, you see an increase in  
14 habitat availability for sturgeon, okay.

15 Now, as we go into the cross sections,  
16 would have to verify that as we go along, the  
17 increases from 4,000 to 6,000 allow more habitat,  
18 and I'm not sure exactly what the percentage is  
19 right now, but it kind of relates back to what  
20 Peters and Parham had recognized in their study as  
21 well.

22 JEFF RUNGE: But the stage change study  
23 too, could that be used to report? It may be  
24 difficult to pull that out of Peters and Parham, but  
25 can the stage change study also show percent habitat

1 at 4,000 CFS versus percent habitat at 6,000 CFS?

2 PAT ENGELBERT: One thing when we're  
3 talking about habitat, that particular report  
4 identified different habitat types, and those  
5 habitat types were based on hydraulic parameters.  
6 Runs and ripples and pools and plunge areas, and  
7 they were all tied to a depth and a velocity value  
8 that was, you know, determined with -- in  
9 consultation with Dr. Mark Pag who's doing a lot of  
10 research for the Games and Parks as you know.

11 We also applied some sensitivity analysis  
12 to create, you know, ranges of flows or ranges of  
13 how that percent habitat types could change over  
14 with the change in discharge. So unfortunately I  
15 don't have those memorized, or if I did, they are  
16 long gone, but they are in the report if you wanted  
17 to take a peek at them.

18 JEFF RUNGE: Okay.

19 RICHARD HOLLAND: Isn't the takehome  
20 message in stage change the project essentially that  
21 due to the constraints of the central Platte  
22 delivery system, they cannot put enough water into  
23 the system to make a significant impact on the flows  
24 and they enhanced the habitat? They can't put  
25 enough water in with the restrictions of the choke

1 points and the canal systems that they have -- the  
2 way they are operating to put significant amounts of  
3 water into the lower Platte.

4 PAT ENGELBERT: And I think it works the  
5 other way as well. When a large flood event moves  
6 through, they don't have the intake structure  
7 capability to peel enough off that hydrograph that  
8 it would make an impact further down the stream.  
9 They can only pull so much in during a larger event.  
10 Same thing, they can't put enough into the system,  
11 nor pull them up off of the system.

12 RICHARD HOLLAND: I'm not asking to pull  
13 them off the system.

14 PAT ENGELBERT: That was the basis of the  
15 study was if they pull waters into their system for  
16 recharge and other things, would that have an effect  
17 as it worked its way down.

18 RICHARD HOLLAND: They don't have the  
19 storage capability. I understand that.

20 LISA RICHARDSON: Jeff, related to your  
21 question about the flows and the percents, yeah,  
22 you're right, the body of the report only talks  
23 about the percentages related to the results of the  
24 analysis from Peters and Parham. In the attachment  
25 in the back of the hydrocycling -- well, on the CD

1 or I guess you don't have a hard copy, you asked for  
2 the attachments there.

3 In the attachment to the hydrocycling  
4 study is all of the data for every single day, the  
5 highs, the lows, and so you can see the flow versus  
6 the percentage.

7 JEFF RUNGE: It seemed like when looking  
8 at the appendices it seemed like the percent  
9 changes, those tables and the appendices weren't  
10 tied to a flow, but --

11 LISA RICHARDSON: Do you have them on your  
12 computer?

13 JEFF RUNGE: I don't. If it's possible,  
14 just plotting those in there I think would be a  
15 benefit.

16 LISA RICHARDSON: Let me take a look when  
17 we have a break and I'm sure that information is in  
18 there.

19 JEFF RUNGE: Okay.

20 SCOTT STUEWE: Matt.

21 MATT PILLARD: Slide 282. And this is a  
22 methodology that we looked at cross sections.  
23 Again, same crossings that were taken as part of the  
24 data collection effort that Pat went through  
25 yesterday. And the purpose of this cross section

1 comparison was just to see from early summer to late  
2 summer what can be gained from looking at how those  
3 cross sections changed just within the season.

4 You know, we can then kind of compare,  
5 make some assumptions as to how might this affect  
6 tern and plover habitat as well as pallid sturgeon  
7 habitat.

8 Scott kind of covered those cross sections  
9 in his portion, so this discussion really just kind  
10 of focus on what can we gain from early summer, late  
11 summer comparison of cross sections.

12 So, again, the cross sections were taken  
13 pre-nesting season, post-nesting season. Again, it  
14 kind of varied June, September kind of time frame.

15 We reviewed those cross sections to see  
16 what changes were there. Pat went through this  
17 yesterday where they looked at what's the channel  
18 capacity for each of the cross sections. And this  
19 portion of the method just kind of reiterates that.

20 And then look at differences affected --  
21 sites by affected by and unaffected by the site. So  
22 really we looked at site three upstream of the  
23 tailrace, and then site four, downstream of the  
24 tailrace.

25 And, Joel, I don't know if -- I don't know

1 who's new today other than Joel, but are you  
2 familiar with the site numbers, site one, two,  
3 three, four, five, because we're going to refer to  
4 those a lot here in the next --

5 JOEL JORGENSEN: I think so. I'll pretend  
6 I do.

7 MATT PILLARD: Site three is just upstream  
8 of the tailrace, site four is just downstream of the  
9 tailrace, and site five is near North Bend.

10 JOEL JORGENSEN: Got it here. Thank you.

11 MATT PILLARD: So what this is, slide 283,  
12 and this is at site four, cross section nine. And  
13 really what this shows again as Pat alluded to  
14 yesterday is over time. And here's -- the blue line  
15 is the June cross section, and the yellow line is  
16 the September cross section.

17 And really to reiterate again what Pat  
18 described yesterday, the lows filled in between June  
19 and September, some of the high forms really matched  
20 quite well, you know, between the two cross  
21 sections. Some of the highs from June were knocked  
22 down to a low by September.

23 So when you looked through each -- there  
24 is about nine cross sections for each study site,  
25 and so when you look at each cross section, it

1 varies depending on what changes and doesn't change  
2 between each cross section.

3 I think my next slide here is kind of a  
4 reiteration of what Pat went through yesterday.  
5 There is one mistake on this slide, and it's at site  
6 three I believe should be 1 percent. What I did  
7 when I pulled this slide together originally is  
8 there were three time frames for -- yeah, there were  
9 three time frames for site three. There was --

10 PAT ENGELBERT: That's right, Matt.

11 MATT PILLARD: This is correct. Okay. I  
12 must still not understand the graph from the report,  
13 but I thought the May to September was 1 percent.

14 PAT ENGELBERT: No, the May to August was  
15 minus 1 percent. May to September was minus  
16 6 percent.

17 MATT PILLARD: I didn't -- so the  
18 6 percent decrease at site three, 4 percent  
19 decrease -- this is again in channel area, at site  
20 four, and 3 percent decrease in site five.

21 So we're just showing over time there is  
22 less channel capacity when you averaged all the  
23 cross sections for the sites together. There is  
24 less capacity there from June to September, thereby  
25 a same flow would result in a slightly higher stage,

1 a slightly higher water elevation.

2 Another thing that we notice is some of  
3 the larger higher formations that were present in  
4 the June cross section were still evident in the  
5 September cross section. Again, kind of going back  
6 to this slide, we know that some of the areas have  
7 diminished over time, other areas increased over  
8 time, but for the most part some of the really  
9 higher areas were available in both times. And I  
10 believe that these weren't large, vegetated islands,  
11 those weren't really surveyed. Pat, you might have  
12 to help me out with when they got to a large  
13 macroform if they skipped around those.

14 PAT ENGELBERT: There was one particular  
15 location down by North Bend that had a very old  
16 established island, big huge tree growth. They kind  
17 of went up as high as they could with their survey  
18 equipment on the island and they went around the  
19 other side. I think that was the only occasion.

20 MATT PILLARD: So these aren't large  
21 vegetated islands, just higher macroforms that might  
22 have been present in June. For the most part, we  
23 found that those still were there in some capacity  
24 in September.

25 We then used -- slide 286. We then used



1 the HEC-RAS model that we developed to try to  
2 garnish what can we gain from the HEC-RAS model  
3 relative to tern and plover -- nesting tern and  
4 plover habitat.

5 I won't go through all the methods but the  
6 one you modeled, because I couldn't pretend to  
7 understand everything there, but steady-state 1-D  
8 model was developed. Really what we could garnish  
9 from that model is how through different flows does  
10 the stage change based on the cross sections that  
11 were taken in both June and September.

12 So, again, you know, we looked at -- we  
13 looked at a number of different variables then to  
14 look at how different changes in flow affect, you  
15 know, the elevation relative to those cross  
16 sections. And so we looked at the wet, dry, normal  
17 years that we described yesterday. We looked at a  
18 range of flows within each year, so we looked at a  
19 25 percent exceedance flow, as I like to call it, a  
20 high flow, a 50 percent exceedance flow, which is a  
21 normal flow, and a 75 percent exceedance flow, which  
22 I've kind of coined a lower flow.

23 If there is any questions on that we can  
24 address that before we move forward, but it's kind  
25 of just a range of flows everything each

1 precipitation year.

2 We then -- for each of those flows then we  
3 were able to calculate between the high bank and the  
4 high bank the percent of exposed channel that was  
5 above a water surface elevation. So for the purpose  
6 of the rest of this analysis, percent of exposed  
7 channel width, and how much is above the water line  
8 for each of these flows. And then we looked at that  
9 for both current operations and a run-of-river  
10 operation.

11 And this is --

12 LEE EMERY: Slide 287.

13 MATT PILLARD: This is purely an example  
14 of what a different water surface elevation look  
15 like on a particular cross section. So this is at  
16 site four during current operations in the, you  
17 know, pre-nesting season or early summer analysis  
18 where the bottom line here is a lower flow,  
19 75 percent exceedance flow, the middle blue line is  
20 the 50 percent exceedance flow, or the kind of a  
21 normal -- a medium flow, and then the higher line  
22 obviously is 25 percent exceedance flow or a higher  
23 flow.

24 So, again, we looked at this for a couple  
25 different ways. We kind of compared between sites

1 three and sites four. It was kind of the first  
2 thing that we did.

3 Site three, upstream of the tailrace, the  
4 percent of exposed channel width was generally  
5 decreases as flow increases. Not surprising, but as  
6 flow gets lower, more sand gets exposed, and we have  
7 some graphics here I can cover.

8 We also found that from early summer to  
9 late summer, the percent of exposed channel width  
10 increased at site three. However, during that same  
11 time period, site four, percent of exposed channel  
12 decreased. So kind of a little -- different things  
13 are happening obviously above and below, below the  
14 tailrace from that perspective.

15 From a current operation standpoint, site  
16 three had a higher percent of exposed channel width  
17 than site four during a wet year. However, again,  
18 opposite is true during normal and dry years. So  
19 there is kind of a difference in those flows between  
20 site three and site four, effective percentage shows  
21 channel width differently.

22 Some of these reasons could include we  
23 know that above the tailrace the channel width is  
24 less than below the tailrace. Site three the  
25 channel width is approximately a 1,000 feet below

1 the tailrace, channel width is approximately  
2 1,700 feet. Percent of exposed channel width is  
3 obviously a function of the width of the channel, so  
4 some things -- you know, some things can be tried  
5 just by that channel width that's available.

6 You know, under higher flows at site  
7 three -- I believe -- here is site three, I went to  
8 slide 290. This helps explain this point.

9 You can see that for the most part we have  
10 deeper channels above the tailrace than below, and  
11 so a change in water surface elevation has less of  
12 an effect on percent of exposed channel width at  
13 site three than comparatively to site four where a  
14 change in water surface elevation has a more  
15 dramatic effect on what's exposed from a channel  
16 width perspective.

17 We also compared current operations to  
18 run-of-river operations at site four. So here we're  
19 just looking at site four, but how the different  
20 operations compared against each other. And for the  
21 purpose of this analysis we're just looking at the  
22 normal year, but there is more detailed results of  
23 wet and dry years comparatively in the report.

24 Early summer between -- again, current ops  
25 to run-of-river operations at site four, early

1 summer had a greater percentage of exposed channel  
2 width than did late summer.

3 Current operations had a lower percentage  
4 of exposed channel width than run-of-river.

5 However, we found that at the normal flow that was  
6 opposite.

7 There was little difference between  
8 operations in late summer conditions for medium and  
9 high flows. And, again, this is taking all the  
10 cross sections for a site and averaging, you know,  
11 that percent of exposed channel width for each cross  
12 section.

13 We also do the same kind of comparison at  
14 site five, the site near North Bend. And here we  
15 found fairly similar results, but current operations  
16 had greater percentage of exposed channel width at  
17 the medium and higher flows -- I'm sorry, the medium  
18 and lower flows, than did run-of-river in both early  
19 and late summer. However, at the lower flows, the  
20 opposite is true. So kind of an inverse  
21 relationship between, you know, a lower flow and  
22 medium and higher flows on what's available.

23 At the normal flows showed -- the normal  
24 flows showed the greatest difference between early  
25 and summer cross sections. So when we just looked

1 at the magnitude of difference in what's available  
2 between early summer and late summer, that normal  
3 flow showed the greatest magnitude of difference.

4 And here in comparing current ops and  
5 run-of-river for sites three and four kind of all  
6 flows -- you know, this is looking at a bigger  
7 picture.

8 Late summer had a larger difference  
9 between operations and early summer did not show  
10 much difference. So basically we're saying that  
11 later in the year as the conditions get drier, you  
12 see a greater magnitude between the two operations.

13 Site three had a greater percentage --  
14 here's kind of a summary slide. I believe this is  
15 one of the last ones I have.

16 Site three had a greater percent exposed  
17 channel width than site four during a wet year, but  
18 not during a normal and dry year, the opposite was  
19 true.

20 Current operations had lower percent  
21 exposed channel width than run-of-river.

22 Early summer had a greater percentage of  
23 exposed channel width than late summer.

24 And site four had a greater percentage of  
25 exposed channel width than did site five.

1 I think that's the end of the hydrocycling  
2 portion of the presentation. We'll take questions  
3 on the percent of exposed channel width or channel  
4 cross sections that were looked at at this time.

5 LEE EMERY: FERC, do you have any  
6 questions?

7 ISIS JOHNSON: I have a quick question.  
8 This is Isis. I wanted to -- I mean, it's not a  
9 specific question about hydrocycling specifically,  
10 but I was wondering if you -- comparing how the  
11 results of hydrocycling study and the results of the  
12 sedimentation study have impacted the sandbar  
13 plain -- the sandbar riff rather?

14 MATT PILLARD: Isis, we've tried to think  
15 of ways to combine -- you know, Pat went over how  
16 sedimentation changes are looked at, how sediment is  
17 affected by hydrocycling, you know, trying to tie  
18 that in to the peaks, the peaks from hydrocycling  
19 versus run-of-river. I think the main problem we're  
20 running into is we have a hard time showing how the  
21 sandbars might move or change as a result of  
22 hydrocycling. I mean, everything that's done here  
23 is an analysis of how elevations affect a cross  
24 section that was taken at a single point in time.  
25 And we know that over time, you know, that cross

1 section is going to look differently two days after  
2 they were there.

3 So the question that you're asking is a  
4 hard one to get to if the thought is how do bars  
5 change and move, that's a -- that's one that I don't  
6 think we have the answer to relative to the model  
7 that we've developed and the analysis that we have.  
8 I know that probably doesn't answer your question.

9 ISIS JOHNSON: I absolutely understand  
10 that. The issue is that we're going to have to take  
11 all the impact and be able to come to some decision  
12 about the ways in which the -- you know, each  
13 particular operating regime impacts the potential  
14 nesting habitat for the terns and plovers, so it's  
15 not -- I guess that's fair that we're asking for  
16 specifics about how they move or change, but really  
17 we're just sort of looking for what could reasonably  
18 happen, what are the reasonable effects that could  
19 occur based on what would happen -- based on the  
20 results of the hydrocycling and based on the results  
21 of the sedimentation. So there has to be some sort  
22 of discussion of the way that those two systems,  
23 because they are so interrelated, would impact  
24 nesting habitat. And so I completely understand  
25 that it's a difficult sort of issue to address, but



1 it has to be in some -- given that kind of attention  
2 one way or another.

3 MATT PILLARD: We understand.

4 RICHARD HOLLAND: I think your data shows  
5 a little bit of what may be happening with this.  
6 When you show early season cross section with a lot  
7 of deep troughs and high points in the form of a  
8 channel, and then late season where that kind of  
9 shallows out, you're having deposition in the  
10 deep -- some of the deep areas.

11 A portion of that deposition is coming  
12 from erosion on the margins of the sandbars. As the  
13 water goes by, you see it peeling off of the margins  
14 of the sandbars. It's a very regular feature of the  
15 river. And so you see that and it isolates some of  
16 those big landforms that are still there. They  
17 still have the main height, but they may be  
18 encroaching in terms of the margins. I think that's  
19 where a portion, probably not all of the fill in for  
20 the deep areas is coming from.

21 Another comment I have on the comparison  
22 between the current operations and run-of-river, I  
23 think one of the most significant -- biologically  
24 significant findings that you have is the  
25 run-of-river decreases the variance of the stage

1 relative to current operations.

2           What that means is you're going to have a  
3 lot of habitat that remains covered by water for  
4 longer periods of time, and allowing primary and  
5 secondary productivity to increase in those  
6 habitats. We've done some studies back in the '80s  
7 and '90s on colonization by invertebrates on  
8 structures that were in that fluctuation zone. We  
9 seen a traumatic difference in colonization rates  
10 and impacts on areas that are inundated and then not  
11 inundated. And so I think the biologically  
12 significant impact of changing to a run of the river  
13 would have an impact on that primary and secondary  
14 productivity. Whether it affects overall -- how  
15 great a percentage of habitat it affects may not be  
16 as important as the effect on the productivity in  
17 the system.

18           MATT PILLARD: Okay.

19           MICHELLE KOCH: This is Michelle Koch from  
20 Game and Parks. My question kind of little bit  
21 relates to Rick's comments about, you know, when  
22 you're looking -- this is backtracking a little bit,  
23 I apologize for that, but when you're looking at  
24 slides like 271 to 274, you know, when you have  
25 those -- the results on 275 state current operations

1 exhibit higher percentage habitat during maximum  
2 flows and lower percent habitat during minimum  
3 flows, but what is the duration of those high and  
4 low flows, because you could have a high flow that's  
5 very short that doesn't really provide, you know,  
6 much habitat, because the water isn't there for a  
7 very long time, and you can have low flows that last  
8 a really long time, and, you know, the fish wouldn't  
9 use those areas, so how is that duration of those  
10 flows taken into consideration?

11 MATT PILLARD: Is this the slide you're  
12 referring to?

13 MICHELLE KOCH: That whole series of  
14 slides.

15 MATT PILLARD: So is this more a question  
16 on pallid?

17 MICHELLE KOCH: Yeah, it would be for  
18 pallid.

19 SCOTT STUEWE: Well, we know that even  
20 during the times of -- you know, of the inundation  
21 due to hydrocycling effect, those fish may actually  
22 go out on that new inundated ground, and they may  
23 actively pursue, you know, macro vertebras or  
24 whatever. I don't know -- has there ever been a  
25 documentation of stranding of sturgeon due to the

1 cycling? If there is, I'm not aware of it. So if  
2 they can actually go up and they can actually access  
3 and utilize those areas, when the water starts going  
4 down, they will go back into the deeper water areas  
5 for refuge. So even though it is less, you know,  
6 less water there, there should be -- you know, there  
7 is habitat for those fish to be able to utilize at  
8 those times during the low flows. If it's not --  
9 for the most part, most fish end up going downstream  
10 with the flow as they can sense the constriction  
11 taking place. So that's a roundabout way. I can't  
12 really answer that completely for you.

13 Rick.

14 RICHARD HOLLAND: In terms of  
15 documentation, strict documentation from a  
16 scientific standpoint, the only -- I'd say, no,  
17 we've never quantified that phenomenon you're  
18 talking about.

19 From empirical observations, though, we  
20 have observed isolation of various fish species, and  
21 I can't say that I've ever seen an isolated sturgeon  
22 before, but, again, years I was out there we were in  
23 somewhat of a drought situation. I doubt there was  
24 that many sturgeon in certain areas, but it was not  
25 uncommon to see fish isolated in pockets that were

1 developed as the hydropeaking was on the downswing.  
2 That's a normal phenomenon in that period. Whether  
3 it's a significant proportion of the population, I  
4 can't say. I don't think it probably is. I think  
5 some of the larger species have a much better  
6 ability to adjust their position if the hydropeaking  
7 isn't on and off just like that.

8           We do know that under drought  
9 circumstances fish will get isolated in pools and  
10 get cut off, and if those pools stay cut off for a  
11 long period of time, they will die because of  
12 temperature and oxygen stress.

13           Again, quantifying those in terms of  
14 population level phenomenon, that's never been done,  
15 at least not that I know of. I don't know if anyone  
16 else has seen any evidence to suggest it's been  
17 done. It's been observed several times.

18           SCOTT STUEWE: We know it occurs in flood  
19 situations fish will get stranded. I'm sure, you  
20 know, just as you say empirically it's happening,  
21 but to what extent, it's just hard to enumerate.

22           JEFF RUNGE: Jeff Runge here. Just a  
23 question about the hydrocycle and from peak to  
24 trough, what's the time duration for that  
25 approximately?

1 SCOTT STUEWE: Pat, can you answer that?

2 PAT ENGELBERT: I think scientifically 12  
3 to 14 hours, somewhere in there.

4 RON ZIOLA: Yeah. From the time it starts  
5 from peak to trough would be 12 hours. It's almost  
6 a 24 hour -- it would be approximately from peak to  
7 trough would be 12 hours. I think, Rick, what you  
8 observed probably when you're in that part of the  
9 river.

10 STEPHANIE WHITE: Any other questions or  
11 comments? It's a great natural time for a break. I  
12 know there are a couple of things we'd probably like  
13 to dig into the reports and look for. It might be a  
14 good use of this time. Let's reconvene at a half an  
15 hour, so at 9:30.

16 LISA RICHARDSON: No, I don't need that  
17 much time.

18 STEPHANIE WHITE: Ten minute break.

19 (9:19 a.m. - Recess taken.)

20 PAT ENGELBERT: We'll start out on 297 for  
21 those of you on the phone. Flow depletion and flow  
22 diversion study. We'll be looking at the amount of  
23 flows that get diverted into the canal system, how  
24 much get bypassed down the loop bypass reach.

25 Moving on to slide 298, the goals of the

1 flow depletion and flow diversion study were to  
2 determine if project operations result in a flow  
3 depletion on the lower Platte River, and to what  
4 extent the magnitude, frequency, duration, and  
5 timing of flows affect the Loup River bypass reach.

6 The other goal was to determine if project  
7 operations relative to flow depletion and flow  
8 diversion adversely affect the habitat used by  
9 interior least tern and piping plover populations,  
10 the fisheries, and the riverine habitat in the Loup  
11 River bypass reach and the lower Platte River  
12 compared to the no diversion condition.

13 Going on to slide 299, the objectives  
14 associated with that goal, one were to determine the  
15 net consumptive losses associated with project  
16 operations compared to the no diversion condition.

17 Two, to use current and historic USGS gage  
18 rating curves to evaluate the change in stage in the  
19 Loup River bypass reach during project operations  
20 and compare against the no diversion hydrograph.

21 Three, to evaluate historic flow trends on  
22 the Loup and Platte Rivers since project inception.

23 And, four, to determine the extent of  
24 interior least tern and piping plover nesting on the  
25 Loup River above and below the diversion weir.

1 Objective five, to determine project  
2 effects, if any, of consumptive use on fisheries and  
3 habitat on the lower Platte River downstream of the  
4 Tailrace Canal.

5 Six, to determine the relative  
6 significance of the Loup River bypass reach to the  
7 overall fishery habitat for the Loup River.

8 And, seven, to determine the availability  
9 of potential whooping crane roosting habitat above  
10 and below the diversion weir under project  
11 operations compared to the no diversion condition.

12 Moving on to slide 301, here is the study  
13 area. We'll be looking at the Loup River bypass  
14 reach, which is that portion of the Loup from the  
15 diversion structure down to the confluence with the  
16 Platte River. The ungaged sites that are associated  
17 with this are sites one, two and three.

18 Moving on to slide 302, again, objective  
19 one, to determine the net consumptive losses  
20 associated with project operations compared to the  
21 no diversion condition.

22 What we did for this, the associated  
23 activities were to determine the surface area that  
24 is exposed or contributes to evaporation for the  
25 project and the bypass reach, and we evaluated it



1 for both current operations and the no diversion  
2 condition.

3 We applied evaporation and ET rates based  
4 on the US Fish and Wildlife Service methodology to  
5 those contributing surface areas. We also evaluated  
6 it for a wet year, a dry year and a normal year.  
7 Okay.

8 In addition, per the study plan  
9 determination letter, we evaluated the consumptive  
10 use of the irrigation water that is withdrawn from  
11 the canal. And we also evaluated the consumptive  
12 use of Lost Creek flows. Again, that was per the  
13 study plan determination letter.

14 Moving on to slide 304, we'll go into a  
15 little bit of the methodology as to how we evaluated  
16 the consumptive use of both the project as well as  
17 the bypass reach.

18 In order to get the surface area that  
19 contributes to the evaporation for the project, for  
20 current operations we based the water surface  
21 elevation on the design drawings and the normal  
22 operating conditions. So the maximum stage in the  
23 canal, and we know the geometry of the canal, so we  
24 can then get the top width of the water, and then  
25 take it times the length of the canal and get a

1 surface area for normal operating conditions.

2 In addition, we got the O and M manuals  
3 for the regulating reservoirs, Lake North and Lake  
4 Babcock, which will give us the surface area under  
5 normal operating conditions.

6 For the no diversion alternative for the  
7 project, we assume that although we're not diverting  
8 any water, there still would be some water standing  
9 in the canal, you know, likely due to ground water  
10 recharge back into the canal roughly, you know,  
11 approximately a foot, so we just use the --  
12 basically the bottom width of the canal. And we did  
13 evaluate the no diversion alternative assuming that  
14 the reservoirs were full of water, or that the  
15 regulating reservoirs had no water, and I'll show  
16 those results here in just a second.

17 The area that contributes to evaporation  
18 for the bypass reach was calculated based on the  
19 hydraulic model that the Army Corps of Engineers  
20 developed for the bypass reach. So we looked at the  
21 hydraulic model results every single day, and we  
22 evaluated what the surface area was for every single  
23 day for a wet year, dry year and a normal year.

24 Okay. The area that contributes to  
25 evapotranspiration for both the project and the

1 bypass reach was the area of riparian vegetation  
2 within 100 feet of the source. This is consistent  
3 with the methodologies that were laid out by the US  
4 Fish and Wildlife Service in coordination with some  
5 of the water users, central Platte NRD, NPPD, the  
6 DNR, CNPPID.

7 Here's an example of how -- slide 306,  
8 this is an example of how we computed the  
9 contributing area to evapotranspiration. Again, we  
10 looked at areas -- we took a 100 foot strip to  
11 riparian vegetation adjacent to both the project,  
12 the canal and the bypass reach. So assuming you got  
13 100 foot of width, then we took it times the length  
14 from aerial photos to get our contributing surface  
15 area for evapotranspiration.

16 Okay. Again, the 100 foot width was based  
17 on the literature, the US Fish and Wildlife Service  
18 methodology in coordination with others. We just  
19 applied that same methodology.

20 Okay. Slide 307, here is a summary table  
21 of the surface areas that were calculated. For a --  
22 and, again, similar to yesterday, we'll kind of  
23 focus on the normal year as -- in an effort to save  
24 some time.

25 So for current operations in 2005, that

1 being the normal year, the canal has approximately  
2 470 acres of surface area. The reservoirs are  
3 approximately 960 acres of surface area, for a total  
4 of 1,430 acres of surface area. The bypass reach  
5 for 2005 has approximately 2,050 acres of surface  
6 area. That is for the current operations.

7 Under the no diversion scenario, the  
8 project canal -- again, we're just looking at  
9 assuming the bottom width of the canal has  
10 approximately a foot of water in it. Has  
11 approximately 230 acres of surface area. The  
12 reservoirs, again, assuming they are full, have  
13 960 acres of surface area for a total of just under  
14 1,200 acres. If we don't include the reservoirs,  
15 we've got just the canal bottom width, which is  
16 230 acres.

17 The bypass reach for that no diversion  
18 scenario, we're diverting all the water down the  
19 bypass reach, it now has approximately 3,400 acres  
20 of surface area.

21 Evapotranspiration areas, those areas that  
22 are contributing to evapotranspiration, for the  
23 project canal we've got approximately 300 acres of  
24 area contributing to ET. Around the reservoirs  
25 we've got approximately -- just under 50 acres, so a

1 total of just under 350 acres of surface area  
2 contributing to ET versus the bypass reach which has  
3 approximately 820 acres of surface area contributing  
4 to evapotranspiration.

5 Any questions on how we calculated the  
6 surface areas or the methodologies, assumptions that  
7 were made relative to the surface areas that  
8 contribute to both evaporation and  
9 evapotranspiration?

10 RICHARD HOLLAND: I'm just not sure why  
11 you're including under the no diversion the canal  
12 water. I mean, why wouldn't the canals be dry?

13 PAT ENGELBERT: Assuming there is a ground  
14 water mound adjacent to the canals, you would  
15 probably see some weeping of water back into the  
16 system very likely for probably quite a few years.  
17 We didn't test it. We just made an assumption on  
18 that. You could clearly evaluate it either way just  
19 by taking that area out as well as in the results.  
20 Just thinking that if there was no water running  
21 through the canal, you probably would still have  
22 some shallow water, you know, french drain type  
23 being pulled into the canal system, so you would  
24 have some water exposed to the atmosphere.

25 Any other questions on that on the

1 assumptions or methodologies?

2 The next step in order to evaluate the  
3 evaporation and the evapotranspiration was to apply  
4 an evaporation rate to those surface areas.

5 For the project canal and regulating  
6 reservoirs, we used National Weather Service daily  
7 pan evaporation rates to the canal in Lake North  
8 because of their depth, you know, in excess of  
9 20 feet. We applied the lake coefficient of 0.7 to  
10 the pan -- the daily pan evaporation rate. Again,  
11 consistent with the methodologies we saw in the  
12 literature.

13 However, to Lake Babcock, because it's  
14 much shallower, we applied a lake coefficient of 0.9  
15 to the pan evaporation rate.

16 For the bypass reach, again, use the  
17 National Weather Service daily pan evaporation  
18 rates, but due to its being relatively shallow, we  
19 applied the lake coefficient of .9 to the bypass  
20 reach as well.

21 The ET rate was a function of the pan  
22 evaporation rates consistent with the service  
23 methodology, but it had a coefficient that was  
24 contingent upon the growing season, whether it's the  
25 winter season or the growing season. So we took the

1 pan evaporation rate times .7, and then you  
2 multiplied it by either .5 for the winter season or  
3 .8 by the growing season.

4 So we had daily pan evaporation rates,  
5 multiplied it by the coefficients that we applied,  
6 and applied those to the daily surface areas for the  
7 bypass reach, and then there were no daily  
8 fluctuations in the project operations, we assumed  
9 it was always operating at its maximum level.

10 Here is a summary of our results on slide  
11 309. For the power canal, under current operations,  
12 the total open water evaporation is approximately  
13 6,000 acre feet, evapotranspiration is roughly 870  
14 acre feet, for a total consumptive use of the  
15 project of 6,900 acre feet.

16 In the bypass reach, we had an evaporation  
17 consumptive use of just over 9,000 acre feet, mean  
18 ET is approximately 2,000 acre feet. So the  
19 subtotal for the bypass reach is just a hair over  
20 11,000 acre feet.

21 So looking at the consumptive use,  
22 combining both the project and the bypass reach, we  
23 get just a hair over 18,000 acre feet per year, and,  
24 again, this is for a normal year. We're looking  
25 here at 2005.

1 Under the no diversion condition, again,  
2 assuming, you know, minimal flow in the canal, we  
3 had 5,400 acre feet of consumptive use, 870 for ET,  
4 for a total -- subtotal consumptive use value of  
5 just under 6,300 acre feet.

6 Looking at the bypass reach for the no  
7 diversion condition, we're diverting all the water  
8 downstream, we get a total evaporation of 16,150  
9 acre feet, ET stays the same at 2,110 acre feet.  
10 The subtotal of the bypass reach is 18,260 acre  
11 feet. So the total for the no diversion condition  
12 is 24,530 acre feet. When you combine both the  
13 project and the bypass reach for the no diversion  
14 condition, you have 24,530 acre feet.

15 George brought up a great point here.  
16 This evaporation of the canal assumes that the  
17 reservoirs are full. They've diverted water and  
18 have filled both reservoirs. That being Lake North  
19 and Lake Babcock.

20 Okay. This table on slide 310 is the  
21 analysis assuming under the no diversion condition  
22 we have -- the reservoirs are bone dry, there is no  
23 water in the reservoirs, however, we did allow for  
24 the one foot of -- approximately one foot of depth  
25 covering the bottom width of the canal.



1                   You can see that the no diversion  
2                   condition for the Loup Power Canal has approximately  
3                   just under 1,100 acre feet of evaporation as  
4                   compared to the 5,000 if we add the regulating  
5                   reservoirs in there. ET stays the same, but now the  
6                   consumptive use for the canal goes to just a hair  
7                   under 2,000 acre feet. The bypass reach numbers  
8                   stayed the same as we had shown on the previous  
9                   slide. So the total without the regulating  
10                  reservoirs for the no diversion condition is  
11                  approximately 20,200 acre feet of consumptive use.  
12                  That's evaporation and evapotranspiration. Any  
13                  questions or comments on those results?

14                  PAUL MAKOWSKI: My question to you is the  
15                  water that's in the power canal is not really  
16                  coming -- I guess it must be a gating section, so  
17                  it's not really coming from the Loup River. And  
18                  basically you have water in there, but it's not  
19                  really coming from the Loup River, so would it -- I  
20                  mean, unless you thought it would be going -- if it  
21                  doesn't go to the canal, it will go to the Loup  
22                  River, because it's counterintuitive that, you know,  
23                  you have two bodies of water, when you go to one, it  
24                  actually has less consumptive use.

25                  PAT ENGELBERT: I guess our assumption

1 there, Paul, was that with it being, you know,  
2 ground water fed back into the system, that it would  
3 eventually make its way to the Loup River.

4 And could you -- the reporter would like  
5 you to speak up if you have a comment. She was  
6 having trouble hearing you.

7 GEORGE WALDOW: This is George Waldow,  
8 Paul, and I'm going to ask Pat to confirm what I'm  
9 about to say, but I seem to recall when we were  
10 structuring this analysis that we have the  
11 irrigators that currently take their water out of  
12 the power canal along its length, and I think we  
13 assumed that we would -- that there would be a  
14 necessity to maintain some flow in that canal to  
15 provide the water for those irrigators, and I would  
16 refer to Pat now to see if that was part of the  
17 final consideration.

18 PAT ENGELBERT: Here very shortly we will  
19 go over the irrigation consumptive use. Per the  
20 study determination letter, the -- under the no --  
21 they didn't consider the -- you know, taking the  
22 project totally out of commission as a viable  
23 alternative, however, they wanted to evaluate the  
24 consumptive use from the irrigation, so I'll be  
25 going through those numbers. But just recognize

1 that, you know, FERC in their study plan  
2 determination letter has stated that decommissioning  
3 the project is not a viable alternative, so there  
4 would, in effect, be water available for the  
5 irrigators.

6           However, for the purposes of this  
7 analysis, the no diversion, we just made an  
8 assumption as to a level or an amount of water that  
9 would get into the canal system under that no  
10 diversion alternative.

11           PAUL MAKOWSKI: You're putting one foot of  
12 water in so the irrigators can use?

13           PAT ENGELBERT: Not necessarily, Paul.  
14 Again, I guess the -- it's kind of two different  
15 things. One, the reality is that the alternative is  
16 not going to be evaluated of decommissioning the  
17 project or having no project there. Therefore, the  
18 irrigation consumptive uses will be the same whether  
19 the project is diverting or not diverting. But for  
20 purposes of just trying to get a number or a handle  
21 on the consumptive use, you know, in the event that  
22 the gates were closed at the diversion and they  
23 spilled all the water out, that you would still have  
24 water seeping into the system, thus being exposed to  
25 evaporation.

1                   LISA RICHARDSON: This is Lisa Richardson.  
2 I just wanted to remind everybody that this was  
3 related to depletions on the Platte, not the Loup.  
4 So because it's all part of the Platte River basin,  
5 water that seeps into the canal under a no diversion  
6 scenario would be considered a potential depletion  
7 to the Platte River; is that right, Pat?

8                   PAT ENGELBERT: Yeah, we're evaluating  
9 flow depletion to the Platte River as a result of  
10 project diversions. That's the overall purpose of  
11 the goal of this particular study. Ron.

12                   RON ZIOLA: Ron Ziola, Loup Power  
13 District. And, again, it was in some of our early  
14 documentation we did show where drainage is allowed  
15 into the canal. So even under some normal rain  
16 events and those kind of things, there are  
17 several -- Pat, the number was someplace in the  
18 order of eight to ten locations where water would  
19 come out of the hillsides. Through -- under normal  
20 without the project being there, normal flows would  
21 take it to the Loup and ultimately to the Platte.  
22 Where under some normal rain events we're going to  
23 see a few culverts that are going to allow drainage  
24 into the canal, and, therefore, it will be in the  
25 canal and have difficulty then getting out of the

1 system to get back to the Platte. So a little bit  
2 of water in the bottom of the canal under no  
3 diversion is still, as you've indicated, is going to  
4 occur, whether it be seepage or whether it be  
5 surface water runoff.

6 PAT ENGELBERT: There are locations along  
7 the canal where there are culverts that discharge  
8 storm runoff into there.

9 We thought about this a little bit as to  
10 how we should evaluate the evaporation under the no  
11 diversion condition. We thought maybe they would  
12 fill the canal in and then they would plant corn so  
13 there would be more irrigation, or maybe the  
14 vegetation would take over the canal and then you  
15 would have greater ET. And we thought maybe the  
16 simplest way to do it is just to think about how the  
17 system would operate if the canal stayed in place  
18 under no diversion, and we thought it seemed fairly  
19 logical that you would have some ground water  
20 seeping back into the canal which would be exposed  
21 to the evaporation that occurs. So it's -- yes,  
22 Michelle.

23 MICHELLE KOCH: Michelle Koch from Game  
24 and Parks. Did you use the same coefficient for the  
25 bypass reach for both the no diversion and diversion

1 scenarios, use the same coefficients?

2 PAT ENGELBERT: Yes, yes.

3 GARY LEWIS: Gary Lewis, HDR. This was  
4 certainly a point of discussion, and I personally  
5 believe because of my understanding of ground and  
6 surface water connections in the state that there  
7 would be continued depletions to the Platte River  
8 from the canal sitting out there with seepage into  
9 it and the drainage that Ron mentions, but this  
10 table, if you did discount all the calculations of  
11 losses during -- or with the no diversion option,  
12 then the balance becomes 18,260 versus 18,080. So  
13 if you want those numbers, they are there.

14 We will hold our position that there would  
15 be continued depletions just from the operators and  
16 from our knowledge of how things are connected  
17 surface and groundwater out there. There would be  
18 continued depletions under the no diversion option,  
19 but the numbers are there. If you have an interest  
20 in them, we're -- they do show up on the chart.

21 RICHARD HOLLAND: You have -- in your no  
22 diversion scenario, you have a reduction in total  
23 acres about 50 percent roughly in the canal, and yet  
24 your evapotranspiration loss goes maybe 10 percent.

25 PAT ENGELBERT: Let me go back to the

1 surface area table. This is on slide 307; is that  
2 what you're referring to?

3 RICHARD HOLLAND: That's correct.

4 PAT ENGELBERT: So under current  
5 operations, we have approximately 470 acres of  
6 surface area contributing to ET. Under no diversion  
7 that goes to 232, so it's roughly half. However, we  
8 did keep the project reservoirs in there, so the  
9 total 1,430 and 1,192 would be the two surface area  
10 values that we would apply the evaporation rates to.  
11 So that looks like a reduction from 1,400 down to  
12 1,200, which is about that 10 to 15 percent roughly  
13 the reduction in the evaporation rate that we saw  
14 with the regulating reservoirs.

15 RICHARD HOLLAND: When you go down to the  
16 309, the table 309, slide 309, you have open water  
17 evapotranspiration, that's the reservoirs?

18 PAT ENGELBERT: This top line here?

19 RICHARD HOLLAND: Yeah, the top line.

20 PAT ENGELBERT: That includes the  
21 regulating reservoirs, yes.

22 RICHARD HOLLAND: What's the second one?

23 PAT ENGELBERT: That is the  
24 evapotranspiration, the riparian vegetation adjacent  
25 to the canals in the reservoirs, and that would be

1 unchanged.

2 RICHARD HOLLAND: Thank you.

3 PAT ENGELBERT: I'm moving on to -- I'm  
4 still at slide 310. Again, any questions on the  
5 calculations of the surface area or the rates that  
6 were applied for both evaporation and  
7 evapotranspiration? Any questions or comments?

8 Okay. I'll go ahead and move on to slide  
9 311, which kind of is a summary of the results of  
10 that particular portion of this.

11 That flow depletions under current  
12 operations are less than what would occur under the  
13 no diversion alternative. So we showed less  
14 consumptive losses under the current operations,  
15 which, again, is a combination of both the project  
16 and the bypass reach were less than what we would  
17 see under the no diversion alternative, again, which  
18 looks at still both the project and the bypass  
19 reach.

20 Next we'll go into the irrigation  
21 consumptive use. Again, per FERC's study plan  
22 determination recognizing that the irrigation will  
23 go on -- there was no alternative that would be  
24 evaluated assuming decommissioning, so the  
25 irrigation would continue.



1                   RICHARD HOLLAND: A thought just occurred  
2 to me. I'm sorry to take us back one step. If  
3 we're including the reservoirs, how are we refilling  
4 the reservoirs every year, just through  
5 precipitation directly into the reservoir?

6                   PAT ENGELBERT: Again, the assumption we  
7 made is that if -- that's why we looked at it both  
8 ways, with and without the reservoirs. Don't know  
9 how logical it would be to fill --

10                  RICHARD HOLLAND: If you include the  
11 reservoirs, they have to be refilled every year to  
12 whatever level you're using to make your estimates.

13                  PAT ENGELBERT: Yeah.

14                  RICHARD HOLLAND: If the analysis was done  
15 over time, I would expect that the reservoir volumes  
16 would decrease over time, and, hence, the loss of  
17 depletion through evapotranspiration from the  
18 reservoirs would decline over time. That's the  
19 statement I made.

20                  LISA RICHARDSON: That's what the analysis  
21 that Pat did shows. I mean, he did the analysis  
22 twice, once with the regulating reservoirs and once  
23 without, so those are for a single year. So over  
24 the course of time the amount of depletion would  
25 transition from the highest number down to the

1 lowest number.

2 RICHARD HOLLAND: Understood.

3 GEORGE WALDOW: George Waldow, HDR. I  
4 don't want us to get into nit-picking here. I think  
5 what we -- we made some gross assumptions, which I  
6 think are probably pretty realistic if you do look  
7 at the long term. No. 1, our recreational analysis  
8 shows that this is a huge recreation resource for  
9 the region, and say the power plants went away,  
10 there would be a lot of public pressure to maintain  
11 not only the reservoirs, but the fish populations in  
12 them. And so somehow there would have to be a  
13 mechanism to feed whatever water was necessary to  
14 offset the evaporation to maintain those resources.  
15 So we had to -- we had to bracket all these  
16 possibilities, and that's basically what we've done  
17 with the approach we took. It wasn't to try and dig  
18 down into all the details of how this project may  
19 function absent the power generation part, so  
20 that's --

21 RANDY THORESON: Randy Thoreson, National  
22 Parks Service. You know, I'm not a part of the  
23 technical part of this, as you know, but very simply  
24 if I was going to summarize this, what you're saying  
25 is the current operations do not contribute

1 significantly to the canal bypass consumptive use,  
2 right, is that what you're saying?

3 PAT ENGELBERT: Can you repeat that?

4 RANDY THORESON: The current operations do  
5 not contribute significantly to the canal bypass  
6 consumptive use; am I off on that?

7 PAT ENGELBERT: I think what we're saying  
8 is that under current operations you have less  
9 consumptive use than if you diverted all the water  
10 down the bypass reach, but both entities still  
11 contribute to that consumptive use. The canal and  
12 the bypass reach contribute under both scenarios to  
13 that.

14 Any other questions or comments?

15 So, again, moving back to the irrigation  
16 consumptive use, and recognizing that this would be  
17 on slide 312, this would be the same consumptive use  
18 whether the project was in operation or not in  
19 operation. So we just evaluated it for what it is.  
20 It would be applied to both sides of the equation,  
21 current ops and no diversion.

22 It was done by a sub to us on this  
23 project, the Platte Water Group, and they  
24 incorporated methodologies that are used by the  
25 Department of Natural Resources in their annual

1 hydrologic evaluation to determine the crop  
2 irrigation requirement based on crop types, demand  
3 curves and precipitation. And then you evaluate  
4 what the consumptive use of the crop is based on a  
5 couple things, net irrigation requirement, gross  
6 irrigation requirement and applied irrigation.

7 And then based on the irrigation records,  
8 the amount of flow that was applied -- or amount of  
9 water that was applied to the system, how much would  
10 be lost to consumptive use, how much would  
11 contribute to the yield of the particular crop  
12 versus how much would run off. And it's not just,  
13 you know, the amount of water that runs off, because  
14 some of it goes into the root zone and can still be  
15 sucked up by the plant, but some of it goes into  
16 deep percolation that gets beyond the root zone and  
17 is essentially lost to the system.

18 I think I'll just stop right there. The  
19 results are -- and they looked at a longer period of  
20 time. I want to say from 1984 to 2009 to try to get  
21 a wide range of precipitation or climatic  
22 conditions. And what they found was on average  
23 approximately 71 percent of the applied irrigation  
24 water is lost to the system in the form of  
25 consumptive use. And, again, just wanted to

1 reiterate that for both conditions, both operations  
2 and no diversion scenario, this would be the amount  
3 of irrigation water on average over the 25 or 26  
4 year period that they evaluated. On average, 71  
5 percent of the irrigation water that is applied  
6 would be lost to the system in the form of  
7 consumptive use.

8 Any comment or question on that?

9 JEFF SCHUCKMAN: Jeff Schuckman, Game and  
10 Parks. How many acre feet a year is that then? How  
11 much comes out through irrigation?

12 PAT ENGELBERT: Jeff, I want to say it's  
13 about 2,000 acre feet per year on average from the  
14 district's metering records that they pull out of  
15 the canal. About 2,000 acre feet, so this would be  
16 roughly on average 1,400.

17 JEFF SCHUCKMAN: And you're assuming that  
18 will be lost under both scenarios, that same 2,000  
19 acre feet is lost?

20 PAT ENGELBERT: Yes.

21 JEFF SCHUCKMAN: Even though there is no  
22 water in the canal, or do you have to provide that  
23 irrigation water? Do they have senior water rights  
24 that you have to provide that irrigation water?

25 PAT ENGELBERT: I guess we didn't look at

1 it under the logistics of how the water would get  
2 there. The study plan determination letter that  
3 said the decommissioning the project -- the reason  
4 we looked at the no diversion was to book end  
5 different -- instead of looking at over periods of  
6 weeks or months and not diverting, let's just not  
7 divert for the entire year, what would those values  
8 be. And assuming that, you know, that's not a  
9 condition that they would actually evaluate, because  
10 decommissioning the project is not a reasonably  
11 foreseeable alternative that they are going to be  
12 evaluating. But they wanted to book at the far end,  
13 so realistically they wouldn't do that, so there  
14 would be irrigation water provided to these folks  
15 whether they are not diverting for potentially short  
16 period of time or the project is operating as it is.  
17 So those consumptive losses would be the same under  
18 any of the alternative conditions that could be  
19 evaluated.

20 I hope I didn't jumble that too bad. It  
21 made sense in my head. All the voices in my head  
22 thought it made sense.

23 Any other questions on the irrigation  
24 calculations that were made, comments? Okay.

25 The next value that we determined was the

1 Lost Creek consumptive use. I just want to provide  
2 a little bit of background as to how Lost Creek  
3 interacts with the project from the time the project  
4 was built, and then other projects being  
5 constructed, you know, since the project was built.

6 The Lost Creek siphon was constructed with  
7 the project to convey Lost Creek flood flows. So  
8 I'm going to move ahead to slide 315 just for a  
9 second. It's kind of difficult to see with the  
10 arrangement of the room, but when the project was  
11 built, this magenta line is the irrigation canal.  
12 The Lost Creek basin covers -- it conveys flow from  
13 the northwest to the southeast through the town of  
14 Columbus, and then the natural pathway for the --  
15 for Lost Creek goes under the canal probably a mile  
16 or a mile and-a-half upstream of where the tailrace  
17 discharges back into the Platte.

18 So historically, any presip that resulted  
19 in runoffs took the flow down Lost Creek through the  
20 city of Columbus, went through the siphon and then  
21 was conveyed, oh, approximately another 16 or 18  
22 miles downstream through the Schuyler Golf Course  
23 and then into the Platte River.

24 So before the project was built, all the  
25 water flowed to Schuyler, after the project was

1 built, the flows were conveyed through the siphon,  
2 went to the Schuyler Golf Course and then into the  
3 Platte River, probably with a couple of Neal's golf  
4 balls.

5 NEAL SUESS: More than likely.

6 PAT ENGELBERT: Again, after the project  
7 was built, they put that siphon in.

8 Going back to slide 314, during those  
9 times when there wasn't any flow in Lost Creek, they  
10 needed a way to discharge water from the canal into  
11 the siphon to keep it clean of debris. So they  
12 installed a gate that they operate periodically to  
13 flush flows through the siphon.

14 In the 1980s the Corps of Engineers  
15 constructed the Lost Creek flood control project.  
16 And going back to slide 315 now, the Corps  
17 constructed this Lost Creek flood control channel to  
18 pick up all -- a large portion of the Lost Creek  
19 basin would be captured in this Lost Creek flood  
20 control channel to prevent those flood flows from  
21 going through the town of Columbus. And those flows  
22 are collected and discharged into the Tailrace Canal  
23 just downstream of the Columbus powerhouse.

24 So prior to construction of this, you had  
25 Lost Creek flows being conveyed all the way down to



1 the siphon and then into Schuyler. As it stands  
2 today since the 1980s, those Lost Creek flows are  
3 collected into the Lost Creek flood control channel  
4 and are now discharged into the Tailrace Canal.

5 Okay. So they are capturing Lost Creek  
6 flood flows, putting them in the canal, running them  
7 downstream, and going into the Platte River at the  
8 tailrace as opposed to in Schuyler, the portion of  
9 the basin that exists upstream of the channel.

10 LEE EMERY: Lee Emery from FERC. Is there  
11 still some water that enters that Lost Creek, the  
12 old entry there on the lower part?

13 PAT ENGELBERT: Yes, there are still flows  
14 that do go through the city of Columbus and are  
15 still being conveyed through the siphon at the Lost  
16 Creek siphon.

17 NEAL SUESS: If I can, Lee, the city has  
18 built some additional structure to basically  
19 force -- especially in the lower southeast corner of  
20 Columbus, and I think you probably saw it last night  
21 when you drove out there. They built some  
22 additional structure to kind of take that and make  
23 it very clear as to where the Lost Creek is at to  
24 put that flow back in there, and then they also have  
25 an additional runoff structure that goes down to the

1 Platte River now. But, yeah, there is some flow  
2 that comes -- basically as Pat said. The flow that  
3 comes through the city of Columbus is then directed  
4 into that structure that the city built. That's  
5 supposed to follow the natural flow of Lost Creek to  
6 take that back into Lost Creek as it is.

7 LEE EMERY: Thank you.

8 PAT ENGELBERT: Any other questions on  
9 that?

10 So the methodology that we evaluated is  
11 look at the consumptive use of the Lost Creek flows,  
12 is we evaluated the amount of runoff that comes from  
13 Lost Creek that is discharged into the canal versus  
14 the amount of water that is taken out of canal at  
15 the siphon.

16 Okay. So Lost Creek flows coming into the  
17 canal, we quantified what that is on an average  
18 annual basis, and we compared that to the average  
19 annual amount that they are discharging out of the  
20 canal through the siphon.

21 All right. And that was done -- in order  
22 to evaluate how much flow was coming into the canal,  
23 we looked at -- again, here's the Lost Creek flood  
24 control channel coming into the canal. We had to  
25 make some assumptions based on watermarks shown on

1 the energy dissipater at the downstream end of the  
2 channel just prior to it going into the Tailrace  
3 Canal.

4 Here's a photo of the small notch at the  
5 upstream end of that energy dissipator. And we  
6 looked at these water stain markings which gave us  
7 an indication of what the typical or the daily  
8 levels are based on those markings. So we made an  
9 assumption as to what the mean daily height of that  
10 is, applied it to a weir equation, and then came up  
11 with what kind of the base flow coming off the Lost  
12 Creek channel is into the Tailrace Canal.

13 Let's see. I'm going back now to slide  
14 316. So we had an idea what the base flows were  
15 coming into the canal, and then we also evaluated  
16 what the average annual runoff was based on some  
17 runoff curves that were developed by the -- I think  
18 the ARCS, Gary, is that right?

19 GARY LEWIS: Yes.

20 PAT ENGELBERT: So we also looked at  
21 average annual runoff, that being average annual  
22 storm events that were factored in to create these  
23 curves.

24 To determine the average annual amount of  
25 flow that is discharged from the Tailrace Canal, we

1 looked at the district's gate opening records from  
2 the pipe that conveys flows from the canal into the  
3 Lost Creek siphon. And we evaluated using a  
4 software package called HY-8 which evaluates culvert  
5 hydraulics to give us an indication of what the  
6 average annual flows being discharged out of the  
7 canal are.

8 Here I'm going on to slide 321, which is  
9 the design drawing from the district which gave us  
10 our parameters to evaluate the culvert losses.

11 Here's a picture of the gated structure.  
12 This is the canal -- I'm on slide 322. So this is  
13 the gate structure on the canal side of the berm  
14 that exists. They open and close that gate  
15 periodically, and it conveys flows into a pipe --  
16 now I'm on slide 323 -- conveys flows into a pipe  
17 that are then discharged into the canal. This is a  
18 picture of the head wall on the upstream side of the  
19 siphon. The pipe that runs from the gate is  
20 actually under the berm there, so you can't see the  
21 pipe that actually goes into the siphon. But that's  
22 just to give you an idea of what that particular  
23 structure looks like.

24 So what we found is that the average  
25 annual Lost Creek flows that are entering the canal

1 on average is approximately 14 CFS, and the amount  
2 of flow that's being discharged from the Tailrace  
3 Canal through the siphon is approximately 12 CFS.  
4 We base the gate openings to be consistent with  
5 other studies from 2003 to 2009. We used the  
6 district's gate opening records from 2003 to 2009.

7 If you go back further, I think they  
8 started keeping them in 1994. It's actually  
9 slightly lower number, it's maybe around ten CFS or  
10 something like that, but to be consistent with the  
11 '03 to '09 time period, that's what the 12 CFS  
12 represents.

13 So any questions on how we calculated the  
14 Lost Creek flows, the amount coming in versus the  
15 amount being discharged out, any questions or  
16 comments on that?

17 GEORGE WALDOW: Just to clarify if  
18 anybody's wondering how this thing works. It's an  
19 inverted siphon, and because an inverted siphon goes  
20 down and under and back out above, it tends to  
21 collect debris down in the area that's not  
22 accessible, and that's the purpose for the flushing  
23 flows was to clean out the sediment that would  
24 accumulate in that -- the bottom of that U-shaped  
25 structure.

1 PAT ENGELBERT: So I guess in summary of  
2 the consumptive use analysis that we performed, the  
3 flow depletions under current operations are less  
4 than would occur under the no diversion alternative.  
5 That's that ET portion.

6 On average, 71 percent of the applied  
7 irrigation water is lost to consumptive use.

8 The average annual Lost Creek flow  
9 entering the Tailrace Canal is approximately 14 CFS.  
10 And the average annual flow being discharged from  
11 the Tailrace Canal through Lost Creek, the Lost  
12 Creek siphon which then is conveyed down to Schuyler  
13 is approximately 12 CFS.

14 Any questions on the summary results, any  
15 component of it, the consumptive use, evapo ET,  
16 areas, rates, irrigation consumptive use or the Lost  
17 Creek analysis that was performed? Any questions on  
18 that before we move on to some stage calculations?  
19 Michelle.

20 MICHELLE KOCH: This is Michelle Koch from  
21 Game and Parks. You may have explained this before,  
22 but other than just the evaporative loss and ET when  
23 you're calculating depletions, was there any  
24 consideration as far as how much water is held back  
25 in those reservoirs that doesn't ever reach the rest

1 of the -- where it joins back in there down by below  
2 the tailrace? I mean, other than evaporative loss  
3 to a river system, if you're taking all that water  
4 out, whether or not it's evaporating or sitting in a  
5 reservoir just sitting there, was that taken into  
6 consideration?

7 PAT ENGELBERT: No, it was not. That  
8 portion of water volume was not taken into  
9 consideration. Ron.

10 RON ZIOLA: Ron Ziola, Loup Power  
11 District. Again, you know, our reservoirs are not  
12 what you construe as a dam. Power retention as you  
13 see through the cycling at the North Bend gage, the  
14 water is impounded for less than 12 to 24 hours.  
15 There is a dead pool in Lake North. We can't  
16 totally drain Lake Babcock through a process, but  
17 there is a small dead pool in Lake North, but it's,  
18 you know, very, very small, probably less than a few  
19 hundred acre feet. But in the idea of Lake  
20 McConaughy which might impound some water for  
21 upwards of a year, we do not have that capability.  
22 The water comes in, the most it would stay there is  
23 about a day, and then the water has to be released  
24 back to the system. It's just a natural operation  
25 of the system.

1 MICHELLE KOCH: So essentially, and this  
2 is for my understanding because I don't know.  
3 Everything that's diverted ends up back into the  
4 river except for whatever is taken out for  
5 irrigation from the canal?

6 RON ZIOLA: Sure. And then there is a  
7 small dead pool in the bottom of Lake North that  
8 can't -- if we were to drain the system dry, there  
9 would still be a small dead pool, maybe less than a  
10 hundred acre -- or probably more in the order of  
11 50 acres and less than four, five foot deep. So  
12 there is a small amount of water that no matter what  
13 we did we could never get out of Lake North.

14 MICHELLE KOCH: Thank you for that  
15 clarification.

16 TOM ECONOPOULY: Tom Econopouly, Fish and  
17 Wildlife Service. Is there any seepage from the  
18 reservoir that's contributed to groundwater --

19 PAT ENGELBERT: One of the underlying  
20 assumptions of the consumptive use analysis was to  
21 evaluate the -- we looked at the Department of  
22 Natural Resources' hydrologically connected lines,  
23 and the project fell within that, so any loss of  
24 seepage would eventually get to the system through  
25 groundwater.



1 TOM ECONOPOULY: And also ET for the  
2 winter and the summer, where do you come up with  
3 those coefficients from?

4 PAT ENGELBERT: It came out of the  
5 literature from that service document, and I believe  
6 it's referenced in the report. We've got the  
7 electronic copies if you would like copies of that.

8 I think it was agreed upon, if I remember  
9 the reference correctly, Tom, it was a consortium of  
10 folks that were evaluating flows that I think on  
11 behalf of the central Platte. They looked at it all  
12 the way down to Louisville. It was the service and  
13 the DNR and I believe NPPD, I think CNPPID. A lot  
14 of folks were involved in developing those.

15 Any other questions before I go on to the  
16 next objective?

17 Okay. On to slide 326, the next objective  
18 was to use the current and historic USGS rating  
19 curves to evaluate the change in stage of the Loup  
20 River bypass reach during project operations and  
21 compare those to -- against alternative hydrographs,  
22 in this case, being the no diversion condition.

23 We did evaluate the stages again using the  
24 25, 50 and 75 percent exceedance discharges based on  
25 the flow duration curves. And then we evaluated it

1 for a wet year, dry year and a normal year. Again,  
2 for the two operating conditions, the current ops  
3 and the no diversion condition.

4           Again, the 25 percent exceedance discharge  
5 is -- that discharge for a given year, that  
6 discharge is equal or exceeded 25 percent of the  
7 time. So 25 percent of the flows are greater than  
8 that, 75 percent of the flows are lower than that.  
9 So it kind of gave you a little higher discharge for  
10 that particular year. 50 percent is the median  
11 discharge, it's that discharge which is right in the  
12 middle. 50 percent of the flows are greater than  
13 it, 50 percent of the flows are less than it.

14           And then the 75 percent exceedance  
15 discharge is kind of on the lower end. Seventy-five  
16 percent of the flows are greater than that and  
17 25 percent of the flows are less than that.

18           Moving to slide 327, here is a summary of  
19 the results. And, again, we're looking at 2005,  
20 which is a normal flow classification year.

21           Under current operations for the  
22 50 percent exceedance discharge, that flow is around  
23 570 CFS. You would get a water surface elevation of  
24 approximately 1546.2. So keep that in your head  
25 just for a second. Under the no diversion

1 condition, that 50 percent exceedance discharge gets  
2 increased from 570 up to just under 2,300 CFS. And  
3 the stage associated with that is 1547.4. So for a  
4 normal year, the median discharge you would have a  
5 stage increase of approximately 1.2 feet.

6 Okay. I don't think that's a stretch to  
7 say that if you have more water going down the river  
8 you're going to have higher stages.

9 Any comment or question on that?

10 That was for the Loup at Genoa. The Loup  
11 at Columbus, again, looking at a similar  
12 situation -- what we see, though, is the difference  
13 in water surface elevation on slide 328, the last  
14 column. The water surface elevation is a hair under  
15 1,433, and under the no diversion condition, it's a  
16 hair under 1,434. So, again, as you work your way  
17 downstream, you see kind of a dampening effect of  
18 that no diversion condition, so it's right at  
19 approximately a foot of stage increase between the  
20 current operations and the no diversion condition.

21 Any questions on that, any questions on  
22 that?

23 Okay. So in summary, there is an increase  
24 in stage under the no diversion alternative.

25 The magnitude of the stage does decrease

1 with increasing discharge. And although I didn't  
2 show the dry conditions, but as we had discussed  
3 yesterday under those lower flow or those drier  
4 conditions, you do see the greatest differential in  
5 stage between current ops and no diversion.

6 Any questions on that stage evaluation  
7 that was performed?

8 We'll go ahead and move on to objective  
9 three, slide 330. And this was to evaluate the  
10 historic flow trends on both the Loup River and the  
11 Platte River since project inception.

12 We evaluated USGS gages as well as some  
13 USGS publications which are listed here on slide  
14 330.

15 Moving on to slide 331, this is a graphic  
16 of the annual mean flow for the Platte River at  
17 North Bend. I'll show the Platte River at North  
18 Bend, and then I believe at the Loup at Genoa just  
19 to show the historic flow trends.

20 You see we do have an increasing flow  
21 trends from 1950 to present. Similarly, at the Loup  
22 at Genoa gage we also see an increasing flow trend  
23 from 1944 to approximately 2008.

24 These are the same trends that we saw at  
25 Duncan, however, I failed to get that graphic in

1 this presentation, but I believe it's either in the  
2 report or it's in the reference.

3 So the results of the historic flow trend  
4 evaluation show that there was a long-term positive  
5 flow trend that has occurred since the gages were  
6 put in place. The same trend -- the same trends  
7 that are seen at the downstream gages are also seen  
8 at Duncan. So it goes without saying it doesn't  
9 appear there is a project impact on the long-term  
10 historic trends.

11 GARY LEWIS: Yeah, this is kind of an  
12 afterthought. When you look at these flow trends  
13 that were done, the studies done by the survey, they  
14 exist all the way up and down the Platte River, but  
15 that may explain part of why if we're getting such  
16 high sediment supply to the stream, why we're not  
17 seeing in that 50 year, even 100 year period -- one  
18 of those studies went back to the turn of the  
19 century -- why we're not seeing the aggradation that  
20 would be intuitively correct.

21 So there is -- we didn't scientifically  
22 look at this, but this is one fact that one might  
23 look at as an explanation of how if there is that  
24 much sediment being produced by the watershed, why  
25 the river is not degrading. As I said, geologic

1 time river has been all over the page vertically,  
2 but none of the investigations have detected either  
3 aggradation or degradation, and they profile the  
4 stream throughout the entire river as well as on  
5 both sides of the tailrace return. It just isn't --  
6 the data doesn't support that, even though there is  
7 some logic to think that it should be changing down  
8 there.

9           So these increasing flow rates may explain  
10 it's able to maintain itself in its equilibrium even  
11 though we're getting a supply of sediment that  
12 exceeds the capacity to transport it. It's not  
13 proven, just a afterthought here.

14           PAT ENGELBERT: And I think Gary's point  
15 is that, again, another piece of the puzzle. We  
16 evaluated a lot of little pieces, and it's taking us  
17 down a path to the conclusions that we've reached.

18           So if there aren't any questions on those  
19 first three objectives, that being the consumptive  
20 use and the trends, then I'll turn it over to Matt  
21 Pillard who I think is going to talk about some  
22 habitat stuff. Any questions? I will be back up in  
23 a little bit on sediment transport, which I can see  
24 everyone is very excited about, but I'll turn it  
25 over to Matt.

1           RICHARD HOLLAND: Your long-term positive  
2 flow trends start at the 50s. There is evidence  
3 that you're decreasing flow from the central Platte  
4 prior to that period of time. I mean, the Duncan  
5 gage obviously shows a decline in flows out of the  
6 central Platte. In fact, the purpose of the three  
7 state agreement, but -- so, I mean, you have to  
8 temper with the fact that you're starting at a low  
9 point, and then we're increasing from that, so  
10 it's -- don't -- part of your explanation from  
11 historical geological time is there used to be more  
12 flow coming from the central Platte system into the  
13 lower Platte system.

14           PAT ENGELBERT: Anything else?

15           LEE EMERY: Any questions from FERC on the  
16 phone?

17           PAUL MAKOWSKI: Paul is here.

18           ISIS JOHNSON: Isis is here.

19           LEE EMERY: Any questions?

20           PAUL MAKOWSKI: Not now.

21           ISIS JOHNSON: No.

22           MATT PILLARD: We'll move on to objective  
23 four. And this objective was to determine the  
24 extent of interior least tern and piping plover  
25 nesting on the Loup River above and below the

1 diversion weir.

2 So we would look at interior least tern  
3 and piping plover nesting on the Loup River bypass  
4 reach, and then we also looked at sedimentation  
5 analysis as it may affect tern and plovers on the  
6 Loup above and below the diversion weir.

7 Slide 335 now. Methodology, the first  
8 part of what we did to analyze this was to do a nest  
9 count comparison. So we looked at nest counts above  
10 and below the diversion weir to see if there could  
11 be any differences or similarities in nesting above  
12 and below the diversion weir.

13 We had about ten years of available data  
14 to do this from. There weren't a lot of -- wasn't a  
15 lot of nesting, the numbers were small in some  
16 years, in other years there may not have been  
17 surveys performed, so per the study plan  
18 determination, if significant differences could be  
19 determined, then we would move forward and do an  
20 analysis of habitat above and below the weir.

21 Because we didn't really feel like we  
22 could make that determination with the numbers that  
23 we had, we went ahead and moved forward and did the  
24 analysis, even though it was really inconclusive due  
25 to the sample size, you know, whether or not there



1 was a little difference in nesting above and below  
2 the weir.

3           There are differences in nesting numbers  
4 to what we have. Nesting numbers do show that there  
5 has been more nesting above the weir than below from  
6 the data that we have, but it was -- we couldn't  
7 distinguish or draw any conclusions from the sample  
8 size. So we went ahead and did the analysis of  
9 comparing habitats above and below the diversion  
10 weir.

11           In order to do this, we looked at observed  
12 habitat parameters that have been identified in  
13 other studies. Most of you are familiar to the  
14 references to the right-hand side of the column.

15           So habitat parameters that we would be  
16 interested in would be things like channel width,  
17 dry sand area, vegetation cover, average location of  
18 sandbars, point bars or mid-channel bars, and then  
19 we also did look at valley width.

20           So this is the list of parameters that we  
21 looked at. I won't go through this whole list, but  
22 this kind of then reflects the types of parameters  
23 that we would try to pull from an aerial imagery  
24 analysis.

25           So in order to determine what to analyze,

1 we looked at -- we wanted to really have an equal  
2 number of river miles above and below the diversion  
3 weir to be analyzed, and so we looked at five  
4 separate river miles above the diversion weir and  
5 five separate miles below the diversion weir.

6 We wanted to have one location in close  
7 proximity to the diversion weir, so one of the miles  
8 we really wanted to locate within the first five  
9 miles above and below the weir. The next -- I guess  
10 the four other miles for both above and below were  
11 then selected randomly based on the number of miles  
12 we had to evaluate from.

13 This image is probably hard to see from  
14 the back of the room. It's hard to see from the  
15 front of the room. But this is below the diversion  
16 weir, so starting at mile zero, I guess downstream  
17 at the confluence with the Platte River, there is  
18 roughly 37 miles from below the diversion weir that  
19 we had to pick from. And keep in mind that we did  
20 want one river mile within the first 5 miles, so you  
21 can see that we randomly then selected the first  
22 river mile was selected at mile 33 to 32, and then  
23 randomly selected from the next grouping of river  
24 miles available, and so we had river miles 27 to 26,  
25 14 to 13, eight to seven and six to five. Those

1 were the river miles that were randomly selected to  
2 do an aerial imagery analysis on below the diversion  
3 weir.

4           The next slide is the graphic above the  
5 diversion weir. Again, working again down --  
6 working down from upstream in this case. Within the  
7 first five miles we selected one mile, and that  
8 ended up being river mile 38 to 39. And then we  
9 randomly selected four other river miles up to river  
10 mile 69, so that we ended up looking at then  
11 randomly selected miles from 49 to 50, 54 to 55, 60  
12 to 61, and 65 to 66.

13           So on slide 341, we looked at -- the range  
14 of the years that we looked at were from 2003  
15 through 2009. We used -- we wanted to have an equal  
16 number of wet, dry or normal years in our analysis.  
17 We based this off the 1985 Food Security Act methods  
18 for aerial color interpretation of wetlands. It was  
19 a method that we could make sure that we looked at  
20 equal number of precipitation type years in the  
21 analysis. So wet years available were 2007, -8 and  
22 -9. So we randomly selected 2009.

23           For dry years, at Genoa, by itself, there  
24 was no dry year, however, years 2003 and -6 were  
25 very close to being a dry year, and so we selected

1 the 2003 as it was two positions away on the -- was  
2 it US Fish and Wildlife Service for selecting those  
3 years?

4 LISA RICHARDSON: The ranking.

5 MATT PILLARD: It was two positions away.  
6 So that was as close as we could get to a dry year  
7 for this scenario. And then the normal years  
8 available were 2004, -5 and -6. So in this scenario  
9 we would have one wet, one dry year and three normal  
10 years to use.

11 We performed a site visit in 2010, early  
12 2010 to try to get a handle on the imagery that  
13 we're seeing in 2009 so that we could -- as we begin  
14 these photo interpretation using an unsupervised  
15 method, be able to ground truth and field verify  
16 some of the images that we would be evaluating on  
17 the aerials to what happened out there in the field.

18 I kind of alluded to it. We attempted to  
19 use an unsupervised method of evaluation, letting  
20 our GIS systems pick and select classifications of  
21 different types of habitat using pixel values. We  
22 also, as we'll get into here a little bit, also how  
23 to use some visual interpretation methods where the  
24 unsupervised model wasn't successful.

25 Again, ERDAS Imagine software was used for

1 the unsupervised method. It's based on the pixel  
2 value, so the software would identify pixel values,  
3 you know, group those in classifications so that we  
4 could assign a habitat type or land use type  
5 associated with those pixels.

6 The results of the analysis were somewhat  
7 mixed. Flat and smooth features, the software was  
8 very successful we felt in identifying bare sand,  
9 wet sand and shallow water. We found a very good  
10 correlation between what we saw in the field, what  
11 we're looking on the aerials, and what the software  
12 was evaluating.

13 Rough features, such as vegetation and  
14 choppy water, we were having mixed results. Things  
15 were kind of not making sense, were out of place,  
16 couldn't refine the model -- the software any more  
17 just based on the resolution of the pixel values.

18 I kind of wanted to point out that wet  
19 sand and shallow water using the unsupervised  
20 method, it was hard to separate those from a pixel  
21 valuation, so the purpose -- for the purposes of  
22 this analysis, wet sand and shallow water were  
23 grouped in the same classification. We couldn't  
24 separate those with any degree of certainty of what  
25 was just wet sand versus very shallow water, you

1 know, from very small amounts of water. Deep water,  
2 however, we could begin to see a darker pixel value,  
3 so we could then establish how the deeper water  
4 areas based on a darker pixel value, the lighter  
5 pixel values were established as shallow water or  
6 wet sand.

7 This is kind of one example. These  
8 figures are in the attachments associated with the  
9 report. This is slide 344. It's river mile 13  
10 through 14. And this is just kind of a result of --  
11 one example the result of the analysis of the areas  
12 that were identified as dry sand, areas that were  
13 identified as emergent, vegetation force in  
14 vegetation, water in the darker blue, and kind of  
15 shallow water, wet sand in the lighter blue. So,  
16 again, there is an image of this for every year that  
17 was analyzed in the attachments.

18 From a visual interpretation perspective,  
19 you know, we had a GIS technician, environmental  
20 scientist look at the imagery, classify the areas  
21 that were emergent, scrub-shrub and forested  
22 vegetation strata, as well as some of the water  
23 features. And I think -- I think the -- let me go  
24 back to this slide here.

25 One of the challenges that we had was

1 grouping what a sandbar was or what a sandbar  
2 wasn't, or where those parameters began and end. As  
3 often you would have, you know, smaller areas that  
4 might be in between two bars, and, you know, there  
5 had to be -- there was some user inferences that had  
6 to be made where a bar stops and where a new bar  
7 begins. So we kind of tried to group areas of sand  
8 even though there might have been a small separation  
9 of water between bars, you know, somewhere we had to  
10 draw the lines on where does the bar begin, where  
11 does the bar end. And that's because to determine  
12 the number of bars in that river mile, the size of  
13 that bar, that's where that piece of information  
14 becomes important.

15 From a parameter classification  
16 standpoint, slide 346, we used the usable substrate  
17 from habitat standpoint, bare sand versus vegetation  
18 bars is what we tried to look for.

19 From a macroform determination, from a  
20 sandbar perspective again, you know, the size, the  
21 area, the number of the position of those bars  
22 within each river mile, you know, where they -- you  
23 hear again this kind of gets back to the point I  
24 just made from a mid-channel bar perspective, you  
25 know, greater than 75 percent of the exposed sand

1 was surrounded by water we classified as a  
2 mid-channel bar versus a point bar.

3 Again, there was really no attempt made to  
4 define was that bar a good habitat or bad habitat,  
5 just was it bare sand, was there vegetation on it,  
6 what were the percents of those is what was  
7 analyzed.

8 And then again channel width, channel  
9 width is fairly consistent, at least from below the  
10 weir and above the weir from site to site. And,  
11 again, channel width we analyzed that based on the  
12 typical high bank to high bank or the edges of the  
13 vegetation that could be seen on the aerials.

14 I think I've kind of hit some of these  
15 points, but kind of wanted to make some notes on the  
16 methods that we recognize, and I'm sure folks that  
17 are familiar with this kind of technique also  
18 recognize that the unsupervised portion of the model  
19 is repeatable. You know, anyone can use the same  
20 software and hopefully derive the same results that  
21 we could.

22 The visual inspection, just like anything,  
23 it's open to some human influence and human  
24 interpretation. We try to limit that by having the  
25 same individual do the -- do all the analysis, you



1 know, that's reviewed by other scientists. Again,  
2 that's one area where one scientist might view, you  
3 know, a habitat type differently than another.  
4 That's just one of the inherent flaws of photo  
5 interpretation.

6 Another thing I would like to point out  
7 obviously is the years that were selected were wet,  
8 dry and normal. I think it was probably pointed out  
9 during the study plan meetings that the flow and the  
10 dates is also very important in this analysis, and  
11 each of the figures has the flow on the date of the  
12 aerial. Even though it might have been a wet year,  
13 that particular day that the photo was taken might  
14 have been a very low flow day. That has some  
15 effects on what we might see in the river that day.

16 Other things may not have as much  
17 influence on such as vegetated bars and those type  
18 of things might have been established earlier in the  
19 year, you know, based on the weather conditions.

20 We had some issue with some of the  
21 aerials. Some of the aerials we had some issues  
22 with relative to the quality of those, something we  
23 had to work around. We shifted one river mile  
24 slightly to avoid -- where two aerials didn't seem  
25 to match. We shifted it a couple hundred feet so

1 that we had one clear image. And then, again, I  
2 already kind of addressed the sandbar grouping and  
3 how to determine where sandbar starts or stops.

4 From the methods from the valley width  
5 perspective, we built upon the study that was done  
6 by Elliott in 2009. We used the USGS shapefiles  
7 that they used to look at valley width for that  
8 study. It -- that study went from the Loup River to  
9 the confluence with the Platte to the diversion  
10 weir. They grouped that Loup River valley as all  
11 part of the Platte River valley. And we extended  
12 the Platte River -- extended that to Platte River  
13 mile 187.

14 Basically we took their analysis and  
15 extended it upstream to include the valley width for  
16 the Platte River valley, still encompassed the Loup  
17 valley through the portions of our study area.

18 We established transects based on those  
19 valley widths here, and this is slide 349. Based on  
20 that valley width to determine what the valley width  
21 was we then just did a transect every quarter mile  
22 to get that average valley width that then would  
23 bisect our study area sites so we could get an idea  
24 for our study area what are the valley widths.

25 Slide 350, we're on results of the aerial

1 imagery. We found obviously differences above and  
2 below the diversion weir, and I'll kind of go  
3 through those.

4 There were a greater number of sandbars  
5 per river mile above the diversion weir.  
6 Approximately 41 sandbars per river mile versus 24  
7 sandbars per river mile below the diversion weir.

8 Above the diversion, sandbars were  
9 typically smaller. Four acres in size versus  
10 10 acres in size for below the diversion weir.

11 From a channel width perspective, again,  
12 fairly consistent above and below, but the  
13 differences are the channel is approximately  
14 400 feet wider above the diversion weir than below.

15 There was a lower percentage of vegetation  
16 on sandbars above the diversion weir.

17 There was, interesting enough, a lower  
18 percentage of bare sand on the sandbars above the  
19 diversion weir as well.

20 Location of sandbars, more point bars  
21 below the diversion weir, more mid-channel bars  
22 above.

23 From a valley width perspective because we  
24 were in the Platte River valley it was fairly  
25 consistent for both above and below the diversion

1 weir.

2 The distances in valley ranged from 15.2  
3 miles to 24.3 miles of valley width.

4 I guess I'll stop here and see if there  
5 are any questions on the aerial photo interpretation  
6 before we move on to how to use the HEC-RAS model.  
7 Again, very similar to yesterday in hydrocycling,  
8 how we use the HEC-RAS model to evaluate percent of  
9 exposed channel width on the Loup River.

10 ISIS JOHNSON: I have a quick question.  
11 This is Isis Johnson from FERC.

12 I wanted to know, you said that you got a  
13 lower percentage of vegetation on the sandbar above  
14 the diversion weir, but there was also a lower  
15 percentage of bare sand, so I guess I was wondering  
16 if you could explain that.

17 MATT PILLARD: It's because the sandbars  
18 are smaller above the diversion weir, it's how the  
19 percentages play out based on the size of those  
20 sandbars.

21 ISIS JOHNSON: Intuitively when I looked  
22 at them I thought, hmm, okay, there is a lower  
23 percentage of vegetation, but there is also a lower  
24 percentage of -- I guess, are you talking about just  
25 overall surface area, is that what's playing into

1 the lower -- because if you just sort of look it in  
2 passing, you would think, well, there is lower  
3 percentage of vegetation, then you think there would  
4 be more bare sand.

5 MATT PILLARD: It's based on the surface  
6 area available.

7 ISIS JOHNSON: Okay.

8 MATT PILLARD: Joel.

9 JOEL JORGENSEN: Joel Jorgensen, Game and  
10 Parks. So the photos that were used, were they  
11 photos taken in late July, August time period for  
12 crops?

13 MATT PILLARD: Yes.

14 JOEL JORGENSEN: I guess I'm curious if  
15 you were to change your macroform depth  
16 determination from greater than 75 percent of the  
17 exposed sands surrounded by water to 100 percent  
18 surrounded by water, would the results change?

19 MATT PILLARD: I'm sure they would change.

20 JOEL JORGENSEN: Would the conclusions  
21 change dramatically?

22 MATT PILLARD: It would be the number of  
23 point bars for mid-channel bars would change. I  
24 mean, most likely the number of mid-channel bars  
25 above might go down to more point bars; does that

1 make sense?

2 JOEL JORGENSEN: Okay.

3 MATT PILLARD: If we increase that  
4 percentage to 100, there might be fewer mid-channel  
5 bars upstream of the diversion weir than are  
6 currently being shown if that number were  
7 100 percent needing to be surrounded. So I guess we  
8 gave the benefit of the doubt to the day that we  
9 have the aerial, if there was a small little portion  
10 that might have been connected through a few little  
11 small pieces of sandbar, that if the flow were to go  
12 up a little bit then it would be surrounded. That's  
13 why we didn't go with a rigid 100 percent and  
14 assuming there might be some times there is limited  
15 areas where that could be totally surrounded.

16 JOEL JORGENSEN: So I guess how did you  
17 define whether it was disconnected or not? I  
18 understand how challenging that can be looking at  
19 aerial photographs, but from a bird's standpoint, a  
20 little bit of water is probably the same as being  
21 bone dry given the access to predators and those  
22 sorts of things. So a little bit of -- yeah, what  
23 was the -- how did you sort of define that portion  
24 of it?

25 MATT PILLARD: In terms of disconnected

1 from the bank?

2 JOEL JORGENSEN: Right, 75 percent,  
3 100 percent determination.

4 MATT PILLARD: Melissa might be able to  
5 help me out.

6 MELISSA MARINOVICH: We went with the --  
7 as we said in the study plan, we were going with  
8 Kirch's (phonetic) methodology. And Kirch defined a  
9 mid-channel bar as anything that was surrounded by  
10 75 percent or more water. So we went with what she  
11 went with for that, for the mid-channel versus point  
12 bar determination.

13 MATT PILLARD: It doesn't help maybe  
14 answer the question how we did it.

15 JOEL JORGENSEN: Well, again, I still  
16 think more to the point is whether if you changed  
17 the parameters would the results change.

18 So moving on --

19 JEFF RUNGE: I guess before you go to the  
20 next topic, that's why us as a official wildlife  
21 service requested that the one dimensional modeling  
22 come in place as well, because it's difficult to  
23 pick out isolation connection based on aerial  
24 photography, but then if we supplement that with  
25 information on the ground to see if these bars are

1 connected or not.

2 JOEL JORGENSEN: Right. Particularly when  
3 aerial photographs -- using aerial photographs that  
4 are taken in below, you obviously have much less  
5 water which would change the way the features look,  
6 because it's being diverted, right?

7 JEFF RUNGE: It does, except with the one  
8 dimensional modeling, assuming that there is no  
9 significant change within your bed, that you can  
10 project if there is a certain point they become  
11 disconnected.

12 JOEL JORGENSEN: I agree, yeah. That  
13 would be definitely helpful in supplementing that.

14 JEFF RUNGE: Yeah.

15 JOEL JORGENSEN: Regarding the number of  
16 sandbars, I'm less familiar with this part of the  
17 report. Is there a summary, sort of a statistical  
18 summary of the size and that sort of information in  
19 the report? I don't need to see it right now.

20 MATT PILLARD: There is a table. I can  
21 get it for you later. Melissa might have the page.  
22 Not really statistical analysis, just comparative --  
23 we didn't statistically compare the difference.

24 JOEL JORGENSEN: It shows the means  
25 potentially?



1 MATT PILLARD: Yes.

2 JOEL JORGENSEN: And with channel width, I  
3 guess here's a situation where means -- really the  
4 average is really maybe don't matter a whole lot as  
5 much to the birds as potentially the extremes. If  
6 it's on the lower Platte River, 50 percent of our  
7 nesting occurs in the widest 2 percent of the  
8 channel. So I'm curious maybe how much of the  
9 extremes. You said the channel was relatively  
10 uniform above and below, so there isn't a great deal  
11 of variation in the channel width and maybe those  
12 extremes.

13 Again, I think what the birds are probably  
14 going to respond to the 1,065 sort of range, and I  
15 guess I'm curious on whether that top -- the near of  
16 channel widths, how much different those are rather  
17 than merely the --

18 MATT PILLARD: So from an average I guess  
19 for each -- you know, within each mile more the  
20 range of channel widths would be as much interest as  
21 just averaging what we had, because we did tran sex  
22 just to get the average. You can also know the max  
23 and min for every --

24 JOEL JORGENSEN: I guess focusing more on  
25 the top 10 percent of those channel widths may be

1 more to the point regarding what the birds are  
2 using, because, again, probably at the top -- the  
3 lower 50 percent of channel width really may not --  
4 I mean, it's important to birds to have channel --  
5 you know, certain things in broader habitat context,  
6 but specifically looking at where the birds will be  
7 selected for nesting, it's really the wider portions  
8 that are really most important.

9 MATT PILLARD: Okay.

10 JOEL JORGENSEN: And that's about all I  
11 have.

12 I guess one other point I think there was  
13 a quote in there in the report from Brown and  
14 Jorgenson regarding -- it talks about habitat uses  
15 and habitats not used. It's a direct quotation and  
16 it's factually correct. We made the observation on  
17 the lower Platte River that sandbars where there  
18 were no colonies were larger in size than those  
19 unused. However, the direct quote in the report  
20 leaves out -- it's not actually a direct quote. It  
21 omits the parenthetical statistical information  
22 which shows it wasn't a statistical test. It shows  
23 there is a great deal of overlap between those two  
24 values. And essentially even though we're sort of  
25 summarizing the average of what we observed, it

1 really isn't making a conclusion in a statistical  
2 sense that there is a difference there.

3 So I think either incorporating that  
4 parenthetical data back into those quotations is  
5 very important, because I think after that quotation  
6 is mentioned, the argument or the narrative builds  
7 upon that point, so I would ask that that be  
8 rectified.

9 MATT PILLARD: Sure. Thanks, Joel.

10 JEFF RUNGE: Yeah. When looking at the  
11 average valley widths, 15.2 miles to 24.3 miles,  
12 those are pretty wide valley widths I guess. Would  
13 it be safe to assume that the valley at any point  
14 does not constrict the channel width, or is there --  
15 or have you seen cases or instances where there is a  
16 constriction in the valley width that would result  
17 in a restriction in your channel width?

18 MATT PILLARD: The narrowest is  
19 15.2 miles, so we didn't necessarily analyze in that  
20 location is the valley width having an effect on the  
21 Loup River channel width. We were looking at valley  
22 width as relationship to terns and plover nesting,  
23 not to channel width formation.

24 JEFF RUNGE: Okay. But I guess I would  
25 assume that these are wide valleys that wouldn't

1 constrain the active channel.

2 MATT PILLARD: It's probably a little  
3 different situation maybe on the lower Platte where  
4 you have some very narrow valley widths, you know,  
5 that might have been shown to maybe have some  
6 relationship versus here the wide valley widths may  
7 not be -- valley width may not be a player on the  
8 Loup River in the area we looked at in terms of how  
9 it may or may not affect habitat production.

10 JEFF RUNGE: Yeah, that seemed pretty  
11 obvious to me too, but I thought -- I wasn't quite  
12 sure. You did all the work so I wanted you to  
13 verify that. Thanks.

14 MATT PILLARD: Yeah. So we'll move -- I  
15 think we'll move on. I'm on slide 352, and I'll go  
16 through this methods of the HEC-RAS analysis to  
17 identify percent exposed channel relatively quickly.  
18 It's the same methodology that we did for the  
19 hydrocycling analysis on the Platte River, just  
20 obviously different locations. We used obviously  
21 different sites. Sites one -- site one was above  
22 the diversion weir, site two was below the diversion  
23 weir. We used the model to evaluate for the  
24 different scenarios of flow, what would be exposed  
25 from a channel width perspective on average at each

1 site.

2 So I'm just going to kind of blow through  
3 this page. It's kind of the same kind of things  
4 that we used for the hydrocycling. Different flows,  
5 pre-nesting, post nesting surveys were used, study  
6 sites one and two for both current operations and no  
7 diversion.

8 Again, another example, this is at -- I'm  
9 not sure what site this one is at. We can assume  
10 this is at site one. I think for purposes of the  
11 graphic is to show the same things we showed earlier  
12 that a change in stage results in a change in what's  
13 exposed from a channel width perspective.

14 Again, maybe didn't make this point  
15 yesterday. This only evaluates what's exposed from  
16 a percent channel width perspective, it doesn't  
17 really make any indication of whether or not that --  
18 what was exposed was suitable habitat for nesting or  
19 not. Just whether or not it was above or below the  
20 elevation line.

21 So I'll go through the results of what we  
22 found similar to how we addressed before. Here  
23 we'll compare between sites one and two. Under both  
24 operation scenarios, percent exposed channel width  
25 decreased as flow or wetter conditions increased.

1           At site two, current operations had a  
2 greater percent of exposed channel width than under  
3 the no diversion condition. It's less flow, you  
4 know, under a current operations scenario.

5           Site one had a similar percent exposed  
6 channel width as site two under the no diversion  
7 condition. Maybe that's self intuitive. If the  
8 flow is going down the bypass reach, you have  
9 similar flows above and below. Even though we have  
10 some differences in channel widths, the amount of  
11 percent exposed channel widths were relatively  
12 close.

13           This is just kind of a summary graphic.  
14 I'm on slide 358. It shows site one, the channel  
15 width differences, and then, you know, looking at  
16 the different years. Site one, 20 percent exposed  
17 channel width, current operations, site two, and  
18 that dry year was 63 percent. Under a no diversion  
19 condition in a dry year was 14 percent, so a little  
20 bit less under the no diversion condition downstream  
21 than upstream under the same flow scenarios. All  
22 typically higher from percent of exposed channel  
23 width at site two under the current operations  
24 condition.

25           That's -- I can take questions on the

1 percent of exposed channel width portion. Pat's  
2 going to help describe how the sediment transport  
3 parameters worked into the flow depletion flow  
4 diversion portion.

5 JEFF RUNGE: Not really a question, but a  
6 statement here is the exposed channel width is very  
7 helpful, but I don't think -- getting back to the  
8 reference here with Joel is that this is -- the one  
9 dimensional model is to help verify a lot of the  
10 information that was done at the two dimensional  
11 photography analysis. A lot of the different  
12 evaluations, such as you've got the exposed --  
13 percent of exposed sand, but it doesn't say whether  
14 these are attached or whether these are connected to  
15 the bank or disconnected at these different flows,  
16 and that's one important component.

17 I think other important variables that are  
18 missing that would help to improve this analysis is  
19 wetted width and mean depth as well. I think those  
20 are also -- may not be direct selected for  
21 variables, but they may imply things like land  
22 predator access and those types of variables. So I  
23 believe that the analysis is really good, but I  
24 think it could be improved with the addition of  
25 those variables, which shouldn't take that much

1 extra work, because you do have the model grounds,  
2 you do have the output, it's just reporting those.

3 MATT PILLARD: Thanks, Jeff.

4 PAT ENGELBERT: Any other questions for  
5 Matt before he sits down, or even after?

6 Just really quickly, we'll go through --  
7 we performed the sediment transport calculations as  
8 we had done previously for the hydrocycling stuff.  
9 We did it for the no diversion alternative.

10 Again, after we evaluated the sediment  
11 transport under the current ops versus the no  
12 diversion hydrograph, we determined what the  
13 dominant and effective discharges were as well as  
14 the total sediment transport. And we also put those  
15 results into our regime analysis, and I think I'll  
16 just go right into the summary of results.

17 Slide 360, site -- up here we've got sites  
18 one, site two and site three. Under current  
19 operations, the dominant discharged at site one is  
20 approximately 2,300 CFS, and the total sediment  
21 transport at capacity is around 2,200 tons -- is  
22 that tons per day, George?

23 GEORGE HUNT: That's tons per year.

24 PAT ENGELBERT: Tons per year. Sorry  
25 about that. 2.2 million tons per year.



1           So looking at site two, under current  
2 operations, the dominant discharge is around 1000  
3 CFS, and that dominant discharge gets increased to  
4 approximately 2,400 CFS under the no diversion  
5 alternative. More water, more sediment being  
6 transported.

7           And then that sediment capacity goes from  
8 890,000 tons per year up to approximately  
9 2.4 million tons per year.

10           As we get down into site three, the  
11 dominant discharge for current operations is around  
12 1,200 CFS, and the dominant discharge under the no  
13 diversion condition is approximately 3,400 CFS.

14           And the sediment capacity increases from  
15 950,000 tons per year to approximately  
16 1.8 million tons per year.

17           So any questions on that? Basically you  
18 have more flow, more sediment being transported,  
19 higher dominant discharge. Any questions on that?  
20 And that was for 2005, which is a normal flow  
21 classification year.

22           We also evaluated it looking at the  
23 hydrographs from 2003 through 2009 and averaged the  
24 results to get the average annual.

25           The dominant discharge for current

1 operations gets slightly increased from just looking  
2 at 2005 up to 2,500 CFS which is the sediment  
3 transport capacity of around 2.6 million tons per  
4 year.

5 Site two, the dominant discharge under  
6 current operations is 1,100 CFS. Under the no  
7 diversion condition it's 2,600 CFS.

8 Capacity increases from just under a  
9 million tons per year to 2.57 millions tons per  
10 year.

11 Downstream at the tailrace, the dominant  
12 discharge for current ops is 2,400 CFS, and that  
13 increases to 3,900 CFS under the no diversion  
14 condition.

15 The total sediment transported increases  
16 from a million tons per year under current ops to  
17 approximately 2.1 million tons per year under the no  
18 diversion condition.

19 Okay. So kind of the -- a summary of  
20 those results, the total sediment transport,  
21 effective and dominant discharges are higher for the  
22 no diversion condition than the current operations  
23 condition.

24 Any questions on that? Any questions on  
25 the values?

1           Moving on, I'll go to slide 363. We then  
2 compared the change in dominant discharge between  
3 current operations and the no diversion alternative  
4 to their respective channel widths and depths.

5           For 2005, which is a normal year, I'm  
6 going to focus on the dominant discharge side of  
7 things. At sites two and three, you do see an  
8 increase in that width from between current  
9 operations and no diversion. Again, seems pretty  
10 logical, you have more sediment transport, you would  
11 have greater wetted width.

12           Similarly to the depth on the slide 364,  
13 on the dominant discharge half of that graphic,  
14 looking at sites two and three, you have an increase  
15 in the hydraulic depth for the respective dominant  
16 discharges between current operations and the  
17 run-of-river condition.

18           Again, we looked not only at just a normal  
19 year 2005 or a wet year, a dry year, we also looked  
20 at a full hydrograph between 2003 and 2009. And we  
21 see similar trends on slide 365. You have an  
22 increase in width and an increase in hydraulic depth  
23 under the no diversion condition than you did under  
24 the current operations condition.

25           So in summary, the channel widths and

1 depths are greater for the no diversion condition  
2 than under the current operations condition.

3 Anyone have any questions or observations  
4 on that? Joel.

5 JOEL JORGENSEN: Can I go back -- based on  
6 the sediment and the dominant discharge information,  
7 is it safe then to conclude that the no diversion  
8 alternative then in that scenario you have sandbars  
9 of a higher elevation than you do with the  
10 diversion; is that safe to say? There is more  
11 sediment and there is a greater dominant discharge?

12 PAT ENGELBERT: I think -- would it have  
13 more exposed sandbars.

14 JOEL JORGENSEN: No, would the sandbars in  
15 the system be greater elevation or not?

16 PAT ENGELBERT: That's a good question.  
17 Let me think about that while Matt responds.

18 MATT PILLARD: Just one quick thought on  
19 that, and maybe Ron or Neal might be able to help me  
20 out more. When they have those large flood events,  
21 it's somewhat routine to close the gates so that you  
22 don't get debris into the canal. This is more of a  
23 question, Neal, I guess.

24 NEAL SUESS: Yeah, to a great degree.  
25 Yeah, depending on the size of the event.

1           MATT PILLARD: So in some events there may  
2 not be much difference, because if they close the  
3 gates to let those go downstream, you know, maybe a  
4 large event -- if that's forming the higher bars,  
5 the larger events are forming the larger bars, some  
6 situations that's happening. Others, you know,  
7 medium events they may not close their gates so it's  
8 getting less water under some storm events. Maybe  
9 doesn't totally answer your question, but that's one  
10 observation I made.

11           JOEL JORGENSEN: From a generic sense, a  
12 greater dominant discharge, more sediment in the  
13 system, and some of those other variables,  
14 generically speaking, they should create sandbars of  
15 a higher elevation, right? I mean, a million CFS  
16 and 18 billion tons of sediment are likely to  
17 produce higher sandbars than 10,000 CFS and  
18 whatever. You know, I'm just speaking for --

19           PAT ENGELBERT: I'm trying to wrap it  
20 around the true definition of the dominant and the  
21 hydraulic characteristics of the channel itself, you  
22 know, the -- it would convey more sediment. Would  
23 they be higher or would there be more, I don't know  
24 that I could say definitively that you would have  
25 one that's higher as opposed to two or three that

1 are there as opposed to one or two with more  
2 sediment being transported. I'm not quite sure you  
3 can say they would all be higher.

4 JOEL JORGENSEN: I'm not saying all. I'm  
5 saying maybe average, you know, on an average maybe  
6 the extremes. I'm just saying from a principle  
7 standpoint, the greater dominant discharge more  
8 sediment -- does it produce sandbars of higher  
9 elevation than a system with less -- with those  
10 decreases? You're telling me you don't know, right?

11 PAT ENGELBERT: I'm saying I don't know  
12 that we can make that leap in that you've got a  
13 channel that is so wide, its banks are so wide, and  
14 there is a theory out there that says, you know,  
15 that sandbar will reach a height that is just below  
16 the water surface elevation. So if your channel  
17 banks are so high, that height would potentially be  
18 limited by the channel banks, you know. So if you  
19 increase the dominant discharge and you still have  
20 those fixed channel banks, you're not going to get a  
21 sandbar that's essentially that much higher. Once  
22 it gets out of banks, it spreads out over very long  
23 distance, and so that's why I'm a little hesitant to  
24 say that greater dominant discharge means higher  
25 bank. Now, I don't know, Gary, would you like to

1 take a shot at that?

2 GARY LEWIS: Yeah. The literature on  
3 dominant discharge, there is none to my knowledge,  
4 and I've probably read most all of it, that link the  
5 height of the sandbars to changes in the dominant  
6 discharge. What creates the higher sandbars is  
7 higher flows. It's hydrograph related, not dominant  
8 discharge related.

9 So as was pointed out by Matt, during high  
10 flow conditions, so if you're looking at the --  
11 these two alternatives, during high flow conditions,  
12 the district diverts the water through the river, so  
13 there probably are occasions where the flows being  
14 discharged in the middle range maybe would be higher  
15 without the diversion than with it, and those, you  
16 know, mediate level sandbars would presumably be  
17 higher, but I think where we're both struggling is  
18 there is no effort -- or no literature or no use of  
19 the method as we've applied it that relates it to  
20 the height of the sandbars. It can be related to  
21 the width and depth, but it can't -- it hasn't been  
22 related in my knowledge to height of the sandbars.

23 PAT ENGELBERT: Now we did state there  
24 would be greater depth, so maybe from the distance  
25 from thalweg up to top, you know, potentially could

1 increase.

2 JOEL JORGENSEN: Is there also an inverse  
3 relationship there too if you have deeper  
4 channels -- again, I'm speaking out of boundaries of  
5 knowledge, but if you have greater depth, isn't the  
6 height of the sandbar merely an inverse of that?

7 PAT ENGELBERT: Meaning greater depth also  
8 higher sandbar?

9 JOEL JORGENSEN: Right.

10 PAT ENGELBERT: From that context  
11 that's -- probably could make that leap. Gary, is  
12 that --

13 GARY LEWIS: It would be a taller sandbar.

14 JOEL JORGENSEN: Higher elevation.

15 GARY LEWIS: Just taller.

16 PAT ENGELBERT: Same elevation. Are you  
17 talking standing in the thalweg looking up? So from  
18 thalweg up to top could be a bigger number than --

19 GARY LEWIS: Look at the cross sections  
20 that we have before and after a fairly high flow  
21 event. There is numerous ones of those, and Matt  
22 and both Pat pointed out, if you look at the tops of  
23 those sandbars, in both cases they are at the same  
24 level. So we had this high event, and the peak --  
25 or the top level of those sandbars didn't change



1 even though the channel deepens. So the height of  
2 the sandbar gets taller, divert the dimension  
3 between the thalweg and the top of the sandbar, but  
4 the sandbars didn't go up.

5 PAT ENGELBERT: So we're saying height and  
6 tall in the same context, then I think you could  
7 make that.

8 RICHARD HOLLAND: I have a question. As  
9 long as the flows stay within the banks of the  
10 river, can you have -- if you increase discharge  
11 flow, can dominant discharge increase without an  
12 increase in flow? Let me put it another way. Can  
13 flow increase without an increase in dominant  
14 discharge? That's what I meant.

15 PAT ENGELBERT: I don't -- the more flow  
16 you have, the higher that dominant discharge would  
17 be. The more flow, the more total sediment being  
18 transported, the higher the average of that -- the  
19 dominant discharge would go up.

20 RICHARD HOLLAND: So you're going to  
21 have -- dominant discharge has to increase if flow  
22 increases?

23 PAT ENGELBERT: Yes.

24 RICHARD HOLLAND: As long as we're within  
25 the banks?

1 PAT ENGELBERT: Yes.

2 JEFF RUNGE: Since your higher flows  
3 transport a higher proportionate amount of sediment,  
4 you can have a change in flows, and like the  
5 average, but still have the same effective  
6 discharge. It's just your organization of how those  
7 flows are represented proportionately you could have  
8 different hydrographs and still have the same  
9 effective discharge with the same mean flow.

10 PAT ENGELBERT: Now, effective and  
11 dominant are two different things. If you're  
12 talking dominant, that would be more of a reflection  
13 of the total volume. You could have higher flows,  
14 but if the lower flows offset the highers between  
15 two years -- if the volume is essentially the same,  
16 the dominant would be the same.

17 Effective is a little different. That's  
18 subjective and it's -- we've got quite a few  
19 examples in the initial set of report. I don't want  
20 to bore everybody to tears with that again, but from  
21 a dominant -- if the period you're analyzing you  
22 have more flow volume between two years, you'll have  
23 an increase in the volume of discharge. The flow  
24 volume is essentially the same. We wouldn't expect  
25 that great of a -- you know, much difference between

1 them all.

2 JEFF RUNGE: Yes, that's a good difference  
3 between the two. Were you finished, Rick, or --

4 PAT ENGELBERT: Did that make sense, the  
5 tall height thing? Maybe we can flip through some  
6 stuff on the previous slides to -- off to the side  
7 and just kind of make sure you're square with that.

8 JOEL JORGENSEN: Let me digest. If I have  
9 any questions, I'll have a chance to follow-up.

10 PAT ENGELBERT: Absolutely.

11 JEFF RUNGE: I've got a few questions  
12 here. Just sort of going off of what was said  
13 earlier is that this is sort of a fixed bed analysis  
14 to where those sites downstream there is no channel  
15 adjustments. There is a change in effective or  
16 dominant discharge, but there is no respective  
17 change or adjustment in your channel geometries, so  
18 this is -- again, this is a fixed bed analysis.

19 PAT ENGELBERT: The one D model assumes  
20 fixed bed hydraulics. Again -- and we fully  
21 understand that's a limitation of the system. One  
22 of the ways in which we tried to make it a little  
23 more university applicable is to evaluate the  
24 hydraulics between the two points in time in which  
25 they were taken. We had June and we had September.

1 Some deeper, some more leveled off, and we combined  
2 the two to come up with our width and depth  
3 relationships. So in some respect we kind of  
4 averaged the difference between the two to come up  
5 with our approximation for a discharge with the  
6 width and depth, but you're right.

7 JEFF RUNGE: And so -- thanks, Pat. And  
8 to build upon that too, the slopes are very similar  
9 upstream and downstream. It seems like based on  
10 your report, the grain sizes are similar, and in the  
11 no bypass alternative or no bypass option, it's  
12 roughly the same amount of flow going through. And  
13 so when thinking in terms of channel geometry -- and  
14 I guess the other assumption too is that there is no  
15 odd things going on with the valley that would  
16 constrain your channel plan form. And so with that,  
17 unless I'm wrong here, thinking about geometry wise,  
18 no diversion alternative geometry wise downstream  
19 would look very similar to that of site one.

20 PAT ENGELBERT: Yeah, I think that would  
21 be fair to say. Gary?

22 GARY LEWIS: Yeah.

23 PAT ENGELBERT: Over the long haul it  
24 would trend back toward that.

25 JEFF RUNGE: So I guess to help Joel with

1 that question. What would you see in terms of bar  
2 height and bar size and position and stuff, for the  
3 no diversion alternative, it would be similar to  
4 what you see in site one.

5 PAT ENGELBERT: Any other questions on  
6 that?

7 We did then went ahead and plotted the  
8 dominant discharges on our regime graphics, and  
9 the -- again, most of -- or all of the either  
10 current ops or no diversion are still well within  
11 the braided.

12 What you see on the lighter colors, the no  
13 diversion, it looks like it shifted even farther  
14 into the braided portion. See very similar  
15 situation with the Lane's graphic on slide 369. Go  
16 ahead, Jeff.

17 JEFF RUNGE: Question on the previous  
18 slide, 368. I'm having a little bit of trouble with  
19 the definitions. There is a braided point bar and  
20 wide bend point bar stream and a straight braided  
21 stream, and -- or, excuse me, the steep braided  
22 stream versus the braided point bar and wide bend  
23 point bar stream. Given the different geometries,  
24 you've got a straighter wider mid-channel bar  
25 geometry upstream versus it seems like a narrower,

1 more sinuous point bar system downstream. I wonder  
2 how those two different geometries relate to those  
3 definitions.

4 PAT ENGELBERT: Gary, do you want to take  
5 a crack at that?

6 GARY LEWIS: Yeah. Probably the best  
7 answer is to refer you to Chang's paper. You'll get  
8 a paragraph type description of each of those  
9 categories as opposed to the brief statements at the  
10 bottom that we can't read from here.

11 Our point I think in doing this is you're  
12 a long way in any of these comparisons from a  
13 morphological change. And the line that Chang and  
14 others have drawn between straight braided and some  
15 of the other terms that are at the bottom of the  
16 page is pretty narrow. And I think if you look at  
17 his data, you'll see points straight braided down  
18 closer to one of the other definitions and points  
19 that are close to the lines that we drew through  
20 there. It's probably better to understand this  
21 graph if you just look at it as a division of two  
22 categories. Above is braided, and we're firmly up  
23 above that threshold between braided and meandering.  
24 If we were moving vertically down, you would have to  
25 have the bankful discharge changing, and the

1 slope -- I'm sorry, the slope changing and the  
2 bankful discharge being constant. Or to move  
3 sideways, you would have to have the bankful  
4 discharge or dominant discharge change for the same  
5 slope. And those in real systems kind of move  
6 together, so it's a generic method of looking at the  
7 regime the river would be in that has been adopted  
8 and applied universally in the literature, including  
9 by the Corps of Engineers.

10 JEFF RUNGE: And given what you seen  
11 through a lot of the results as far as these two,  
12 you know, it seems like there is some difference in  
13 geometries, but they are both considered braided.

14 GARY LEWIS: Correct.

15 JEFF RUNGE: Okay.

16 PAT ENGELBERT: Joel.

17 JOEL JORGENSEN: Another question.

18 PAT ENGELBERT: And talk real loud.

19 JOEL JORGENSEN: I guess what Gary just  
20 said is that, you know, there hasn't -- you haven't  
21 seen a change in the regime above and below; is that  
22 correct? But is it fair to say -- I'm speaking out  
23 of sorts here a bit. When you have a system like a  
24 river, you can have numerous changes to the system,  
25 but for a braided river system to go to a meandering

1 river system, it's not going to be a gradual change  
2 in what I understand. Those changes are more or  
3 less episodic; is that correct?

4 PAT ENGELBERT: I would think so speaking  
5 more in geologic time frames again. Gary, is that  
6 correct?

7 GARY LEWIS: I've published papers on the  
8 Platte, not on the Loup, that really support the  
9 idea that the Platte is not episodic in the  
10 geomorphologist's definition of episodic.

11 The changes we see on the Platte River are  
12 not driven by the high floods events. That's an  
13 episodic extreme. The Cimarron River in Kansas is  
14 episodic. It's a braided stream.

15 JOEL JORGENSEN: On the central Platte you  
16 have had a regime shift -- I'm using the term regime  
17 in the generic sense, not specific to geomorphology.

18 So like on the central Platte where you  
19 had a number of variables acting on the system year  
20 over year, you've had diminution of those variables  
21 over time, and then at some point more or less the  
22 overall system went from a braided river system now  
23 to more of a meandering system. Is that -- so you  
24 can have numerous changes to the system without an  
25 episodic change I guess is the point I'm trying to



1 make, or asking about.

2 GARY LEWIS: If I can comment on that, the  
3 system -- the change went from braided to  
4 anabranched. And I don't know of anybody who's  
5 calling the central Platte River meandering. So  
6 anabranched --

7 JOEL JORGENSEN: That was a recent paper  
8 in 2007 by -- I can't remember the person that was  
9 using the term meandering, but from a bird's  
10 perspective, meandering and anabranched are probably  
11 the same thing.

12 JEFF RUNGE: To me, I guess, in summary is  
13 you've seen some differences upstream and  
14 downstream, but the whole definition of end regime  
15 and graded is such a broad inclusive that it  
16 includes both the upstream conditions and the  
17 downstream.

18 PAT ENGELBERT: Yeah.

19 GARY LEWIS: I might point out in the  
20 first paper on sedimentation, if you look at the  
21 year-by-year dominant discharge and plot those on  
22 this graph, you'll see the same slope. So just  
23 moving horizontally. That it will move left and  
24 then move right, left and right. And that's really  
25 the basis of our dynamic equilibrium conclusion that

1 we make. It's not heading in any particular  
2 direction and sustaining that direction. So we did  
3 this on a year-by-year basis from '85 to 2009. And  
4 if you look at the plot of that data, and if you  
5 look at just the graph of the downward discharge,  
6 it's cyclic. So it will move left and then right  
7 and left and right on this graph within certain  
8 limits. All of those limits are well within Chang  
9 and Lane's classification of braided rivers. So  
10 none of the data support the idea that it's even  
11 becoming anabranching in this reach. It all supports  
12 the idea that it's braided and not moving outside to  
13 any proximity of either an anabranching, which is one  
14 of Chang's classifications. If you look at the  
15 paragraph definitions of these classifications, it's  
16 not even getting close to the anabranch condition.

17 JOEL JORGENSEN: I guess I'm not  
18 challenging that. I'm saying that you can have  
19 changes to the character of the system and still  
20 maintain what you're saying. I mean, channel width  
21 is one, I guess above and below. If you look at  
22 those figures, it's almost twice as much wider above  
23 than below. And, I mean, that's a character that I  
24 guess I'm looking at and saying there is a  
25 difference here. And I don't know if it's

1 statistical or not. Again, I know this is  
2 different, but from my standpoint I'm not  
3 understanding geomorphology. You can have changes  
4 to the system and still maintain the same regime.

5 GARY LEWIS: Correct.

6 PAT ENGELBERT: Yes.

7 JOEL JORGENSEN: I'll sit with that.

8 Thank you. I appreciate this.

9 PAT ENGELBERT: Any other questions on the  
10 regime stuff?

11 So, again, just to resummarize, the  
12 current operations of the no diversion condition  
13 again are well seated within that braided morphology  
14 with neither transitioning toward another  
15 morphology. That's on slide 370. With that, no  
16 more discussion on sedimentation. Last chance.  
17 We're going to turn it back over to Matt on  
18 objective five.

19 LISA RICHARDSON: Scott.

20 MATT PILLARD: And I'll turn it over to  
21 Scott.

22 SCOTT STUEWE: We are on slide 370.

23 LISA RICHARDSON: Should be 371. I don't  
24 know why it doesn't have a number on it. No number.

25 SCOTT STUEWE: The objective is to

1 determine project effects, if any, of consumptive  
2 use on fisheries and habitat on the lower Platte  
3 River downstream of the Tailrace Canal. Associated  
4 tasks are consumptive use analysis for objective  
5 one. And the results are no measurable depletions  
6 to the lower Platte River. Therefore, fisheries and  
7 habitat are not adversely impacted to a greater  
8 extent under current operations than it would be  
9 under a no diversion condition.

10 Next objective is to determine the  
11 relative significance of the Loup River bypass reach  
12 to the overall fishery habitat for the Loup River.

13 Associated tasks are the fishery  
14 populations above and below the diversion weir were  
15 measured and evaluated, and to include the Montana  
16 method in determining habitat.

17 Slide 373, methodology for population  
18 above and below the diversion was determined from  
19 Nebraska Game and Parks' fish data surveys done in  
20 1996 and 1997. Many reaches on the Loup were  
21 evaluated, but we used two reaches above and two  
22 reaches below for this study.

23 The Game and Parks' study was used to help  
24 determine effects of the diversion on the fisheries  
25 in the Loup.

1           These are the sites that we looked at or  
2 that determined we worked with. Below Genoa and  
3 Columbus and above Fullerton and Palmer.

4           Results of the fishery population above  
5 for 1996 -- whoops, Palmer area, when you look at  
6 '96 versus '97, it's fairly similar. Fullerton,  
7 this is again above the diversion weir, very similar  
8 in number. Again, in '96 and '97, number is very  
9 similar. We did have a jump here in the Columbus  
10 collection area.

11           Part of the -- part of the collection, you  
12 can correct me if I'm wrong, Rick, the collection  
13 was conducted in four different time periods,  
14 spring, early summer, late summer and autumn.

15           And there were times when they could not  
16 access and do the collection I believe at one -- at  
17 several times because of water, high water events.  
18 But as you can see, it's very similar across the  
19 board anyway.

20           When you look at the percentages of the  
21 most common fish, a lot of them are in the middle  
22 family. And you can see it's fairly similar when  
23 you look at '96, 55 percent of Red Shiner,  
24 75 percent at Fullerton for Red Shiner, and these  
25 are the top fish in the collections both above and

1 below.

2           Then you go down through here. Everything  
3 pretty much mirrors so that there is -- you know,  
4 there is not a separation except for the Western  
5 Silvery Minnow. Now, it doesn't state why there is  
6 a difference for that. Maybe the habitat is not  
7 there above the diversion that -- you know, that  
8 they are conducive to, but they do show up at the  
9 Fullerton area anyway in the next year. Again, it  
10 doesn't look like there is any impact due to the  
11 diversion as far as population comparisons.

12           Slide 377 is one of showing the sport  
13 fisheries. Channel Catfish are well represented.  
14 Same way with Largemouth Bass both above and below.  
15 There is a little bit of fluctuation among the sites  
16 for Bluegill. Otherwise everything else pretty much  
17 masks as you go down above and below the diversion.

18           Because of this, the results have been  
19 determined the diversion is not negatively affecting  
20 the fisheries. The populations and habitat  
21 collected in the study indicate that typical  
22 rivers -- you know, at mass the typical rivers for  
23 this region.

24           Again, results in the populations above  
25 and below sport fisheries are similar in both

1 reaches. The power canal and Lake Babcock, as  
2 stated within the study, are preferred by fishermen,  
3 so there has been a fishery created by development  
4 of the Loup Power Canal.

5 Next thing to look at was fish passage to  
6 try and determine if the diversion has created a  
7 problem for fish passage up and down through the  
8 system.

9 When the sluice gates are open, the  
10 velocities through, according to the model, are  
11 prohibitive to fish passage. But as we know, there  
12 are situations when fish are able to go through  
13 the -- either over the diversion, through the gates,  
14 or whatever, and there are several reasons that this  
15 may happen. There is opportunity for the fish to  
16 rest in what we call the hydraulic shadows, and that  
17 can be the bowworks or the headworks, they can hide  
18 in there. They can stay in that area until they've  
19 rested up enough, and then they can work their way  
20 down through the corner interstitial areas, reduced  
21 velocities there, and then use their burst speeds to  
22 get through, or they can hide behind debris or ice  
23 buildup within the gate and structure areas. And,  
24 again, there is a potential, though it's less than  
25 1 percent where the fish might actually be able to

1 make it over to the diversion weir during flood  
2 situations.

3 We were required by FERC to look at the  
4 Montana method. The Montana method uses flow data  
5 to determine habitat condition. Through this,  
6 several -- you know, we looked at several different  
7 sites. On the Loup River we looked at the ungaged  
8 site above the diversion weir, and the Genoa gage  
9 below the diversion weir. And we also looked at two  
10 sites on the Platte, the Duncan gage, which is above  
11 the Loup River confluence, and the ungaged site  
12 three below the Loup River confluence.

13 The Montana method is recognized  
14 throughout the country for quick assessment. It's  
15 easy to use. You can desktop it. It doesn't  
16 require extensive field work. It's easy to apply to  
17 nearly any situation and system, and it's been  
18 commonly adopted, as I say, through the country.

19 However, there are disadvantages. It only  
20 looks at one criterion, which causes some -- you  
21 know, depending on what kind of a system you may  
22 actually be looking at. It doesn't incorporate  
23 intra-month variation. You're looking at an  
24 average. And it does -- does not model the true  
25 complexity of the system, whether it be plunge pool



1 or whatever if you're looking at flows.

2 Study sites, again, this just points out  
3 where we looked at them. Above and below the  
4 diversion and then on the Platte.

5 Slide 384. One thing that we tried to do  
6 to make it easier to visualize was we took -- we  
7 decided to go ahead and group optimum, outstanding,  
8 excellent and good into what we call our  
9 satisfactory category.

10 So anything -- if we have 40 percent of  
11 annual mean flow and above, we put it in the  
12 satisfactory category from April to September. And  
13 if we're 20 percent of annual mean in October to  
14 March, that puts it in the satisfactory category.

15 When we looked at the different sites, we  
16 went down through there, and these are the average  
17 annual flows as indicated in previous slides.  
18 Satisfactory, 40 percent of flow, of course, 952  
19 CFS. And you can see the numbers as we go across  
20 here.

21 This is an example of how we determine the  
22 occurrences of satisfactory, poor or degraded.  
23 Black is degraded or poor, and green, of course, is  
24 satisfactory and above. And that's how we determine  
25 when we came in to develop these graphs.

1           On this graph, this is the average number  
2 of years each site met each strained condition  
3 category. At ungaged site one, we show -- this is  
4 on the Loup again. We had two to three years of  
5 fair and approximately five years of poor condition,  
6 but we had better than 51 years of satisfactory or  
7 better.

8           Down at Genoa below the diversion, we  
9 do -- there is a drop in satisfactory. Very similar  
10 for fair, and we had a little increase in the poor,  
11 and we had a definite increase in degraded.

12           You go back to the October and March time  
13 frame, you see we have -- there are no poor or  
14 degraded time periods. You go down to Genoa and you  
15 have very few as well.

16           And to break it down further on the Loup,  
17 habitat assessment by month, again, site one,  
18 satisfactory. Majority of the time from April to  
19 June very -- you know, little area for fair.  
20 However, everything has stayed either satisfactory  
21 or no worse than poor.

22           When you go over to look at the time  
23 period from October through March, all flows remain  
24 satisfactory or better.

25           When you go down to Genoa below the

1 diversion, still we have a majority of satisfactory  
2 time periods for April, May and June. Then we start  
3 seeing due to flow depletions or whatever that  
4 occurs naturally, that then drops the satisfactory  
5 levels to less than 20 years.

6 The degraded periods do show up a little  
7 bit more, however, when we go over here for the time  
8 periods of October through March, those begin to  
9 pick up again, and we're back in the satisfactory  
10 categories.

11 Even though the Montana method shows that  
12 there are some variations in the habitat  
13 availability, the Game and Parks studies reveal that  
14 the fish communities above and below the diversion  
15 are similar and appear to be healthy.

16 The Montana method may not take into  
17 consideration the intra-month variation that may  
18 help maintain deeper channels and pools due to the  
19 difference in flow.

20 Also, the power canal, we want to  
21 emphasize this, provides habitat and public access  
22 opportunity that the Loup River diversion may not  
23 provide.

24 On the Platte, as you can see, there are  
25 periods even on this -- on the river system.

1 Satisfactory -- there are some areas of satisfactory  
2 or better, but there are still times and periods of  
3 degraded habitat correlations.

4 Also, same thing is over here for October  
5 through March. You still have some degraded time  
6 periods. This is probably a direct result of  
7 effects that are occurring farther up the river  
8 system itself.

9 Again, as we take a closer look by month,  
10 the Duncan gage, which is above the confluence, you  
11 know, there are satisfactory time periods for flow,  
12 but then as the summer progresses, you get degraded  
13 conditions as well.

14 You get into October through March, again,  
15 it improves, increased rainfall, decreased  
16 irrigation impacts. Same way down here on the  
17 unged site below the confluence, everything -- you  
18 know, there is a lot of satisfactory times, fewer  
19 degraded times, and, again, go back into the  
20 improved satisfactory conditions.

21 So summary results of this are Game and  
22 Parks study show fish used the lower reaches as much  
23 as they do the upper reaches suggesting that habitat  
24 is not limiting.

25 The sport fisheries are similar upstream

1 and downstream, which would indicate that the  
2 diversion is not totally effectively cutting off  
3 passage.

4 The Montana method analysis suggests  
5 degraded flows for the Loup, but the fisheries  
6 studies also show that there are fisheries  
7 populations in there, and we know that it is also  
8 being accessed for sport fishery activity.

9 And the power canal is an important sport  
10 fishery resource for this region.

11 Further results, Platte River exhibits  
12 degraded flow upstream and downstream of the  
13 confluence.

14 Rick, did you have something?

15 RICHARD HOLLAND: Yeah. Just -- I hate to  
16 interrupt your flow. Your statement and conclusions  
17 concerning the fish studies I think is unfounded,  
18 and I'm just going to say that the sampling that  
19 went on in the fish studies for those two years was  
20 sampling with -- for relative abundance presence and  
21 absence kind of sampling. We did no population  
22 estimates, we have no data on trends for population  
23 numbers up or down, so I'm not going to comment one  
24 way or the other which way they are, because I have  
25 no data to make that statement. It's a relative

1 abundance kind of approach.

2           So saying the habitat is not limiting, we  
3 have no information to suggest there is any -- there  
4 is or is not any density dependent habitat related  
5 functions going on in the river segment there, so I  
6 don't think you can make that statement that habitat  
7 is not limiting. I'm not saying it is, I'm not  
8 saying it isn't. I'm saying the data doesn't  
9 support such analysis or conclusion, so I think you  
10 need to take that out of there.

11           The fact that these studies were done post  
12 project says that what we're doing is simply finding  
13 out the relative abundance of these various species  
14 and their presence or absence in those various  
15 locations. This was a resource inventory study, and  
16 it wasn't designed as a population dynamics kind of  
17 project. So just want to clarify what that study  
18 was designed for.

19           SCOTT STUEWE: And I understand, though,  
20 the fish that are there, they are generalists, and  
21 pretty much mimic what are in other river systems  
22 here in the central part, correct?

23           RICHARD HOLLAND: Yes.

24           SCOTT STUEWE: I believe I read that too,  
25 so I just wanted to make sure. We will address

1 that.

2 Fisheries habitat in the Platte River is  
3 not affected by the Loup River diversion. If you  
4 recall, there were degraded conditions above the  
5 confluence and slightly modified below the  
6 confluence.

7 With that, are there any other questions  
8 or comments?

9 JEFF RUNGE: Could you back up to the  
10 previous slide?

11 Was there -- there wasn't exhibits  
12 degraded -- suggest that fisheries habitat in the  
13 Platte River not affected by Loup River diversion.  
14 That's implying that the Montana method is an  
15 indices of physical habitat.

16 SCOTT STUEWE: Okay.

17 JEFF RUNGE: That's correct?

18 SCOTT STUEWE: Yes.

19 JEFF RUNGE: And so was there a with  
20 diversion and without diversion assessment so that  
21 you can compare conditions with the diversion and  
22 without the diversion?

23 SCOTT STUEWE: No, because we looked at --  
24 we looked at the conditions above the confluence and  
25 below the confluence. We didn't look at what

1 happens if the diversion and no diversion.

2 JEFF RUNGE: Okay.

3 LISA RICHARDSON: You have to just -- if  
4 you want to try to think what a no diversion  
5 alternative would be, you would make the assumption  
6 that it would be similar to what you see upstream,  
7 but it would -- we talked about that at length. It  
8 would be improper application of the Montana method  
9 to compare the monthly flows or the daily flows at  
10 Genoa to the average mean flow above, because that's  
11 not the habitat. You need to compare the flows that  
12 routinely are seen in that stretch.

13 JEFF RUNGE: Well, for the short term, but  
14 if there is any long-term changes in flow, there  
15 would be some channel adjustment to that change in  
16 flow. So I would agree I would think short term,  
17 yes, but long term you would -- your channel would  
18 adjust to those conditions of the changed flow  
19 regime.

20 SCOTT STUEWE: So what you're suggesting,  
21 though, is then, you know -- let me go back.

22 JEFF RUNGE: I guess what I'm suggesting  
23 is there is no diversion versus no diversion  
24 alternative comparison, and I'm not sure quite how  
25 to do that, but, you know, I guess that's something



1 I'll have to sit down and think about.

2 GEORGE WALDOW: I think your -- I think  
3 you're asking the question that was not intended to  
4 be answered here. And if I remember right, the  
5 Montana method is an indicator of habitat  
6 suitability, does that ring a bell?

7 SCOTT STUEWE: Yes.

8 GEORGE WALDOW: And I'm not a fisheries  
9 guy obviously, but I think what we're trying to show  
10 here is like a snapshot. The Montana method relies  
11 simply on the flow duration curve, and you apply it  
12 on a seasonal basis and it's a snapshot. To ask it  
13 to indicate long-term versus short-term habitat  
14 elements to me is something it can't do and can't be  
15 expected to do. I don't know how to answer your  
16 question relative to the Montana.

17 JEFF RUNGE: That just shows the -- like  
18 with all models, all evaluations there is always  
19 some sideboards, some restrictions with what you can  
20 do, and that's -- it's clear to me now that those  
21 are some of the limitations of the analysis.

22 LISA RICHARDSON: I think that if you --  
23 and Pat's said this in the other portion of the  
24 studies, if there were no diversion -- if no  
25 diversion were to occur, the downstream section

1 would over time become pretty similar, maybe  
2 identical to the upstream reach, right, Pat?

3 PAT ENGELBERT: Seems logical, yeah.

4 LISA RICHARDSON: And so I guess when we  
5 did the analysis separately for upstream and  
6 downstream, we're really using that same premise in  
7 that you can only compare the downstream monthly  
8 flows to the downstream average over the period of  
9 record, because the channel has changed slightly.

10 JEFF RUNGE: That's good. That's a good  
11 explanation and this is very helpful.

12 SCOTT STUEWE: Is there anything else?  
13 Okay. Matt.

14 MATT PILLARD: I know it's noon and we're  
15 hungry. I have 14 slides to get through. It's on  
16 the whooping crane.

17 Objective seven is to determine the  
18 availability of potential whooping crane roosting  
19 habitat above and below the diversion weir under  
20 project operations compared to the no diversion  
21 condition.

22 So we're using tools here for this  
23 objective that we've already established in other  
24 studies, and so we'll be able to kind of fly through  
25 the methods.

1           We use the aerial imagery review that we  
2 did on objective four, and then we also used the  
3 HEC-RAS model to help analyze roosting habitat.

4           Slide 395. So these are the methods  
5 that -- I'm sorry, these are the observed  
6 measurements for whooping crane roosting habitat.  
7 We looked at channel width, channel inundated,  
8 unobstructed channel width and depth of water for  
9 roosting. And we'll get into those as we address  
10 the results.

11           Again, we use the aerial imagery review to  
12 perform channel width area -- average area of  
13 shallow water, wet sand per river mile, percentage  
14 of water and wet sand areas and unobstructed width.

15           What we found -- I'm on 397. What we  
16 found is that the -- again, consistent with the  
17 results for the terns and plovers that from a  
18 channel width perspective above the diversion is  
19 wider than below the diversion. Again, that's an  
20 average.

21           Just as a note here that from the habitat  
22 parameters, the observed habitat parameters, the  
23 range for Nebraska is roughly 764 plus or minus 275  
24 odd feet for whooping cranes.

25           From using the aerials to review the

1 shallow water, wet sand component, we observed that  
2 on average for all the river miles looked at,  
3 upstream roughly 11 to 12 percent of the river miles  
4 had shallow water, wet sand, and downstream that  
5 range was 10 to 16 percent.

6 LEE EMERY: You mean 24 percent or 12  
7 percent?

8 MATT PILLARD: Eleven to 24 percent  
9 upstream, 10 to 16 percent downstream.

10 MELISSA MARINOVICH: Matt, just a  
11 clarification. I think what you meant to say was  
12 that 11 to 24 percent of the channel width was the  
13 correct -- was the actual shallow water resting.  
14 That it was not 11 to 24 percent of the entire river  
15 mile was the shallow water resting.

16 MATT PILLARD: Eleven to 24 percent of the  
17 channel width was shallow water or wet sand.

18 MELISSA MARINOVICH: Yes.

19 MATT PILLARD: That's correct.

20 From an unobstructed width perspective, in  
21 this particular -- in these -- for the reaches that  
22 we looked at, the river miles that we looked at, the  
23 unobstructed width was equal to the active channel  
24 due to the forest station that was observed on each  
25 bank.

1           In addition, there are locations both  
2 upstream and downstream where, you know, the banks  
3 are tall, you know, higher than 3 feet, which would  
4 also serve as an obstruction.

5           The average channel width is consistently  
6 wider above the diversion weir again then below.

7           We then used the HEC-RAS model that was  
8 developed to look at the whooping crane parameter of  
9 water depths. We tried to focus on water depths  
10 obviously per the observed parameters, that was  
11 .8 feet or less that would exist within each of  
12 those river miles.

13           Again, we used the same years, same flows,  
14 and we looked at study sites one and two for both  
15 current operations and no diversion. For whooping  
16 crane, though, we only looked at the early summer  
17 cross section for this analysis.

18           Slide 401. Upstream of the diversion weir  
19 we found generally as the flows increased, the  
20 percentage of channel width with water depths of .8  
21 feet or less decreased.

22           And on average there was little difference  
23 between the dry, normal and wet years of those water  
24 depths.

25           Downstream of the diversion weir, for

1 current operations, generally as flows increased,  
2 again, the percentage of channel width water depths  
3 of 20 feet or less increased. And, again, similar  
4 to upstream on average, there is very little  
5 difference between the dry, normal or wet years.

6 And then downstream the diversion weir  
7 under a no diversion condition, generally as flows  
8 increased, the percentage of channel width with  
9 water depths of .8 feet or less decreased under a no  
10 diversion condition.

11 Then kind of comparing here upstream  
12 versus downstream, site one versus site two. For  
13 current operations, really the differences  
14 between -- the difference between site one and two,  
15 the amount of percent exposed sand between those two  
16 sites diminish as flow increase. So the first  
17 bullet really talks about the difference between  
18 what's available between sites one and two.

19 And at higher flows, high flow for normal  
20 and wet years, at downstream, site two had a higher  
21 percentage of channel width with water depths of .8  
22 feet or less than upstream.

23 And here upstream versus downstream for  
24 the no diversion condition, so, again, site one  
25 versus side two looking at a no diversion condition.

1 There was a small percentage of channel widths with  
2 water depths of .8 feet or less downstream than  
3 there was for upstream for all flows.

4 The difference between those two  
5 conditions of site one or two increase as the flow  
6 increased.

7 This is just looking at site two  
8 specifically for current operations versus the no  
9 diversion condition. Current operations there is a  
10 smaller percentage of channel widths with water  
11 depths of .8 feet or less during all low and medium  
12 flows.

13 During current operations there is a  
14 greater percentage of channel widths with water  
15 depths of .8 feet or less during all higher flow  
16 conditions. And the percentage of difference are  
17 greater -- is greatest during lower flow conditions.

18 So summarize here objective seven,  
19 unobstructed widths above and below the diversion  
20 weir were outside of the whooping crane parameters  
21 for what's required for an unobstructed width.

22 The channel widths above and below the  
23 diversion weir are within the whooping crane  
24 roosting parameters.

25 There is -- from area -- the area of

1 shallow water, wet sand it is greater upstream than  
2 downstream.

3 For current operations, there is a smaller  
4 percentage of channel widths with water depths of  
5 .8 feet or less during low to medium flow, and there  
6 is a greater percentage for higher flow conditions.

7 So I kind of went through that kind of  
8 fast. Hopefully you got the gist of what those --  
9 I'll take some questions on that.

10 JEFF RUNGE: I'll make this quick so we  
11 can get to lunch here.

12 Slide No. 395, similar to the tern and  
13 plover one, you did great work here, just one small  
14 suggestion here to improve the analysis. Channel  
15 inundated percent, that greater than 80 percent,  
16 this is oftentimes interpreted as wetted width, and  
17 it seemed like a lot of the analysis was done  
18 looking at wetted width of a proportion that's  
19 shallow. But it would also be good to separate  
20 wetted width from that wetted width shallow. And  
21 that's it. That's the only comment I had for that.

22 MATT PILLARD: Joel.

23 JOEL JORGENSEN: On slide 397. This is  
24 kind of an example, maybe a general theme. The area  
25 of shallow water, wet sand upstream from -- there is



1 very -- because you have a wider channel width, you  
2 probably have more area. So in terms of absolute  
3 area, there is probably a substantial difference  
4 there between upstream and downstream, and that's  
5 probably be carried out in a number of calculations.  
6 The absolute area is probably quite a bit larger  
7 upstream than downstream I would presume, because  
8 again channel --

9 MATT PILLARD: The channel is wider.

10 JOEL JORGENSEN: Fifty to 100 percent  
11 wider upstream.

12 And I guess just maybe another -- this is  
13 just kind of a general comment maybe about whooping  
14 cranes. You know, applying sort of observational  
15 information from throughout the state, and, again,  
16 it's not really a criticism, but maybe a  
17 perspective. But the way whooping cranes migrate,  
18 they are not power fliers where they have the  
19 opportunity to go around and selecting or choosing  
20 where they are going to spend the night when they  
21 are migrating. They are essentially kites up in the  
22 sky, and when it gets late in the day, they look for  
23 a place to sit down. And sometimes, you know, they  
24 don't have many options.

25 So if a bird was hanging over -- you know,

1 if a group of birds are coming in over the Loup  
2 diversion, they would be making a decision within  
3 that finite area. They really don't have the option  
4 of saying, well, this doesn't look good, we're going  
5 to travel down the road and see if we can find a  
6 better place. They are going to make a decision  
7 based on that small area. So bigger, wider is  
8 probably going to be what the birds would prefer.

9 But with that said, sort of -- again, it's  
10 relative to the habitat that's available to the end  
11 of the day, and that's why sometimes, you know, once  
12 whooping cranes are outside of the main corridor  
13 away from areas with really good habitat, why they  
14 sometimes end up in really some untypical whooping  
15 crane areas, small farm ponds or something. Just a  
16 point about whooping crane migration. Again, they  
17 don't have the ability to say we're not going to  
18 stop here tonight. They are doing down and that's  
19 it. Just a point.

20 MATT PILLARD: Thanks, Joel.

21 LISA RICHARDSON: Well, I'm a little  
22 surprised that we ended up so far right on schedule  
23 when we were so far ahead yesterday, but I guess  
24 that means we kind of had a good estimate of what  
25 this was going to take, we just didn't split it

1 right between the days on the agenda.

2 Does anybody have any additional questions  
3 on any of the studies that we've presented, because  
4 I'm just going to go through a couple slides on next  
5 steps and then we'll be ready for lunch. But there  
6 is no lunch. You can have lunch wherever you want.  
7 There is a couple of donuts back there.

8 No questions on any other studies. Randy.

9 RANDY THORESON: Very, very quickly.

10 Randy Thoreson, National Park Service. Maybe you're  
11 going to tie this into the schedule. As I said  
12 yesterday, there is a lot of good information on  
13 recreation report, and I look forward to the  
14 recreation management plan, be involved early in the  
15 process of that. I know Quinn isn't here today, but  
16 I hope that be conveyed to me when that is going to  
17 start that process to form that together for the rec  
18 management plan. I just say that again.

19 LISA RICHARDSON: Yep. I have one thing  
20 to add. Before the break this morning Jeff was  
21 asking about kind of the relationship between the  
22 percent suitable habitat under Peters and Parham and  
23 the actual flows, because there was the stage change  
24 study that talked about 4,000 to 6,000. Attachment  
25 J in the back of the hydrocycling study does have

1 the -- every day the min and max flow based on a 15  
2 minute or 30 minute hydrograph. It does have those  
3 in there, and then also the percent suitable  
4 habitat, so you can just kind of work your way down  
5 through the table and see, oh, there is 3,500 CFS,  
6 that's about 10 percent suitable habitat, and what  
7 did we see about 23 percent suitable habitat by the  
8 time you got up to 6,000 CFS. So you can see those  
9 comparisons in the attachment.

10 So if there are no more questions -- as I  
11 said at the beginning of the meeting yesterday,  
12 March 11th, that is a Friday, I believe, the  
13 district will be submitting the mean summary from  
14 today's meeting. Similar to what we did last time  
15 where it's just kind of an overall summary.

16 Then the agencies will have 30 days till  
17 April 11th to submit your comments. I believe  
18 April 11th may be a Monday. And to submit your  
19 comments, any recommendation for modifications you  
20 may have, concerns about any study results presented  
21 so far. That's the time frame.

22 The district will then have 30 days to  
23 prepare responses to that to provide any additional  
24 information that we may not have included directly  
25 in the study report or anything else we have.

1           And then in June, FERC would be making a  
2           determination about what additional study  
3           modifications may be needed or whatever needs to be  
4           done, if we've addressed the comments appropriately  
5           or if some more analysis needs to be done.

6           Lee, do you have anything to add to that  
7           time frame?

8           LEE EMERY: Nothing to the time frame, but  
9           you have to follow the regs of the reasoning behind  
10          why you may want to modify a project, some of the  
11          reasoning. There is about six steps you answer in  
12          terms of asking why you want those modifications or  
13          need something else. Same as the first go around,  
14          same kind of thing as the first go around.

15          LISA RICHARDSON: Any questions?

16          All right. The next slide, these are just  
17          those other dates that I talked about at the  
18          beginning of the meeting. August 26th would be the  
19          updated -- I guess I shouldn't say updated initial.  
20          It should say updated study report to FERC on  
21          August 26th.

22          And then September 9th there would be a  
23          meeting for that report, and then November 18th is  
24          the date that the district will be filing a draft  
25          license application. There will be a comment period

1 on that, and then the actual final license  
2 application will be submitted in April of 2012. And  
3 that's it. So I'm only -- we're only 15 minutes  
4 over on a ten-hour meeting. That's pretty doggone  
5 good.

6 (Conclusion - 12:15 p.m.)

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'03 [1] 85/11	16 [3] 30/17 79/21 156/9	256 [1] 18/8
'09 [1] 85/11	16 percent [1] 156/5	25th [1] 6/6
'80s [1] 50/6	16,150 [1] 64/8	26 [2] 77/3 98/24
'85 [1] 138/3	166 [1] 167/10	261 [1] 20/17
'90s [1] 50/7	16th [1] 13/20	262 [1] 21/21
'96 [3] 141/6 141/8 141/23	18 [1] 79/21	264 [1] 22/22
'97 [2] 141/6 141/8	18 billion tons [1] 125/16	266 [1] 24/10
-	18,000 [1] 63/23	268 [1] 25/4
-5 [1] 100/8	18,080 [1] 70/12	26th [2] 165/18 165/21
-6 [2] 99/24 100/8	18,260 [2] 64/10 70/12	27 [2] 5/8 98/24
-8 [1] 99/21	187 [1] 106/13	27 percent [1] 25/19
-9 [1] 99/22	18th [1] 165/23	271 [1] 50/24
.	1944 [1] 92/23	272 [1] 26/15
.5 [1] 63/2	1950 [1] 92/21	274 [1] 50/24
.6 [1] 21/6	1980s [2] 80/14 81/2	275 [2] 50/25 155/23
.7 [1] 63/1	1984 [1] 76/20	277 [1] 28/16
.8 [9]	1985 [1] 99/17	27th [1] 8/19
.8 feet [3] 157/11 158/9 160/5	1994 [1] 85/8	281 [1] 33/3
.9 [1] 62/19	1996 [2] 140/20 141/5	282 [2] 32/24 36/21
0	1997 [1] 140/20	283 [1] 38/11
0.7 [1] 62/9	1st [1] 8/15	286 [1] 40/25
0.9 [1] 62/14	2	287 [1] 42/12
029 [1] 1/11	2 feet [1] 29/2	290 [1] 44/8
1	2 million [1] 8/19	297 [1] 54/20
1 percent [4] 39/6 39/13 39/15 143/25	2 percent [2] 23/11 113/7	298 [1] 54/25
1,000 [1] 43/25	2,000 [6] 33/11 63/18 65/7 77/13 77/15 77/18	299 [1] 55/13
1,065 [1] 113/14	2,050 acres [1] 60/5	3
1,100 [2] 65/3 122/6	2,110 [1] 64/9	3 feet [1] 157/3
1,192 [1] 71/9	2,200 tons [1] 120/21	3 percent [1] 39/20
1,200 [2] 71/12 121/12	2,300 [2] 91/2 120/20	3,400 [1] 121/13
1,200 acres [1] 60/14	2,400 [2] 121/4 122/12	3,400 acres [1] 60/19
1,400 [2] 71/11 77/16	2,500 [1] 122/2	3,500 [1] 164/5
1,430 [1] 71/9	2,600 [1] 122/7	3,900 [1] 122/13
1,430 acres [1] 60/4	2.1 million tons [1] 122/17	30 [4] 28/4 164/2 164/16 164/22
1,433 [1] 91/15	2.2 million tons [1] 120/25	300 acres [1] 60/23
1,434 [1] 91/16	2.4 million tons [1] 121/9	301 [1] 56/12
1,700 feet [1] 44/2	2.57 [1] 122/9	302 [1] 56/18
1-D [1] 41/7	2.6 million tons [1] 122/3	304 [1] 57/14
1.2 feet [1] 91/5	20 [4] 25/19 29/19 29/25 147/5	306 [1] 59/7
1.8 million tons [1] 121/16	20 feet [2] 62/9 158/3	307 [2] 59/20 71/1
1.9 [2] 21/6 21/8	20 percent [2] 118/16 145/13	309 [4] 63/11 71/16 71/16 71/16
10 [3] 71/12 156/5 156/9	20,200 [1] 65/11	310 [2] 64/20 72/4
10 acres [1] 107/10	2000 [2] 18/20 33/13	311 [2] 14/7 72/9
10 percent [3] 70/24 113/25 164/6	2003 [7]	312 [1] 75/17
10,000 [1] 125/17	2004 [1] 100/8	314 [1] 80/8
100 [5] 31/15 93/17 109/17 110/4 110/13	2005 [8]	315 [2] 79/8 80/16
100 feet [1] 59/2	2006 [1] 24/7	316 [1] 83/14
100 foot [3] 59/10 59/13 59/16	2007 [2] 99/21 137/8	32 [2] 21/12 98/22
100 percent [3] 110/7 111/3 161/10	2008 [8]	321 [1] 84/8
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11,000 [2] 8/21 63/20	2011 [2] 1/25 167/17	326 [1] 89/17
11th [3] 164/12 164/17 164/18	2012 [1] 166/2	327 [1] 90/18
12 [9]	220 [1] 3/16	328 [1] 91/13
12 percent [1] 156/3	226 [2] 5/3 5/5	33 [1] 98/22
1256-029 [1] 1/11	228 [1] 10/2	330 [2] 92/9 92/14
1256-029-Nebraska [1] 1/4	23 percent [1] 164/7	331 [1] 92/15
12:15 [1] 166/6	230 acres [2] 60/11 60/16	335 [1] 96/7
13 [2] 98/25 102/9	232 [2] 4/9 71/7	341 [1] 99/13
14 [6] 54/3 85/1 86/9 98/25 102/10 154/15	233 [1] 16/9	344 [1] 102/9
14 percent [1] 118/19	24 [5] 1/25 54/6 87/14 107/6 156/14	346 [1] 103/16
15 [2] 164/1 166/3	24 percent [4] 156/6 156/8 156/12 156/16	349 [1] 106/19
15 percent [1] 71/12	24,530 [2] 64/12 64/14	350 [1] 106/25
15.2 [2] 108/2 115/11	24.3 [2] 108/3 115/11	350 acres [1] 61/1
15.2 miles [1] 115/19	247 [1] 16/23	352 [1] 116/15
	25 [4] 6/2 7/14 77/3 89/24	358 [1] 118/14
		360 [1] 120/17



<b>3</b>	<b>820 acres [1]</b> 61/3 <b>86 [1]</b> 21/12 <b>870 [2]</b> 63/13 64/3 <b>890,000 tons [1]</b> 121/8	<b>alluded [2]</b> 38/13 100/18 <b>altered [1]</b> 22/16 <b>alternative [23]</b> <b>alternatives [1]</b> 127/11 <b>AMERICA [1]</b> 1/1 <b>amount [21]</b> <b>amounts [2]</b> 35/2 102/1 <b>anabranched [3]</b> 137/6 137/10 138/16 <b>anabranched [3]</b> 137/4 138/11 138/13 <b>analysis [69]</b> <b>analyze [4]</b> 96/8 97/25 115/19 155/3 <b>analyzed [6]</b> 15/6 24/2 98/3 102/17 104/7 104/11 <b>analyzing [1]</b> 130/21 <b>and-a-half [1]</b> 79/16
<b>363 [1]</b> 123/1 <b>364 [1]</b> 123/12 <b>365 [1]</b> 123/21 <b>368 [1]</b> 133/18 <b>369 [1]</b> 133/15 <b>37 miles [1]</b> 98/18 <b>370 [2]</b> 139/15 139/22 <b>371 [1]</b> 139/23 <b>373 [1]</b> 140/17 <b>377 [1]</b> 142/12 <b>38 [1]</b> 99/8 <b>384 [1]</b> 145/5 <b>39 [1]</b> 99/8 <b>395 [2]</b> 155/4 160/12 <b>397 [2]</b> 155/15 160/23	<b>9</b> <b>9,000 [1]</b> 63/17 <b>950,000 tons [1]</b> 121/15 <b>952 [1]</b> 145/18 <b>960 acres [2]</b> 60/3 60/13 <b>9:19 [1]</b> 54/19 <b>9:30 [1]</b> 54/15 <b>9th [1]</b> 165/22	<b>annual [17]</b> <b>answer [11]</b> <b>answered [1]</b> 153/4 <b>anybody [2]</b> 137/4 163/2 <b>anybody's [1]</b> 85/18 <b>anyway [4]</b> 17/23 27/15 141/19 142/9 <b>apologies [1]</b> 21/20 <b>apologize [1]</b> 50/23 <b>apparently [1]</b> 5/16 <b>appear [2]</b> 93/9 147/15 <b>appears [1]</b> 27/16 <b>appendices [2]</b> 36/8 36/9 <b>applicable [1]</b> 131/23 <b>application [3]</b> 152/8 165/25 166/2 <b>applied [19]</b> <b>apply [4]</b> 62/3 71/10 144/16 153/11 <b>applying [1]</b> 161/14 <b>appreciate [1]</b> 139/8 <b>approach [5]</b> 10/19 10/22 11/4 74/17 150/1 <b>appropriately [1]</b> 165/4 <b>approximately [42]</b> <b>approximation [1]</b> 132/5 <b>April [11]</b> <b>April 11th [2]</b> 164/17 164/18 <b>April 27 [1]</b> 5/8 <b>ARCS [1]</b> 83/18 <b>area [56]</b> <b>areas [39]</b> <b>argue [1]</b> 9/3 <b>argument [1]</b> 115/6 <b>Army [1]</b> 58/19 <b>arrangement [1]</b> 79/10 <b>arrive [1]</b> 7/7 <b>arriving [1]</b> 6/18 <b>Ashland [2]</b> 27/14 28/15 <b>asked [1]</b> 36/1 <b>asking [7]</b> <b>assess [1]</b> 16/11 <b>assessment [3]</b> 144/14 146/17 151/20 <b>assign [1]</b> 101/4 <b>associated [13]</b> <b>assume [6]</b> 7/22 8/1 58/7 115/13 115/25 117/9 <b>assumed [2]</b> 63/8 66/13 <b>assumes [2]</b> 64/16 131/19 <b>assuming [12]</b> <b>assumption [10]</b> <b>assumptions [8]</b> <b>atmosphere [1]</b> 61/24 <b>attached [1]</b> 119/14 <b>attachment [4]</b> 35/24 36/3 163/24 164/9 <b>attachments [4]</b> 32/7 36/2 102/8 102/17 <b>attempt [1]</b> 104/3 <b>attempted [1]</b> 100/18 <b>attention [1]</b> 49/1
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