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case # 4993

File # 202

4453

IN THE DISTRICT COURT FOR THE FIFTH JUDICIAL DISTRICT

WASHAKIE COUNTY, STATE OF WYOMING

IN RE:	)	
	)	
THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE BIG HORN RIVER SYSTEM, STATE OF WYOMING.	)	Civil No. 4993

FILED

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Margaret V. Hampton CLERK

DEPUTY

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Wednesday, July 29, 1981

ORIGINAL

APPEARANCES

FOR THE STATE OF WYOMING:	HALL & EVANS 2900 Energy Center Building 717 17th Street Denver, CO 80202 BY: MR. JAMES MERRILL and MR. MICHAEL D. WHITE
FOR THE UNITED STATES OF AMERICA:	MR. JAMES CLEAR Attorney at Law Land and Natural Resources Division Department of Justice P.O. Box 7415 Benjamin Franklin Station Washington, DC 20044
FOR THE ARAPAHOE TRIBE:	WILKINSON, CRAGUN & BARKER 1735 New York Avenue, N.W. Washington, DC 20006 BY: MR. R. ANTHONY ROGERS
FOR THE SHOSHONE TRIBE:	SONOSKY, CHAMBERS & SACHSE 2030 M. Street, N.W. Washington, DC 20006 BY: MR. HARRY SACHSE
FOR THE PRIVATE WATER HOLDERS:	MR. GEORGE RADOSEVICH Attorney at Law 910 15th Street, Suite 866 Denver, CO 80202
CLERK TO THE SPECIAL MASTER:	MR. LEO SALAZAR Attorney at Law 701 Rocky Mountain Plaza Cheyenne, WY 82001

THE SPECIAL MASTER: We'll come to order, please.

We will go until one o'clock today if necessary, in order to give me some time to take care of my afternoon chores. As a matter of fact, we can go to two o'clock if necessary, but that's tough on you fellows without lunch.

CROSS-EXAMINATION (RESUMED)

BY MR. MERRILL:

Q Mr. Bliesner, would you please describe to the Court the computer program that you used to develop -- to simulate the operation of center pivot sprinkler system.

A May I use the exhibit that I used in the direct testimony to explain it?

Q You bet.

A If you recall the discussion from the direct testimony, just briefly to run through it again, what the simulation program does is superimposes an eliptic sprinkler pattern on the intake function of the soil as derived from the intake tests. In the program, this intake function is in equation form as it is in the report indicated in the upper corner of the figure that shows that relationship.

The equation for the sprinkler pattern is eliptic

in nature. The program takes time steps and steps the system across the -- across an individual point in the field, increasing at each time step, increasing the application rate on the front side and decreasing the intake rate according to the time step that's used.

What it's doing then is that it tests at each point to determine the application rate has exceeded the intake rate and calculates the balance.

Okay. If the intake rate if still higher than the application rate, then the balance to storage requirement is zero. When we get to this point right here it starts accumulating storage.

Okay. It compares the two rates and calculates the amount going to or from storage. So in this range here we're in this total range, we're accumulating storage at every point where the application rate is above the intake rate, it accumulates storage, that increment of application that is in excess of the intake rate until it gets to this point, and the application rate may or may not be again below the intake rate, depending on the application rate-intake rate functions, and just calculates as a mass balance the water to and from storage.

That's basically the function of the program.

Then the output of the program is in the form of the required storage for that length of system, that speed of passage, the sprinkler, the width of the sprinkler pattern that you have and then the intake function.

Q For how many different locations or sprinklers or test sites did you operate this program to calculate those parameters?

A This was done on the average of the six test sites. In other words, the relationship was used -- was used, was the rate relationship that was used for all of the simulation, so it was the average relationship for the land on the Stagner -- or on the Big Horn Flats.

Q Did you use the results of this center pivot simulation program to design the actual length and nozzle types and so forth of the center pivot sprinklers?

A Yes.

Q Do you have the results of the simulation for those six sites with you?

A I do.

Q Can you share them with us, please?

A Yes.

(Brief pause.

Q Mr. Bliesner, I hand you what I've temporarily marked

for identification as Exhibit RB-11. Would you describe that document, for the record please.

A The exhibit consists of three pages of notes on the operation of the center pivot simulation model used to determine system -- maximum system length in the Big Horn Flats and Stagner Ridge design.

Q Is that model operated by hand calculations or is it put on a computer?

A It's done by computer. Its output is video so the output is extracted by hand.

Q You had to copy it off of a C.R.T.?

A Yes.

THE SPECIAL MASTER: Off of a what?

MR. MERRILL: C.R.T., a Cathode-Ray tube.

THE SPECIAL MASTER: I understand.

MR. MERRILL: I should have said a television set.

* * * * *

MR. MERRILL: Your Honor, I would request permission to withdraw RB-11 and substitute copies later on.

THE SPECIAL MASTER: All right. It will be the same number as RB-11?

MR. MERRILL: Yes, Your Honor. Yes.

MR. ROGERS: Just to understand your coding, Mr. Merrill, does that stand for Ron Bliesner, or what?

MR. MERRILL: It certainly does.

Q (By Mr. Merrill) Mr. Bliesner, in running this simulation model, did you say that the intake rate, the decending function on Tribes' Exhibit 17, is based on the equation shown on Page 13 of your report, Tribes' Exhibit 13?

A That's correct.

Q And that function itself is based on the results of the six intake rate tests that you conducted on Big Horn Flats?

A Yes.

Q I hand you what has been marked for identification as Exhibit RB-10 and ask you to identify that, please.

A That's the plot of the data from the six tests that were conducted.

Q I believe when we were talking yesterday afternoon about the little sprinkler simulator machine that you

used to run these tests, you said you weren't concerned after you had run them about the representative nature of the six locations you studied because the results of the test were within ten percent of one another, is that correct?

A I don't know, somewhere in that neighborhood. I had not calculated that percentage actually.

Q Well, I'm having trouble understanding how the results are within ten percent of one another because looking, for example, at the bottom most row of symbols on the graph on RB-10 it looks to me like some of the times to ponding are between six to seven minutes and some of them are in excess of ten minutes. Am I reading the graph wrong?

A No, you are reading it right. This is at the lowest application rate.

Q Okay, at the lowest application rate you had some locations where the time to ponding was approximately six and a half minutes and other locations where the time to ponding was perhaps twelve minutes?

A Approximately eleven minutes.

Q As I understand it, at the medium application rate you found times to ponding between two minutes and approximately three and a half minutes, is that correct?

A That's true.

Q And likewise for the lowest application rate, times to ponding varied between one minute and something over two minutes?

A That's true.

Q You also mentioned yesterday that you had a model that simulated or optimized, I'm not sure which, the life cycle cost of the center pivot sprinkler system, is that correct, or did I --

A What is does is sizes the pipe for optimized cost. It does not cost the center pivots, doesn't price them out.

Q It simply sizes what, the pipe that runs between the towers?

A Yeah. What it does is make the selection of where you change pipe size. We limit the pipe size and center pivots to two sizes generally, and it selects the point, the optimum point to change sizes.

Q Does it select the sizes as well as the change point?

A Yes. There are only three choices, there are only three sizes of pipe in center pivot design.

Q Oh, okay. What are those sizes?

A The ones we used for this study are eight-inch O.D. steel, six and five-eights inch O.D. and six-inch O.D; of those,

only eight inch O.D. and six and five-eights O.D. were used.

THE SPECIAL MASTER: What does "O.D." stand for?

THE WITNESS: Outside diameter.

Q (By Mr. Merrill) Would you explain to the Court how this model actually selects which pipe size you are going to use and how it selects the point at which you change from one size pipe to another?

A It determines the flow rate at which you have the same total annual cost for pipe and for energy required to overcome friction at that point for either eight inch or the next size down, which is six and five-eights. So anything with a greater flow rate than that is eight inch, anything with a lesser flow rate than that is six and five-eights inch.

Q In operating this model, do you have to make certain assumptions about the cost of pumps and the costs of energy or the costs of obtaining pressure in the system?

A Yes, you do.

Q What assumptions did you make with respect to pump costs and energy costs?

A Well, the fixed cost variable of the pumping plant is not used. The only cost that is used is the cost for energy, and 1979 energy costs from Riverton Valley

Electric were those rates that were used. The hours of operation that I have indicated previously in my testimony were the hours of operation used to determine pumping costs.

Q Did you price your electricity in terms of cost per kilowatt hour?

A Yes.

Q What figure did you use for that cost?

A 2.54 cents per kilowatt hour plus $7.75 per horsepower per season demand charge.

Q You got those figures from Riverton Valley Electric?

A Yes.

Q Does this model that we have been talking about, about the center pivot sizing and so forth, does it make any predictions or calculations about the life cycle or the lifetime of the sprinkler system?

A Yes, that's required as input. It doesn't make the decision.

Q Oh, that's an assumption that goes in?

A That's right.

Q Did you assume a given lifetime for all these sprinklers?

A I did. That's indicated in the appendix in my report.

Q Okay. Does the model compute or predict any other parameters of the center pivot operation?

A It calculates the head loss.

Q What is the head loss?

A The loss in pressure due to friction in the pipeline.

Q Is this a computerized model or is it something you work out by hand?

A It's computerized.

Q Did you run the model for each of the center pivot and side roll sprinklers that are shown in your conceptual irrigation development plans?

A No. It's run only for center pivots. You don't operate them on --

Q You run all center pivots, but not for those three side rolls?

A That's right.

Q Do you have the results of those runs with you?

A I do.

Q Can you share those with us?

A The results of the runs are actually tabulated in the report, I believe. Table 4 in the report, Page 15.

Q Does Table 15 (sic) show the head loss in each sprinkler system?

A No, it doesn't.

Q Do you have that information?

A Yes, I do.

Q Can you share those with us?

A Yes.

MR. ROGERS: Your Honor, we would prefer that the Witness just read these results and put them in, read them into the record as if they had been part of the table. There is a great deal of other extraneous information not requested on this same sheet, and it might be simpler that way.

MR. MERRILL: That would be fine, Your Honor.

THE WITNESS: Okay, let's begin at the bottom of the table and work up.

Q (By Mr. Merrill) We are on Table 4, Page 15 of Exhibit 13?

A Yeah. Let me check these numbers again just one more time.

Q You bet. Go right ahead.

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A. I apparently don't have them all with me. Again, it's video output and if it doesn't get recorded here it's not here. I can give it to you for the ones I have with me.

Q. Okay. Could you supply us with the balance when you get back to your office?

A. Yes, I could.

Q. Okay. Let's have the ones you have.

A. The 1620 foot system I have 35.9 feet of head loss, and the 1400 foot system, of 25.4 feet of head loss. Those are the only ones that I have.

What happened, I have the notes here from the length run on some sample sizes that was used to do some comparative cost studies. I don't have with them the notes on the remainder of the actual system designs, apparently did not get included in my book. I'll have to supply those to you.

Q Okay, that would be fine, thank you.

Do you know who developed the system or the program or the model by which you sized the center pivots?

A. I did.

Q. When was it developed?

A. '78.

Q. Have you ever used this model to size and design a center

pivot sprinkler system which was actually constructed and successfully operated?

A. Yes, I use it to design all the center pivots I designed.

THE SPECIAL MASTER: What?

THE WITNESS: I use it to design all the center pivots I design.

Q. (By Mr. Merrill) Since 1978?

A. Yes.

Q. Was it used on the 5,000 acre farm in Georgia, for example?

A. It was.

Q. Is your center pivot design system generally accepted in the engineering community?

A. It is.

Q. I take it during your professional career that you have designed a fair number of sprinkler irrigation systems; is that correct?

A. That's correct.

Q. Can you describe for the Court, based on your professional experience, the general staqes through which the system is designed; what happens first, what kind of specifications have to be drawn up and what's the next level of detail of the work; how much work has to be done before you seek funding and begin construction.

A. I'm not sure which phases you're talking about. Are you

talking about like preliminary stages of design?

Q. I don't know what phases there are, and based on your professional experience I'm wondering if you can give the Court sort of an outline of the procedures you do. I don't know how many different times you do sort of an engineering study or feasibility study or evaluation, or at what stage you develop the actual construction specifications and hand them to the guy who's going to build them.

A. A lot, of course, depends on the complexity of the job. The -- Generally speaking there would be one set of designs done at either the preliminary stage or at the feasibility stage, depending on your evaluation of the situation and how far you want to go with the first step. Occasionally a preliminary design is done where there are just some sample designs done out of the system, the major features are sort of roughed out just to determine if it's in the realm of possibility of what you want to be done.

Q. Is that what's called a preliminary design?

A. That would be preliminary or even reconnaissance.

Q. What would come after that if you decided to go ahead with the next stage?

A. Next stage would be feasibility level in which more detail

or significant -- sufficient detail would be included to accurately determine the costs of the project, to determine the feasibility of the project from a financial standpoint.

Now, there are jobs that we do that have neither of those phases. The first thing we do is the final design, it's -- If it's something that is obviously economic and they're planning on going ahead with it, then essentially what we would do is the final design.

Q. Would that be generally for a fairly simple system?

A. Usually, yes.

Q. What would come after a feasibility study? Say you had done that study and you wanted to go on with the next step, what would the next step be?

A. Well, if it's a project that you're going to let for bids, the feasibility designs may or may not be used as the actual designs, and then with the materials specifications placed to those. In the case of on-farm design such as we've done here, there is a possibility that you would use the designs as they have been done for the feasibility level.

Q Yes.

A. You may actually, in this case where we've used average conditions for intake rates, for example, you may do

a little more detailed investigation in the field to determine which systems would be what length and not just sort of what the average situation would be. The cost difference between those two approaches would be fairly minimal, but before you decide where you're going to put the pivot you'd want a little more information of what was under that machine where it was going to go. So there would be a little more detail at that level.

As far as the actual designs themselves, the level of detail that we've done in the design for the pipelines and for the center pivots would be adequate, and the only thing you would have to do beyond that then is make a list of the materials' specifications sufficient for a contractor to bid on the job.

Q. All right.

A. The same would true of the pumping plants. The pumping plants would require individual site inspection and design drawings for each of those plants based on actual site conditions rather than average conditions. Again, the costs should not be significantly different on the average.

The more major features, of course, there would be, some field surveying done to lay out and get ground measurements for all of these units, ground lengths

rather than just working off of aerial photographs. Again, depending on the type of funding you're requiring and how detailed you want the bid information to be. There are jobs that I've designed and installed without any more field information than we've had here, essentially I use the aerial photos to lay the machines out and the system was constructed off of those specifications. But, again, they tend to be smaller systems than these.

The canal routing would be surveyed, there would have to be some -- a little more detailed work done on sections at different lengths. If you're going to taper the size of the canal, we just assume it would require the full capacity and full length and the extra is used for storage. Here if you want to fine tune those costs a little bit you would do a few more sample profiles. You would do some -- You have the survey done and do profiles of the canal and cross-section at several typical sections. And again, the lists of materials or quantities of excavation and whatnot would be provided.

Q. Have you ever participated in the design of a sprinkler irrigation project for which you have to go to a bank to get funding?

A. Not that I had to go to the bank.

Q. Where your client had to go to the bank?

A. Yes.

Q. At what stage in this procedure of designing, refining, developing materials and so forth are you comfortable going to a lending institution to seek funds to build the project on behalf of your client?

A. Private lending institutions often times don't even require to see the design, all they care about is how much it's going to cost and if the fellow has enough collateral to cover the expense, and that is quite often the case.

* * * * *

Q. (By Mr. Merrill) I take it there are cases also where they want something a little more concrete?

A. Well, the only time I've designed systems for financing, for private financing, where there was any level of detail of design that needed to be seen was if there was a cost participation from the Soil Conservation Service in paying for some of the features, then the Soil Conservation Service wanted to see the main design specifications, not necessarily a bill of materials and the full detail, but essentially the feasibility level and possibly even lower.

Q. Has your design work with respect to the Big Horn Flats and Stagner Ridge Project reached the point in which you would feel comfortable in accompanying your client to a lending institution to seek funds?

MR. ROGERS: Your Honor, I don't particularly object to this line of questioning, but I would like to note for the record that I believe it's beyond the scope of direct.

THE WITNESS: Yes, I feel it's at the level that the costs would be accurate enough that we could go to -- feel comfortable going to a lending institution and securing the funds.

Q (By Mr. Merrill) What would be the total cost of constructing the Big Horn Flats and Stagner Ridge Projects, assuming that the North Crowheart Canal is already built? What

would be the bottom line cost of putting all of that in?

A. I think that was given in my direct testimony, but I can dig that out again.

The cost for Big Horn Flats would be $60,540,882. Now, the Stagner Ridge one, if the canal was already built, you would examine the free board capacity and see if you could increase flow rate by the 1.9 percent; and if you could, then you would not have to spend the $93,180 to increase capacity.

Q. Okay. Let's --

THE SPECIAL MASTER: What would Stagner's total be then?

THE WITNESS: Stagner Ridge, with that increased capacity, would be $1,383,040. And without that increase in capacity, it would be $1,289,860.

THE SPECIAL MASTER: Thank you.

Q. (By Mr. Merrill) I believe in your testimony yesterday you indicated that you had supplied Dr. Cummings with the cost information that is set forth in your report, is that correct?

A. That's correct.

Q. Have you supplied Dr. Cummings any other information for his economic analysis that is not set forth in your report?

A. Yes. As I testified yesterday, I supplied him with the

breakdown on the systems separating project costs from on-farm costs.

Q. Did you make some sort of a tabular breakdown for each area?

A. Yes, I did.

Q. Do you have a copy of that with you?

A. I believe so.

(Brief pause.

Q. Mr. Bliesner, I hand you what has been temporarily marked as RB-12. Would you identify that, please?

A. Those are two tables summarizing the -- excuse me -- one summarizing the Stetson design costs, less on-farm costs, and the second table does the same thing for the Big Horn Flats additional lands and Stagner Ridge.

Q. Thank you. You mentioned in your testimony yesterday that in certain parts of your work where you needed a discount rate you used 4 percent, is that correct?

A. That's correct.

Q. Did Dr. Cummings instruct you to use that figure in your analysis?

A. He did.

Q. Would you tell the Court what other interest rates you have assumed in the studies, feasibility studies you have made in other projects for which you have participated in the

design?

A. I'm trying to think of the -- it's continually changing as time goes on. The last design and feasibility study that I ran was ran at 12 percent.

Q. And who was your client?

A. The LDS Church, Butler Stake Farm is the location.

Q. That would be for a farm in Utah?

A. Yes.

Q. Do you recall what discount or interest rate you assumed when you designed the 5,000 acre one in Georgia?

A. That was '78. I believe it was 10 percent, but I can't be certain. It may have been 8 percent.

Q. In your work for the Superior Farm Company in Bakersfield, California, did you have to assume an interest rate in designing irrigation systems for them?

A. We did.

Q. What interest rates did you assume for the systems you designed for Superior Farms?

A. Well, again, that varied. At the time we were operating, in the neighborhood of 7 to 8 percent, if I recall correctly.

THE SPECIAL MASTER: What years were those?

THE WITNESS: That's '75 through '77.

Q. (By Mr. Merrill) I take it for your work in the Aamodt case in New Mexico that you did some design studies for

the Fort Pueblos Indians, is that correct?

A. That's correct.

Q. Did you assume a 4 percent interest rate in designing those systems?

A. No.

Q. What rate did you assume?

A. I believe it was 6 7/8 percent.

Q. Other than the study that you did for this case, have you ever designed an irrigation system assuming a discount rate of 4 percent or less than 4 percent?

A. No, I haven't.

* * * * *

Q. (By Mr. Merrill) Mr. Bliesner, do the installation costs of the on-farm systems appear in the figures in your report, Tribes' Exhibit 13?

A. They're included in the on-farm costs.

Q. Okay. Do the installation costs that you considered include the cost of an electrical distribution system from your REA supplier?

A. An analysis was done on the basis of power revenues generated for the project, and -- Wrong book.

They -- The company policy is to -- This is Riverton Valley Co-op now. The company policy, which is in line with most electrical power firms is to allow the first five years of revenue to pay for construction. The first five years of revenue would be approximately $2,676,000. That would apply to power line construction, and at the rate they gave me for construction of service lines, that would construct approximately 276 miles of service lines, somewhere in the neighborhood of five to six times as much line as we would need to construct.

Q. Okay. When you say the policy is to allow revenues to pay for the construction, does that mean that the REA revenues for the first five years are used to pay back the costs of building those lines?

A. That's correct.

THE SPECIAL MASTER: Did you note that reflection in the rates they quoted you?

THE WITNESS: Oh, certainly.

THE SPECIAL MASTER: Is that $7 on demand?

THE WITNESS: Yes, sir.

MR. MERRILL: Thank you, Your Honor, that was my next question.

Q. (By Mr. Merrill) Mr. Bliesner, did you at anytime determine the total energy requirement of the projects you designed, all of it operating at the peak irrigation requirement?

A. No, I did not.

Q. Mr. Bliesner, do the costs for your on-farm systems shown, for example on Table XIV, show the cost of fencing your exterior fields?

A. No.

Q. You mentioned in your report and also in your testimony that once corn reached a height of 4 feet you would use gated pipe to irrigate that corn.

A. No, I said I provided sufficient funds so that if some farmer elected to do that rather than irrigate with hand lines, that he could,

Q. If you were to irrigate corn with gated pipe, you'd have to have pretty level fields, wouldn't you?

A. Not necessarily.

Q. You can irrigate -- anything that can be sprinkled can be irrigated with gated pipe?

A. No, but you're only talking about a very small percentage of that land that would, it would be necessary to raise corn on. If you decided you were going to raise corn, you could find leveler places and raise corn in those cases.

Q. As part of your study, did you determine that there was sufficient acreage which would not have to be leveled to grow the corn component of the crop mix?

A. I did not. Again, I only provided that as an additional cost and did not make any assumptions whether they would use hand lines or gated pipe.

Q. On Page 11 of your report you speak of peak consumptive use of alfalfa of being .27 inches per day.

A. Um-hum.

Q. Did you compute that figure using one of the weather stations on the Reservation?

A. Burris.

Q. Burris, okay.

THE SPECIAL MASTER: Where is that quote on Page 7, please, about the middle or upper third?

THE WITNESS: The top paragraph.

MR. MERRILL: At the very top paragraph, Your Honor.

THE SPECIAL MASTER: .27 inches per day.

Q. (By Mr. Merrill) As part of your analysis of the systems designed by Stetson Engineers, did you make any evaluation or reach any opinion whether center pivot sprinklers could be used in the field designed by Dr.Mesghinna?

A. I did not.

Q. Mr. Bliesner, I hand you what's been marked for identification as Exhibit RB-1. Would you please identify that document?

A. That's the tabulation of the computer output for the mainline designs on Big Horn Flats.

Q. Would you explain what the note immediately under the title page there means? I don't understand that.

A. Okay. If you look on the table that lists mainline specifications, you have a column that says material costs, labor costs, machine costs and total costs.

Q. Uh-huh.

A. This program was written to allow you to break those out. For the study we did not necessarily break them out. There are numbers that appear in either labor or machine costs or material costs and they were just ways of modifying it, a cost table I had from'79, to get to the level that we needed for these kinds of materials. So those

columns have no specific meaning. It's not split that way.

The total cost column is the only one that has any meaning.

Q. So the total cost is right, it just wouldn't necessarily fall out the way the other columns say?

A. Yes. The machine cost, the labor cost and material cost are not necessarily broken out that way.

Q. Did you make any determination of those subcategories of the total cost?

A. No, I didn't.

Q. How did you compute then the total cost if you didn't break out these separate items?

A. Well, they were computed on the basis of material costs and installation costs, but they weren't broken out as far as labor and machine costs.

Q. How do you determine -- I've got a pretty good idea how you determined the material costs, but I'm wondering how you determined installation costs.

A. Those were from quotations of installers of pipelines.

THE SPECIAL MASTER: What does the term "well unit" refer to in these documents?

THE WITNESS: This would be pump unit in this particular case. This was originally designed to design wells and systems from wells, so the well unit title is still on

there.

THE SPECIAL MASTER: But it's inapplicable and inappropriate?

THE WITNESS: That's correct. You can substitute pump for well and then it would be accurate.

Q. (By Mr. Merrill) Mr. Bliesner, would you please turn in Exhibit RB-1 to the second from the last page, entitled "Well Unit No. BFK"?

A. Yes.

Q. I'm curious for what appears to be pipe segment or section number or something number 33. The second to the last entry at the bottom of that page before you get to the total mainline costs.

A. Yes.

Q. Is that a 72-inch pipeline?

A. No, it's 48-inch.

Q. Using that particular item as an example, would you explain to the Court how you determined the total cost of that segment to be $272,304?

A. Okay. There's a cost multiplier that goes in if you happen to have a mainline segment that's more expensive to construct than the regular mainline, that particular mainline crosses the highway, so we had to include sufficient cost for boring under the highway, setting a sleeve and running

the mainline through the sleeve. It appears to come out very close to the unit cost of 72-inches, which is purely happenstance, it's just a multiplier that's applied.

* * * * *

Q (By Mr. Merrill) I notice on the next entry down -- oh, now I see a diameter column -- that it looks like there is a one-foot section of 48-inch pipe. What is that for?

A There are a couple of requirements in this system. It was not designed originally to do gravity systems. In order to design gravity systems and have the output work, you have to put in a dummy segment of pipe and specify a head requirement at that point, and if it's expected to be a gravity system, you put in a head requirement of one foot or some very small amount, and that is located right at the turn-out location indicating that you are not requiring any pressure of the system at that point, and therefore, it won't design in a pump.

Q So that's the very last foot of the --

A Yeah.

Q -- of that 1,800 foot segment?

A Essentially. You could throw out that $76.00 cost and be just as accurate.

Q I'm going to hand you what I will mark as Exhibit RB-5, as soon as I get it marked, and ask you to identify that, please.

A That is the sketch of the system layout for the redesigned

areas of Stetson's design entitled Pumping Unit 1 and Pumping Unit 2 of the North Crowheart Unit.

THE SPECIAL MASTER: What is its purpose, Mr. Merrill?

MR. MERRILL: I was going to ask the Witness that, Your Honor. I'm not sure.

THE SPECIAL MASTER: Is it taken from the Witness' work papers?

THE WITNESS: Yes.

MR. MERRILL: Yes.

THE SPECIAL MASTER: I see.

Q (By Mr. Merrill) Do these numbers indicate various segments of pipes that are going into the network?

A They do.

Q Do these numbers key to some sort of a listing that would say for Segment NO. 16 what diameter and thickness of pipe you are using and how long the segment 16 is?

A Yes. It wouldn't be a thickness, it would be the type of pipe. In the output, that's what it would key to. In the input it would key to the information that was required to that segment as input.

Q By type of pipe, do you mean P.V.C. type 125 as opposed to type 160?

A NO, I mean it would decide whether it was P.V.C. pipe,

steel pipe or transite pipe based on its diameter.

THE SPECIAL MASTER: What project does this relate to?

THE WITNESS: This is the reanalysis of Stetson's cost.

THE SPECIAL MASTER: Oh, this is part of your reanalysis, I see. Thank you.

Q (By Mr. Merrill) Along with these schematic diagrams of the pipe networks, am I correct in assuming then that you also prepared some sort of -- or you or the computer prepared a tabular listing showing for each pipe segment what each pipe size, pipe type and length would be required?

A That's right.

Q Do you have those tabulations with you?

A I do.

Q Could you share them with us?

A Yes.

THE SPECIAL MASTER: Are they just one or two pages?

THE WITNESS: Looks like about 15, 20 pages maybe.

MR. CLEAR: Your Honor, could we take a break then?

THE SPECIAL MASTER: I thought maybe we ought to.

Have you already got them xeroxed?

MR. MERRILL: No, Your Honor. What I have is the

schematic diagram of the pipe network.

THE SPECIAL MASTER: Let's take a ten-minute break.

MR. MERRILL: Before we go off the record, could I ask Mr. Bliesner to pull the same information for all the schematic diagrams he gave us, and I'll show him which ones during the break so we can get it done at the same time?

THE SPECIAL MASTER: Yes. The Witness nodded.

THE WITNESS: I have them.

THE SPECIAL MASTER: Let's take a short break.

(Whereupon, a ten-minute recess
(was taken.

* * * * *

THE SPECIAL MASTER: We will come back to order, please.

Q (By Mr. Merrill) Mr. Bliesner, would you please identify what I've left on your table up there as Exhibit RB-6.

A That's the sketch of the redesign system layout for North Crowheart units 52, 53, and what I've called 53-A.

Q Would you please identify what's been marked for identification as RB-7?

A That's the sketch of the redesign system layout for Riverton East No. 3.

Q And RB-8?

A Sketch of the system layout for North Crowheart No. 32 --

THE SPECIAL MASTER: Redesign system?

THE WITNESS: The redesign system layout for North Crowheart No. 32, 33, 34 and 35.

Q (By Mr. Merrill) Okay. I'll now hand you what I've temporarily marked for identification as RB-13. Would you please identify that.

A That is the computer output from the mainline designs of the redesign systems that we just discussed in these four exhibits, RB-5 through RB-8.

Q As part of your system design, did you put together pipeline network diagrams similar to RB-5 through RB-8

for the Stagner diagrams similar to RB-5 through RB-8 for the Stagner Ridge and Big Horn Flats areas?

A Yes.

Q Do you have those documents with you?

A No.

Q Would you provide them to us at your convenience when you return to your office?

A Yes.

Q Thank you. Mr. Bliesner, as I understand these pipeline networks, you not only have pieces of pipe involved, but a lot of other components; is that correct?

A Oh, such as valves, fittings, that kind of thing?

Q Right.

A Yes, that's true.

Q Are all those components included in the pipe network cost?

A No, the costs from these outputs, these computer outputs were increased by five percent to handle fittings and miscellaneous valves, and the riser outlets are included in the on-farm system cost.

Q I'm going to read you a list of components or features that are commonly included in pipeline systems, and after I list each item I'd like you to tell me whether or not it's included in the five percent figure or you

accounted for it in some other ways.

I presume valves are included?

A Well, the valves, the major control valves are included with the pumping plant cost.

Q Okay.

A Okay. There may be some isolation valves that branches in the system that would be included in the five percent figure.

Q Okay. How about blowout valves?

A Yes, that's included.

Q Air vacuum valves?

A Yes.

Q Thrust blocks?

A Yes.

Q Meters?

A No, that's included in the pumping plant.

Q How about excavation costs?

A It's included in the mainline cost.

Q Embankment costs?

A I don't -- I don't understand that term in relationship to pipeline installation.

Q Okay. Anyplace where you've got a line barrier you would have to have an embankment to divert water or cover so it didn't wash down the line excavation. Do

have --

THE SPECIAL MASTER: Embankment costs?

MR. MERRILL: Yes, Your Honor.

THE WITNESS: These are all flushly graded lines. In other words, there is no spoil bank left after the installation.

Q (By Mr. Merrill) Okay. Do your figures include cost for testing the pipelines?

A That is part of the installation cost.

Q How about cost for road crossings?

A No, there is no specific requirement for, for road crossings on most of these lines with depth to cover that we're using.

Q How about canal crossings?

A None of them cross the canal.

Q All right. Do any of them cross washes or natural drainages where you'd have a --

A If any of them did there was a cost multiplier included in that segment on the mainline.

THE SPECIAL MASTER: Some cross each other, is that just a case of looping under and over?

THE WITNESS: Yes. One would be, just be buried deeper through that section.

Q (By Mr. Merrill) How about saddles and pinnings on

steep slopes?

A The -- Most of the slopes on these mainline segments are not that steep but what they would be laid without saddles and pinnings.

Q How about the mainline for Big Horn Flats up through Lily Pond?

A Yes, in addition to that cost the unit cost shown, there are stretches of steeper slopes that had an increase in cost of $50 per foot to handle extra installation costs on steep slopes.

Q Is that line going to be buried on the steep slope?

A Yes, it is.

Q As I look at the diagram of the Big Horn Flats mainline from Lily Pond up to the flatlands, it looks like it crosses some very steep areas. Does that $50 per foot cover all the special problems in installing the line on a steep slope?

A That's additional installation cost. Just the standard installation cost for burying that line under reasonable normal terrain for agricultural conditions is included in the pipeline cost and the $50 per foot cost for those steeper locations is considered sufficient.

* * * * *

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Q. (By Mr. Merrill) Did you include in your pipe costs any of the costs of reclamation of ground disturbed to bury the pipeline?

A. No.

Q. With respect to the main canal, which I understand to be a dead level canal running across Big Horn Flats, would you please describe to the Court what the canal looks like with respect to its bottom width, the side slope, the water depth and the amount of free board?

THE SPECIAL MASTER: Amount of what?

MR. MERRILL: Free board, Your Honor.

THE SPECIAL MASTER: Free board is the distance from the top of the water to the edge?

MR. MERRILL: I believe so.

THE WITNESS: The canal has a bottom width of six feet, side slope of one to two, the maximum normal depth is 6.4 feet, and the total depth is eight feet.

Q. (By Mr. Merrill) Is that canal going to be fenced off?

A. Yes.

Q. What unit price did you use for fencing?

A. The same as used by Stetson, I believe 65 cents per foot.

Q. I take it that canal is lined with some sort of plastic membrane?

A. That's correct, PVC.

Q. What unit cost did you use for the PVC lining?

A. Ten dollars per square foot.

Q. Will the canal have any sort of crossings or bridges so you can get from one side to the other?

A. No, not in that length.

Q. What excavation cost did you use for digging the canal?

A. The same as Stetson, a $1.06 per yard for excavation.

Q. What unit cost did you use for embankment compaction?

A. A $1.06 per yard.

Q. With respect to the lily pond area, did you do any special designs of the diversion works to get the water into lily pond so these nine main pumps can pick it up?

A. Well, again, the diversion dam itself was not designed and costed. We compared the features that would be required here to those at Riverton east and South Crowheart from the Stetson design, and the conditions were similar, so the cost for those -- for that diversion dam was used.

Q. As I understand it, you have nine pumps hopefully on the side of as opposed to the middle of lily pond to pump the water up this main pipeline into the canal to Big Horn Flats, is that correct?

A. That's correct.

Q. Are any of the nine pumps standby pumps, or are you going

to need all nine of them to run during peak demand?

A. Well, the nine pumps are sufficient to supply the full Big Horn Flats in alfalfa. In other words, it would meet the peak demand in alfalfa, so that essentially gives you a standby pump.

THE SPECIAL MASTER: Can I have that run by me again?

THE WITNESS: Well, if you are operating with the average crop mix that is indicated and for which the diversion requirement was calculated, the delivery capacity will be somewhat less than if the full thing is in alfalfa. However, it is designed so it can supply the full flow rate as if it was all in alfalfa, so that in effect gives you the extra capacity that you need.

Q. I notice that on page 6 of your report you have a description of the design specifications for the Big Horn Flats main pumping plant.

A. Uh-huh.

Q. And I really wondered how you can have nine 1,000 horsepower pumps and come up with 950,000 horsepower? I'm sure there's some engineering concept in there. Can you explain?

A. Electric motors have a nameplate horsepower, and then they have a service factor applied. They can be loaded --

they can supply horsepower up to the service factor that's included on the motor times the nameplate horsepower. The nine pumps -- essentially what this amounts to, there are slightly over a 1,005 horsepower per pump of demand, so the total horsepower is motor demand, not line demand, that's motor output essentially rather than input. There's another efficiency number. The input would be slightly higher than that.

Q. So you are really getting more than a thousand horsepower out of each of your pumps?

A. That's right.

Q. In designing your pumping plants, including the main ones, as I understand it you are going to have a shade structure over the plant?

A. That's correct.

Q. And that is one of the factors that reduces the cost of your redesigned pumping plants from those designed by Dr. Mesghinna?

A. That's true.

Q. Did you make any modifications to the useful life of the pumps or the motors or the electrical controlling equipment, the communications equipment other than that assumed by Dr. Mesghinna?

A. I don't believe so.

Q. Did you, in computing the operation and maintenance charges for the pumping plants, take into account that the plants are going to be sitting out in the open?

MR. SACHSE: Objection, Your Honor, just on this ground, that this whole line of questioning was covered yesterday, which Dr. Bliesner testified that you actually have a little less in the way of operation and maintenance problems with an open plant. The whole thing was gone into, questions asked.

THE SPECIAL MASTER: It was.

MR. MERRILL: I will withdraw the question, Your Honor.

THE SPECIAL MASTER: But he was only pursuing it, and there's some degree of latitude in doing it, but he has withdrawn the question.

Q. (By Mr. Merrill) Mr. Bliesner, you testified yesterday that in your experience in Bakersfield, California, you didn't even use shade structures over the pumps, is that correct?

A. That's correct.

Q. Isn't the winter climate conditions in Bakersfield, California a little different than in the Wind River Reservation of Wyoming?

A. It is, but so is the summer condition different.

The summer heat conditions are actually more severe on pumping plant maintenance than winter conditions, and actually the winter conditions there for motor maintenance are a problem, too, because it's foggy very much of the winter so the humidity is high and you can get breakdowns in the motors, in the insulation of the motors from the moisture being in them.

Q. Do your cost figures for the Big Horn Flats area include the cost of the communications equipment to go from this liquid level control at the entry point into the main canal back down to the pumping station?

A. It does.

Q. Did you assign any costs to the wasteways?

A. I did.

Q. Where are those costs included?

A. They are included within the canal cost.

THE SPECIAL MASTER: There's only one wasteway, isn't there?

THE WITNESS: The wasteway, yes.

MR. MERRILL: I'm sorry.

Q. (By Mr. Merrill) When you developed your costs for these various components, did you use actual 1979 prices quoted to you, or did you use current prices and index them back to 1979?

A. It depends on the component. Most of the component prices are 1979 quoted prices. The numbers that are used from Stetson, I'm not sure how those were derived, so all I know is they were for 1979.

* * * * *

Q (By Mr. Merrill) I take it you had some costs in 1980 or '81 or other year dollars for some of the components?

A The price that I received from the Riverton Reclamation office on the P.C.V. lining was a bid price from 1980, and I did not make any adjustment to that price.

Q With that exception, were the rest of your prices either developed in 1979 dollars or taken from the Stetson work?

A I believe they were.

Q Do your operation and maintenance charges include cost for the maintenance and management team, the personnel who will actually go around and take care of all of these systems?

A Yes, they would, although they're not calculated on that basis and -- In other words, I didn't take the approach that, that Dr. Mesghinna did in deciding how many people you would have working and work up the cost from that end. Rather I used percentages of capital costs or dollars per horsepower on pump maintenance based on experience.

Q Okay.

A But those would include the labor cost of performing maintenance.

Q Would that also include costs of motor graders,

bulldozers, of the heavy equipment that you would need to maintain the project?

A Whatever maintenance equipment that would be required would be included.

Q Does that include storage buildings and repair shops?

A There is a lump sum figure included in the pump cost for storage facilities.

Q What's that figure?

A Well, the figure is for parking lots, storage shed and miscellaneous site prep, and it's a lump some of $50,000.

Q Okay.

A And there wasn't specifications for the size of the shed or anything, it's just a number there so you got some funds that you can do something with.

Q Okay. On these main pumping stations, do you have to have some sort of permanently installed rack overhead so that you can get a crane in and lift the motor windings out?

A No. We have access to them, to use a portable crane.

Q So you'd bring in a temporary machine to do that.

On the Stagner Ridge Project, as I understand it, you accounted for the additional water demands in the Stagner Ridge area by beefing up Dr. Mesghinna's pump

Station No. 3; is that correct?

A That's correct.

Q What additional horsepower would be required at Dr. Mesghinna's Pump Station No. 3?

(Brief pause.

A Increases the horsepower of that plant by 225 horsepower.

Q Thank you. Mr. Bliesner, I hand you what's been marked for identification as RB-2. Would you please identify that document.

A That's the computer output for the pumping cost estimates for Big Horn Flats.

Q Is this material that you supplied to us prior to trial?

A It is.

Q Okay. I'd like to turn now for a moment to the water supply study that you performed, the results of which are described in Tribes' Exhibit 14.

I take it that you performed your water supply study in cooperation with Mr. Billstein; is that correct?

A I did.

Q During this work with Mr. Billstein, did you take his computer model and actually input these additional Tribal diversions into it and rerun it?

A No.

THE SPECIAL MASTER: What did you do?

THE WITNESS: I took his computer output from his model run and then applied these extra diversions and return flows by hand to those nodal points that, that were affected.

Q (By Mr. Merrill) A lot of calculated work.

A Fair amount.

Q What was the date of the HKM computer run that you used in developing your water supply study?

A June 15, 1981.

Q Is that the only run of the HKM model that you used?

A It is.

Q In adding in the diversions for the Big Horn Flats and Stagner Ridge areas as well as the lands described by Mr. Higginson, those which you studied in this part of your work, did you distribute the monthly diversion requirements in the same proportion as the percentage of consumptive use distributed?

A Initially that's true. If you recall my testimony yesterday, there were changes in the operation study made to some control points on the Dinwoody Bench area in which the diversions were not taken in the months of consumptive use because of shortages in those months.

Q With that exception, do the rest of your schedules of

diversions follow the monthly consumptive use percentages?

A They do.

Q Okay. With respect to the distribution of return flows, did you make your own independent analysis of how the return flows would be distributed or did you adopt HKM's assumptions?

A Do you mean spacially distributed or distributed in time?

Q Let's start with spacial.

A Spacial distribution followed the same general assumptions, but since Big Horn Flats was, the additional lands on Big Horn Flats was not included in their analysis, then the spacail distribution of that return flow was done on the basis of the topographic conditions and estimates of how the flow would return. Other than that the return flows pretty much followed the, the schematic of the operation study, in that the return flow was taken at the same node. It was in the Billstein study for the same diversion node. In other words, if we diverted at Control Point 8 and -- this would be for fee land, if we had a fee land conversion at Control Point 8 then the return flow went back in at Control Point 24, as the Billstein study.

Q Okay. Did you adopt HKM's assumptions with respect to

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the temporal distributions of return flows?

A Yes.

Q I direct your attention to Page 9 of your water supply study, Tribes' Exhibit No. 14, to the first paragraph at the top of Page 9. You talked, I believe you and Mr. Radosevich talked yesterday afternoon about what a manageable shortage means and I'm still not clear on your definition of a manageable shortage. Are you saying that it's a manageable shortage because you're still going to get the amount of water ultimately to the crop that it requires for normal growth and development?

A Yes. What manageable shortage means to me is that you can manage the irrigation system in such a way that there will be no shortages to the crops.

Q Does that have to do with your description yesterday afternoon of using soil as a little water bank, if you will, to store moisture during some of the time?

A That's one method of managing shortages. The other is to improve irrigation efficiency, which is a very common thing done in areas that receive shortages. For example, in Bakersfield in '77, Superior Farming Company on about 20,000 acres of their land experienced an annual average shortage of about 30 percent of their water supply.

Fifteen percent of that was made up by extra pumping plants -- extra pumpage from wells, essentially, to mix with the groundwater. The other 15 percent was, was eliminated by improvement in the on-farm efficiency.

* * * * *

Q. (By Mr. Merrill) Would there be any special costs associated with improving irrigation efficiencies in the ways you have described?

A. There wasn't in that year at Superior. The farmers just knew they were short on water, so they were more careful how they handled it. That is specifically true in surface irrigation systems. It is not true to the same degree in sprinkler systems because the efficiency is more a function of the system than how it's managed. But there is a large amount of surface irrigation in that Dinwoody Bench area, and looking at the efficiency numbers in that bench area, there would probably be room for improvement in dry years.

Q. When you use the soil moisture holding capacity as one of your methods to manage a water shortage in the areas in which you contemplate doing that, how much soil moisture capacity do you need to manage the shortages in the way you described yesterday afternoon?

A. One inch soil moisture holding capacity would eliminate the problem.

Q. Do the soils in these irrigation projects all have one inch of soil moisture holding capacity?

A. Yes. I don't believe you would have an agricultural soil in the 4-foot profile, in the case of alfalfa in the 6-foot profile, that wouldn't have at least one inch of

holding capacity.

Q. As part of your study of the water supply for irrigation, did you consider the demands on the water supply for the maintenance of the minimum stream flows for fisheries or aesthetic purposes?

A. No.

Q. Did you consider any demands on the water supply for other federal non-Indian purposes within the Wind River Indian Reservation?

A. No. Not unless they were originally included in the Billstein study. I did not make any additional assumptions that he didn't make for these.

Q. In the second paragraph on Page 9 of your water supply study you make the statement that any excess flows were then routed from Control Point 22 to Control Point 13. Would you please define "excess flows" as you used that term in that sentence?

A. Flows that were in excess of the diversion requirements at the last diversion point.

Q. How did you select the diversion point for the Indian-owned fee lands testified to by Mr. Higginson?

A. I believe I testified to that yesterday, but basically in conference with Mr. Higginson and by using his tract location map and his Appendix Table C that lists the

tracts by acreage and by diversion quantity. We took those tract locations from the maps, placed them within the system and determined where a logical diversion point would be. We did not necessarily go through the routing of ditches and that type of thing, so they are approximate in nature.

Q. In doing that work did you identify the locations of these diversion points either on a map or by legal description?

A. No. We identified it only by control point or a model analysis.

Q. Okay. Can you identify them for me by control point?

A. For each tract you want this or by control points they were taken out?

Q. Well, what I would like to get is some idea of how much water you are taking out at whatever locations of the stream you selected for the Indian-owned fee lands.

MR. ROGERS: I'm sorry, Your Honor. Could I have that question read back?

THE SPECIAL MASTER: Yes. Mary?

(Whereupon the reporter read
(back: "Q.: Well, what I would
(like to get is some idea of
(how much water you are taking
(out at whatever locations of
(the stream you selected for the
(Indian-owned fee lands."

MR. ROGERS: Thank you.

(Brief pause.

THE WITNESS: Okay, I can give this to you by total acre-feet at control point, if you would like it done that way.

Q. (By Mr. Merrill) That would be fine.

A. Okay. Control Point No. 1, 453; Control Point No. 2, 637 acre-feet; Control Point No. 8, 6337 acre-feet; Control Point 17, 789 acre-feet; Control Point 22, 1155 acre-feet; Control Point 4, 5,823 acre-feet; Control Point 7, 2,795 acre-feet; Control Point 29, 996 acre-feet; Control Point 32, 11,801 acre-feet; Control Point 34, 1,382 acre-feet; and Control Point 35, 2,141 acre-feet.

THE SPECIAL MASTER: If the total acre-footage you just read exceeds twenty-four thousand nine hundred something, what is that attibuted to, or does it not? It's supposed to come to that, isn't it? That's the total requirements?

THE WITNESS: I assume it's going to be something.

Is that the total diversion quantity out of the --

MR. ROGERS: I think Your Honor may be --

THE SPECIAL MASTER: Confused? That's quite probable.

MR. ROGERS: I'm not sure how this breaks down myself. Mr. Higginson testified as to the Indian fee land requirement which was the total of -- which was 45,000 acre-feet.

THE SPECIAL MASTER: Yes.

MR. ROGERS: Some of which was from the Little Wind system. I'm not sure how much of that was attributed to the Big Wind system. Your Honor's question mentioned 25,000 acre-feet, which I think you may be thinking of the two projects.

THE SPECIAL MASTER: I thought the question was based upon the two projects and where the --

MR. MERRILL: No, Your Honor, the question was based on the Indian-owned fee lands --

THE SPECIAL MASTER: I beg your pardon. I was confused, and I'm no longer confused for the moment.

MR. MERRILL: I'm sorry. Maybe I should have made it two questions.

Q (By Mr.Merrill) Mr. Bliesner, I hand you what has been marked for identification as Exhibit RB-3. Will you please identify that?

A. It says, "Drainage Pipe Sizing Procedure, Wind River Indian Reservation Irrigation Project".

Q. Did you use this procedure as part of your design work?

A. I didn't do the drainage design work.

Q. Do you know if this document was used during the drainage work that you did in collaboration with Dr. Wilardson?

A. You will have to ask Dr. Willardson that question.

Q. Okay. Have you seen that document before?

A. I believe I have, yes.

Q. In conjunction with your work on this case?

A. Yes. I think in the process of Dr. Willardson's preparation of that document I have seen it, but I have seen a lot of things and I can't be absolutely certain.

* * * * *

Q (By Mr. Merrill) We'll ask him when the time comes.

I hand you what's been marked as Exhibit RB-4. Would you please identify that.

A Cost projection for 12-inch drains, Wind River Indian Reservation Irrigation Project.

Q Is this your work?

A No, it's not.

Q Have you seen it before?

A I have.

Q As part of the work on this case?

A Yes.

Q Thank you.

(Brief pause.

Q Mr. Bliesner, did you develop pumping plant cost estimates for Stagner Ridge in a format similar to that shown on Exhibit RB-2?

A I did.

Q Do you have those with you?

A I do.

Q Can you share those with us?

A Yes.

(Brief pause.

Q Mr. Bliesner, I'll hand you back what you just handed me. I've temporarily marked it as Exhibit RB-14. Would you

identify that for the record.

A That's the pumping plant cost estimates for North Crowheart Pumping Plant No. 3, before and after the addition of Stagner Ridge and the cost estimate for the booster pump for Stagner Ridge.

Q Thank you.

MR. MERRILL: Your Honor, I'd request the Court's permission to withdraw RB-14 and make copies for the Court and Counsel.

THE SPECIAL MASTER: Very good.

MR. MERRILL: And it will be handed back and marked with the same exhibit number.

Your Honor, that concludes my cross-examination of Mr. Bliesner. I would like to reserve the right to reserve any cross-examination which may develop as a result of information that he's going to supply us but we haven't gotten yet. I would anticipate --

THE SPECIAL MASTER: That's duly noted.

MR. MERRILL: I would anticipate that it would happen at some later time, should that become necessary.

I will go ahead and make my objections if the Court wishes, to Exhibits 13 and 14, if you want them now or I can wait until Mr. Rogers concludes his redirect and we do our recross.

THE SPECIAL MASTER: Give me just a minute to -- Mr. Rogers --

MR. ROGERS: We have no redirect, Your Honor.

THE SPECIAL MASTER: You have no redirect.

Why don't you make those objections now to 13 and 14.

MR. MERRILL: Certainly, I will, Your Honor.

THE SPECIAL MASTER: I'll listen to them.

MR. MERRILL: Your Honor, my objections to Tribes' Exhibit 13 are sort of addressed at separate areas of the report since as you're aware, the report includes the results of several different inquiries.

THE SPECIAL MASTER: Sure.

MR. MERRILL: With respect to that part of the report devoted to a review of the irrigation systems design by Stetson Engineers, my principal objection to the introduction of that document into evidence, which I assume is offered for the truth of its contents.

MR. ROGERS: Yes.

MR. MERRILL: Is that the document has no probative value. It's based on a very quick review of only 10 percent of the irrigation systems designed by Stetson Engineers, and includes redesigned cost for certain areas of the systems such as the Arapahoe and South Crowheart Units, which Mr. Bliesner has admitted on cross-examination he didn't even examine at all.

And so my principal objection to the portion of Tribes' Exhibit 13, devoted to the review of the Stetson work, is that the document is based on so little factual inquiry as to not have any probative value.

My objection to the portion of Tribes' Exhibit 13 devoted to designing irrigation systems for the Stagner Ridge and Big Horn Flats areas, are that the document is speculative in that it is not based on any actual design that would be sufficient to carry these projects through construction, and that it is based on certain programs and models --

THE SPECIAL MASTER: What basis for your assertion is there that this is not, this could not be the basic material to carry a program through to construction? It might have to have some more design specifications after these, but what is your basis for that?

MR. MERRILL: Exactly that, that there hasn't been enough work done.

THE SPECIAL MASTER: Oh.

MR. MERRILL: To develop full materials lists and come up with actual construction specifications.

I would further object on the grounds that it's based on the use of certain techniques such as the irrigation spraying machine developed by the graduate student at the Utah State University this spring, which

is a brand new device, it's the subject of a thesis that was just published and accepted, I believe, in partial fulfillment for a Master's or Doctoral Degree. It's been out so long that it hasn't even had time to be generally accepted within the engineering profession, this particular device that was used, and furthermore that person who developed this brand new device was not on the sites where the infiltration tests were conducted to insure that it was properly used. And the objection to the use of that device then prevades the rest of the analysis that was done by Mr. Bliesner because everything comes after that; the sprinkler systems and the water requirements and everything else were based on the use of that model. Furthermore, there is testimony now that although Mr. Bliesner thinks he conducted those tests, those deponding tests at representative locations, he admitted he did not texture the soils at the location where he conducted the infiltration tests, and furthermore, he admitted on cross-examination that the results of the infiltration tests vary in some cases by almost as much as 100 percent, and therefore, his testimony yesterday with respect to his confidence in the results of those tests being within ten percent of one another is in conflict with what he admitted on cross-examination. And those tests

again, are sort of the foundation of the entire irrigation system that was designed, that affects the water requirements and also effects the costs.

That concludes my objections to Tribes' Exhibit No. 13.

With respect to Exhibit 14, I would object to the introduction of Page 2 into evidence, first based on the five-day rule. I was handed a copy of a corrected Page 2 on Monday of this week, that's two days earlier than today, and that corrected copy varies from the information that we were given last week.

I would also object to Tribes' Exhibit No. 14 generally on the grounds that it incorporated a great deal of work that was not performed by Mr. Bliesner but was certainly used straight out of the Stetson's analysis. There is no foundation for the results and professional opinions that are contained within the report because Mr. Bliesner is not a hydrologist, he's not qualified to do the type of work that he performed in this analysis.

I would object on the ground that the water supply study is not realistic because it does not consider all the demands on the river system. I'm speaking specifically of the fisheries flows that have been claimed by the Tribes. I'm also speaking of other diversion requirements

claimed by the Federal Government for uses within the Wind River Indian Reservation; that the document does not consider any of the other water rights involved in this adjudication.

And based on all of those objections, I would object to the introduction of Tribes' Exhibit 14. I believe that at the conclusion of his cross-examination of Dr. Willardson, Mr. White may have further objections addressed specifically to the portion of Tribes' Exhibit 13 concerning --

THE SPECIAL MASTER: Mr. who? -- Oh, Mr. Michael White.

MR. MERRILL: Yes, Your Honor.

THE SPECIAL MASTER: Should I wait for those before ruling on 14?

MR. MERRILL: Probably only 13, Your Honor. I don't think Mr. White will have any objections to 14 unless Dr. Willardson testifies--

THE SPECIAL MASTER: I would like to do that, I think I'm going to make these conclusions on your arguments if you are finished, Mr. --

MR. MERRILL: I am, Your Honor, except I just realized that Mr. Rogers also offered into evidence Tribes' Exhibit 13-1, -2 and -3, which are the conceptual irrigation plans developed by Mr. Bliesner for the

Big Horn Flats and Stagner Ridge areas, and I would incorporate my objections of Tribes' Exhibits 13 into the admission of those documents into evidence, and I believe that covers it all.

THE SPECIAL MASTER: You do not object to the professional resume?

MR. MERRILL: No, Your Honor, I don't. I'm impressed by the professional resume.

THE SPECIAL MASTER: All right.

MR. ROGERS: Your Honor, may I respond to these?

THE SPECIAL MASTER: Yes, Mr. Rogers, you may.

* * * * *

MR. ROGERS: I assume that in the first instance -- well, let's clarify one thing. You are making no objections to any of the other exhibits we have offered --

MR. MERRILL: Well, I would object to --

MR. ROGERS: -- I would assume?

MR. MERRILL: I would incorporate my objections as to the ones that are taped together or are simply duplicative of items contained in the report. And I believe you said Tribes' Exhibit 17 was offered for illustrative purposes only, and I have no objection to that.

MR. ROGERS: Well, 17 -- 17, 16 -- where are we? 16, 17 and 18 are all offered for illustrative purposes.

MR. MERRILL: I have no objections to those, Your Honor.

MR. ROGERS: Your Honor, --

THE SPECIAL MASTER: Mr. Rogers, I have seen this done by others on other courts, so I'm going to take the liberty of doing that and I ask you to abstain from your arguments because I have strong convictions about ruling on these two motions to deny admission to the exhibits, and I would like to get to them at my distress, and I don't think any objections --

MR. ROGERS: The only thing is, Your Honor, with respect to 13, and I appreciate Mr. Merrill bringing up what he did at this point, we, of course, have not formally

moved 13 in yet because of the portion of it that relates to what Dr. Willardson has testified to. We had requested a voir dire relating to that exhibit that involved Mr. Bliesner being done at this time, and that's what Mr. Merrill has done.

THE SPECIAL MASTER: I will abstain from ruling on the admission of 13 at this time.

MR. ROGERS: At some point, if it's necessary, I would like to comment on what he has stated about it.

THE SPECIAL MASTER: 14 then I can rule on now, if you wish, and I will do so if you are ready.

MR. ROGERS: All right, I will sit down.

THE SPECIAL MASTER: All right. I believe I said earlier yesterday that regarding this witness's testimony on streamflow for irrigation that there's an inevitable overlapping of the science, of the diciplines, one into the other, and it is sufficient I think on the basis to permit the introduction of 14. It is true with 14, as well as 13, and I hope I can marshall my thinking a little more accurately when we get through the reasons for 13, because I respect the objection raised to that, Mr. Merrill, and I want to respond to them point by point.

It is true 13 has no probative value, but when it's all said and done, the person to judge that is me, and in order to be able to judge, I have to have them both in

front of me. I must have the affirmative reasons that the Bliesner professional opinion is that these are doable, workable projects, and I must balance that with professional objective reasons by the Stetson Engineers why they were ommitted, and then I have to make my judgment, and if I don't have 13 in the record, I get a top-heavy situation. So I think I have to admit both of them, and I will hold off on 13 until I hear Mr. White's objections to it. The "Estimates of the Effect on Streamflow from Irrigation of Additional Trust Lands on Big Horn Flats and Stagner Ridge, Wind River Indian Reservation, Wyoming," is hereby admitted into evidence.

12 is already in evidence, Tribes' Exhibit Number 12. 13 is in abeyance -- oh, 13-1 and 13-2.

MR. ROGERS: And 13-3.

THE SPECIAL MASTER: And 13-3 are already a component part of 13, so they will await any disposition on 13.

MR. ROGERS: No, Your Honor. I don't think we can wait on those.

THE SPECIAL MASTER: Then they are admitted into evidence.

MR. ROGERS: Your Honor, may I also request just when we are fresh on the objections just made, if Your

Honor is prepared to rule on the objections made to 13, in allowing Mr. White to make additional objections after he's examined Dr. Willardson, if you are prepared to rule on the objections to 13 so far stated it might be good to get those into the record at this point, deferring any additional objections that Mr. White may have to make.

THE SPECIAL MASTER: I don't want to admit it into evidence at this point.

MR. ROGERS: No, that's right.

THE SPECIAL MASTER: Why don't we hold off. They weren't all that much different from 14, one being that who am I to say that this can have so little probative value when the engineering firms have their origins in the same institution of higher learning, when the men involved have known each other or known of each other for many years, when the systems have a remarkable similarity as to analysis first, diversion from a main source, irrigation system in that 7.6 that Dr. Mesghinna went through on the blackboard for us to begin the project, which is not much different than from what this gentleman, Mr. Bliesner, used. I think I have to have 13 in evidence, even though I may make the conclusion its probative value is somewhat less or I reject certain portions of it and observe portions of it, I don't know.

MR. ROGERS: I appreciate the Master saying that. There were a couple misstatements in the objections about the facts of the matter, and if necessary, I wanted to correct those, but in view of what the Master said, I won't make any further comment.

THE SPECIAL MASTER: There's an adversarial position between the United States and the position of yours,I'm beginning to see, and I'm going to have to decide what to do about it.

Now, we have a set of Tribes' Exhibits 15, 16, 17 and 18, and any of these three?

MR. ROGERS: That's all, Your Honor.

THE SPECIAL MASTER: Let me see your list. Yeah, 15 is a composite map of the two that have already been introduced. 16 is a large scale drawing of figures on page 10 of Exhibit 13. 17 is a center pivot operation simulation, shows that overlap. 18 is another illustrative--these are all for illustration, illustrative purposes only.

MR. ROGERS: Those three, Your Honor, yes.

THE SPECIAL MASTER: They are, and the same are hereby admitted into evidence.

MR. ROGERS: 15 was also admitted, I believe, is that correct?

THE SPECIAL MASTER: That is correct.

MR. ROGERS: All it is is a composite of 13-1 and 13-2.

THE SPECIAL MASTER: That is right.

MR. MERRILL: Your Honor, during the course of my cross-examination I had marked and had the witness identify a variety of exhibits. Since they are now all part of the record, I will not offer them into evidence, but if he would like, for purposes of Mr. Salazar's notes, we can go through them and attach some sort of identification to them, and if you would prefer not to, since I'm not moving their admission into evidence, we can skip it.

THE SPECIAL MASTER: Are they Plaintiff's Exhibits RB-1 through RB-10?

MR. MERRILL: Your Honor, I believe they go through 13, with a few skips and jumps.

THE SPECIAL MASTER: Okay, we will skip them.

MR. MERRILL: That is all I have, Your Honor.

THE SPECIAL MASTER: No redirect, and the United States desires no further questions.

Mr. Bliesner, will you hold yourself available to stay under oath and remain available for further testifying in these proceedings?

THE WITNESS: Yes, I will. Thank you.

THE SPECIAL MASTER: Okay. Thank you very much.

THE SPECIAL MASTER: Let's come to order. Did you decide not to use this wall, and you're going to use the wall --

MR. SACHSE: We're going to use that wall (indicating).

THE SPECIAL MASTER: You're going to use the east wall. All right.

(Off-the-record discussion.

THE SPECIAL MASTER: Go ahead, Mr. White.

MR. WHITE: Well, I was just going to say while we're waiting for a moment, I thought I would indicate while I'm absolutely -- well, I'm not absolutely sure as the initial order of the witnesses in the State's case in chief, I can advise the Court and other counsel at this time of two alternatives, one of which I will follow and either of which I would hope the Tribes and the United States could be prepared for. The most likely alternative is to start with Mr. Sinning, followed by Mr. Keith.

THE SPECIAL MASTER: Followed by Mr. who?

MR. WHITE: Keith, followed by Dr. Martin. The other alternative which I'm looking at now and really depends on how our work progresses in August, we'll start with Mr. Rice, followed by Mr. Christopulos, followed by Mr. Fassett, all for the general purposes which were outlined in our letter of endorsement.

THE SPECIAL MASTER: Thank you. Mr. Sachse.

MR. SACHSE: Yes, our next witness is Lyman Willardson.

THE SPECIAL MASTER: All right. Dr. Willardson, will you be kind enough to stand up and take an oath.

LYMAN S. WILLARDSON

having been first duly sworn, was examined and testified as follows, to wit:

DIRECT EXAMINATION

BY MR. SACHSE:

Q. Dr. Willardson, would you give the Court your full name and your address?

A. Lyman Sessions Willardson, 146 North 5th, West Logan, Utah.

Q. What is your current occupation, Dr. Willardson?

A. I'm a professor of agricultural and irrigation engineering at Utah State University.

Q. You also do consulting work?

A. Yes, I do.

Q. I want to start with your educational background. Would you give the Court the various degrees that you've obtained and where they're from?

A. I have a Bachelor's Degree in civil engineering from Utah State University with a specialization in irrigation and drainage; a Master's Degree in civil engineering from Utah State University and Ph.D. Degree in agricultural engineering from Ohio State University.

Q. Now, I want to go into your work history a little bit so the Court will have some idea of your experience in the field.

I understand that you got your Bachelor's Degree in 1950. What did you do in the way of employment immediately after that?

A. Well, while I was getting my Bachelor's Degree I worked for the U.S. Bureau of Reclamation and Soil Conservation Service as an engineer-trainee and also as an engineer, and immediately upon graduation I entered into a Master's Degree program and I completed all the course work and research work, took all my examinations and then, without completing the degree, took a job with United Fruit Company as an irrigation engineer in the Dominican Republic. I worked there in farm development for a year and then they transferred me to Honduras in Central America, and I worked there in irrigation system installation and farm development for approximately a year, at which time I was hired by the University of Puerto Rico in their Agricultural Experiment Station system in the Lajas Valley. That was 25,000 acres on the south coast of Puerto Rico that was having drainage problems, and they hired an irrigation engineer to do irrigation research and to develop an analysis system for drainage problems in that

irrigation project.

Q. In what year did you get your Master's Degree?

A. In 1955 while I was working. I was also working on the thesis and I completed the work during that time and graduated in abstentia.

Q. What did you do after you got your degree in 1955?

A. I continued with the Agricultural Experiment Station in Puerto Rico until 1957, at which time I was hired by the U.S. Department of Agriculture as a research agricultural engineer and was stationed at Utah State University in the Department of Agricultural Engineering.

Q How long were you there at that time?

A. I was there for eight years. And then I received a training grant and went to Ohio State University on a government training grant for nine months and they left me there then to do research until I completed a Ph.D. Degree.

Q What was the subject of your Ph.D. Degree?

A. Engineering losses for water entering a partially full drain.

Q. Now, after you got your doctorate, what did you do then?

A. The U.S. Department of Agriculture transferred me to the Imperial Valley of California where I stayed for seven years doing research in irrigation and drainage. We conducted some extensive field drainage experiments there,

and I worked with the drainage contractors in the Soil Conservation Service, people doing drainage in that area.

Q. How did you happen to leave the Department of Agriculture?

A. Utah State University offered me a position as a full tenured professor, and it had been our desire to return to Logan, having been there to school and lived there for some time. In addition, I had gained considerable experience that I thought would be valuable to students, so I took the position for that reason.

Q. And that was in 1974?

A. That was in 1974.

Q. What would have been the nature of the courses that you've taught since 1974 at Utah State?

A. I teach there only the drainage courses, in addition, a seminar. A seminar has various subjects, but my principal assignment is research in teaching -- or in drainage.

Q. Since you've been at Utah State, I take it you've had some consulting assignments as well?

A. Yes, I've had a number of consulting assignments in various parts of the world.

Q. Would you first describe a few of your -- well, first, it might be helpful if you just list some of the foreign countries in which you've consulted on drainage problems.

A. Well, I've been to Guatemala, Honduras, Peru, Equador,

Syria, Pakistan, and I've consulted on a drainage problem in Saudi Arabia but I did not go there.

Q. What have been some of your major consulting assignments in the United States?

A. There was one consulting assignment with a New Jerusalem watershed project in California, and the biggest one was with Harza Engineering of Chicago on an 80,000-acre irrigation project in North and South Dakota.

* * * * *

Q (By Mr. Sachse) Have you published chapters, have you written chapters that were published in any textbooks concerning drainage?

A Yes, I have a chapter in the American Society of Agronomy, Monograph No. 17 on drain envelopes, and I've written a section of a chapter in the new agricultural engineering handbook on irrigation management. I can't say exactly the title at the moment.

Q That is the American Society of Agricultural Engineers?

A Yes.

Q The handbook you are referring to?

A It's a new textbook on irrigation. It has a drainage section, and I prepared the irrigation design section of that.

Q Have you done any consulting for the United Nations?

A Yes.

Q What has that been?

A I have been to Rome on two occasions to develop drainage criteria, and have been an advisor to the Irrigation and Drainage Institute of the Government of Cuba in the development of drainage research on drainage criteria.

Q Would I be correct in assuming you are also the author of numerous articles on various aspects of drainage and

irrigation?

A Yes, about 75.

Q I hand you what has been marked for identification as Tribes' Exhibit 19. Can you identify that form?

A This is my curriculum vita, and it's current up to November, 1980.

Q Have you ever testified in a lawsuit for the United States or for an Indian tribe?

A Not before this time.

Q Have you ever testified in a lawsuit at all before this time?

A No.

MR. SACHSE: Now, we offer into evidence Tribal Exhibit No. 19, Dr. Willardson's curriculum vita.

THE SPECIAL MASTER: Is there any voir dire?

MR. WHITE: Not on the vita, Your Honor.

MR. CLEAR: No.

THE SPECIAL MASTER: That will be fine.

MR. SACHSE: Secondly, we offer Dr. Willardson as a qualified expert on irrigation and drainage engineering.

MR. WHITE: Could I have just a moment?

THE SPECIAL MASTER: May I hear that again, please? Yes.

MR. SACHSE: As an expert on irrigation and drainage engineering.

THE SPECIAL MASTER: All right. First, the Tribal Exhibit No. 19 is received into evidence. I am very much prone to admit with pleasure the expert qualifications of this witness, but I must defer that to Mr. White for questions, if you have some.

Before Mr. White begins and while he is conferring, in your experience when you said you were in Honduras at the time, is that the part that is Belize now or is that Tegucigalpa?

THE WITNESS: Tegucigalpa.

VOIR DIRE EXAMINATION

BY MR. WHITE:

Q Dr. Willardson, isn't it true you have done no consulting work in Wyoming aside from this case?

A That's true.

Q Isn't it true that you have never personally designed a drainage system and carried it through to construction?

A That's true. May I --

MR. WHITE: I have no --

THE WITNESS: May I correct that to say a large scale drainage system?

Q (By Mr. White) Such as the size of the ones involved in this

case?

A Yes.

MR. WHITE: Your Honor, if the Court will bear the answers of those questions in mind, we waive any objection.

THE SPECIAL MASTER: Very well. Dr. Willardson, you are admitted for the purposes requested.

You may proceed, Mr. Sachse.

(CONTINUED) DIRECT EXAMINATION

BY MR. SACHSE:

Q Dr. Willardson, when did you first hear about the designs for future irrigation projects on the Wind River Reservation and drainage for those designs?

A In November, December of 1980.

Q And how did that come about?

A Dr. Mesghinna called and asked me if I would give him some assistance in the design of this drainage system. He had been a student at Utah State University and in my drainage classes, and asked if I could come to San Francisco and assist him in setting up the criteria for the drainage design. I was involved in teaching at the time and could not go, and so invited him to come to Logan.

Q Did he come to Logan?

A Yes, he came and spent three days there, and in working together we mutually developed the drainage criteria and the design procedure that was used on the project.

Q Now, when you say "drainage criteria and design procedure," what do you mean by that?

A Well, before you can design a drainage system you have to set -- decide on a procedure for designing the spacing of the drains, and then choose the parameters on which you are going to base the design. You can develop, for example, the drainage coefficient, which is the amount of water that has to be removed by the drainage system. That is a very critical point and very important because it influences everything else. The other degree of freedom you have is the depth of the drains, and with those two pieces of information, then you -- plus the distance that you will allow the water table to approach the soil surface, you can then design the drainage system and drain spacing.

Q Now, when you consulted with Dr. Mesghinna, did you go out to the Wind River Reservation?

A No.

Q Did you look in any detail at the data concerning depths to barrier, soil classifications in the Wind River Reservation at that time?

A No. He had with him maps showing the general shape of the plots to be drained, and he had an approximate value for the depth to barrier, which is a physical criteria, and the general hydraulic conductivity. We used those bits of information and used a drainage coefficient along with the other criteria I mentioned to set up a design procedure.

Q Now, once you set up the design procedure, did you have any further consultation with Dr. Mesghinna?

A No, not that I recall.

Q Did you in any way help actually draw the drain design -- the lines showing where the drains would go on the actual fields?

A No. My role was to help develop the procedure and the design criteria.

Q So at that stage and in connection with that consultation, you had no idea what actually developed out of the procedures that you had helped work through?

A That's correct.

MR. WHITE: I would like to object to that question.

THE SPECIAL MASTER: Too much leading for you?

MR. WHITE: Just a wee bit leading, Your Honor.

Dr. Willardson is fully competent to testify himself without Mr. Sachse's testimony.

THE SPECIAL MASTER: It is pretty leading.

MR. SACHSE: I admittedly am just repeating to some extent the information the Witness already said to make it clear, but if Mr. White objects, I won't go further with that.

THE SPECIAL MASTER: "Was it a dual," if you could put it in a question of that form.

Q (By Mr. Sachse) Was it a dual task that you were asked to do?

A Yes.

THE SPECIAL MASTER: I wanted to ask at this point, when you had completed your consultation with Dr. Mesghinna, none of it applied to Stagner Ridge or to the two programs that Mr. Bliesner is working on, is that right?

THE WITNESS: I had no idea where this was going to be applied except in the Wind River Indian Reservation.

THE SPECIAL MASTER: All right.

Q (By Mr. Sachse) Now, I assume because you are here that you agreed to do the work that Mr. Bliesner came to you with, is that correct?

A That's correct.

MR. SACHSE: I hope that was not too leading a question.

THE SPECIAL MASTER: Mr. Sachse, instead of "you did," I think "did you" would remove the objection.

MR. SACHSE: I will try. I will point out, as the Court may know, generally it's not considered improper at all to ask a leading question to an expert witness.

MR. WHITE: Your Honor, that may be the law in Louisiana, but there is no case to that effect in Wyoming.

THE SPECIAL MASTER: All right. This is a little professionalism we are indulging in, Dr. Willardson.

Q (By Mr. Sachse) When were you next consulted about the drainage situation -- drainage plans for the projects on the Wind River Reservation or any other work on the Wind River Reservation?

A In May of this year Mr. Bliesner came and asked me if I would assist in the design of a drainage system for part of the Wind River Irrigation Project, and at the same time look at the design that had been done by Stetson Engineers for the drainage.

Q So it was a dual task that he was asking you to do, one was to help in the --

MR. WHITE: He can answer the question, Your Honor. He doesn't have to say "so it was a dual task," that's about as leading as they come.

MR. WHITE: I'm going to have to use my objections sparingly on that, Your Honor.

Q (By Mr. Sachse) What was the first thing that you did after talking to Mr. Bliesner towards getting this work done?

A Well, when he asked me to review the design by Stetson Engineers, I said that I could not offer anything additional because I had been -- I worked with Dr. Mesghinna to develop the design criteria, and whatever I came up with would be exactly what he came up with. We made some preliminary calculations that showed that to be true, that what Dr. Mesghinna had done was what we had planned should be done, and that I didn't see any reason to go further with the review at that time.

* * * * *

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Q. (By Mr. Sachse) Well then, why did you agree to go further with the review?

A. Well, he wanted me to see these new areas and see what the drainage needs of those were.

Q. So you did agree that to -- Well, let me ask you this: Did you visit the Wind River Indian Reservation?

A. I said that I would have to see the Wind River Indian Reservation because on the basis of the information we had there was nothing additional that I could do.

Q. Now, when you say the information that you had, what information had you been given?

A. The hydraulic conductivity of the soil, the drainage coefficient and the depth to barrier.

Q. Now, when did you go out to Wind River Reservation?

A. On June, I think, the 3rd, 4th and 5th.

Q. Of this year?

A. Of this year.

Q. 1981. Did you meet anyone out there or go out with anyone?

A. I rode out there with a technician who went for the purpose of making the sprinkler tests that you've spoken about earlier, and there I met Mr. Bliesner who was with Dr. -- who was with Dr. Keller, who had been there for a few days, and with Mr. Bliesner we then traveled in the project.

Q. Now, before you get into your travels on the Reservation

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and your eyewitness observations, I'd like you to tell the Court what documents you had concerning depth to barrier, conductivity or the nature of the soil at the Wind River Indian Reservation.

A. Well, the documents we had were the Stetson report, the Stetson drainage maps, a Bureau of Reclamation report on drainage, report of a Board of Consultants to the Regional Director on drainage, and a third section of the Riverton Project, and an HKM report on soil profiles, depths to barrier and hydraulic conductivity.

Q. Now, what was the first area of the Reservation that you examined in person, you stood on and looked at?

A. It was Big Horn Flats. That was the concern because there was no drainage there and he wanted me to see that problem first.

Q. He wanted you to advise him on what drainage would be necessary for the Big Horn Flats project?

A. Yes.

MR. WHITE: That's all right, Your Honor, I'll catch another one.

Q. (By Mr. Sachse) What were your -- What observations did you make visually about drainage on Big Horn Flats?

A. Well, there was -- One of the main features was a change in elevation in the middle of the flat where there might

be a problem with an accumulation of water moving across the flats, but the principal thing I saw there was the soil profile for the first time which consisted of a shallow topsoil over gravel, over what appeared to be fractured sandstone.

Q. Now, when you say the soil profile, do you mean something in a book?

A. No, I saw the profile in the field.

MR. SACHSE: Okay. All right. Now, at this point, Your Honor, I think it would be appropriate for us --

Q. (By Mr. Sachse) Well, let me ask a question first. While you were there and were observing the soil profile, were any photographs taken of what you were observing?

A. Yes. Mr. Bliesner took some photographs of the soil profile.

Q. And you have some of those photographs with you?

A. Yes, we have three slides.

Q. Are these of the bluffs and benches surrounding the perimeters of Big Horn Flats?

A. No, they're in a road cut that goes down off the top of Big Horn Flats.

MR. SACHSE: We have identified these slides as Tribes' Exhibit 20, 21 and 22, and I think, since they are slides, the only effective way to handle this would

be to first show one slide, let Dr. Willardson identify it, and then go through all three and we can have whatever voir dire there is about the slides after they've been shown on the wall.

THE SPECIAL MASTER: That sounds all right.

MR. WHITE: I'd like to object to their use on the five-day rule, Your Honor.

THE SPECIAL MASTER: I know you will, and normally I would be inclined to sustain you, but I don't think it's going to have that much damage.

MR. WHITE: Can I have three more chits then?

THE SPECIAL MASTER: Keep track of the chits.

MR. CLEAR: Your Honor, those are not chits against the United States.

MR. WHITE: What's a chit for one purpose probably will be a chit for all purposes.

MR. SACHSE: I'd like to ask my expert on drainage, he's also better on the slide machine.

MR. CLEAR: Your Honor, are we going to have prints made of these so we get copies?

THE SPECIAL MASTER: Well, you can --

MR. SACHSE: Yes, I think that would be approriate. We will have that done.

THE SPECIAL MASTER: You can supply the State with a

copy and one for the records and originals, too. Do you want some lights out?

THE WITNESS: Yes, please.

MR. WHITE: I think the record ought to show we haven't seen these, Your Honor.

THE SPECIAL MASTER: Yes, --

MR. WHITE: This is the first time we've seen them.

THE SPECIAL MASTER: -- it does.

THE WITNESS: This is the first slide. It shows the level top of the bench and this is the gravel material that's under the topsoil, and here you can see the sandstone outcrops that this gravel material overlies.

This gravel material is currently dry and has never had a water table in it and has a lot of storage capacity, a lot of water can be put into that aquifer because the water table would come up and cause a problem. And then this sandstone appears to be fractured, we can only see it here where it's exposed. We have no idea what's back inside, but sandstone itself is sometimes porous and there's an opportunity then for the water that comes down from the irrigation system to be, some of it, stored in the gravel and to leak out the sides and to filter down through the sandstone, get back to the river. That's what this one shows.

MR. SACHSE: For the record, let me state that the

slide just referred to was Tribes' Exhibit 20.

THE WITNESS: This is a close-up of the profile. You can see the topsoil and then the gravel material and the sandy material and here we're not down to the sandstone yet. The gravel material is quite deep. This white material is lime deposits in the soil that indicate the limit to which the natural precipitation has gone in the past.

When irrigation starts, this material will be dissolving and will be traveling with the water and coming out in the drainage system or upon the sides of the bluffs.

You can see besides this gravel there's sandy material underneath.

MR. SACHSE: This is Tribes' Exhibit 21.

THE WITNESS: And this is a shot of the sandstone with indications that there has been, even with the low precipitation on this area, there has been some water movement through the sandstone to the outside. So some of these sandstones are permeable, and as a matter of fact, the Bureau ofReclamation indicated that some of their better aquifers were the sandstones.

MR. SACHSE: That was Tribes' Exhibit 22.

Q. (By Mr.Sachse) What general conclusion did you reach as to drainage on Big Horn Flats as a result of your examination of the area?

MR. WHITE: Objection, foundation.

MR. SACHSE: I think I've just laid the foundation.

THE SPECIAL MASTER: I'll overrule it.

MR. SACHSE: He was there, he observed, he's spoken of what he did.

THE WITNESS: My conclusion was that there would not need to be any relief drainage system on Big Horn Flats, that essentially the problem, if a drainage problem arose, it would be at the change in slope or the change in elevation that occurred toward the middle of the flat; therefore, we could handle the drainage problem in that particular area with one interceptor drain that ran along the toe of that ridge; that the rest of the water, excess water, that would come from the irrigation system could be handled by the natural drainage.

MR. SACHSE: At this point we offer in evidence Tribes' Exhibits 20, 21 and 22.

MR. WHITE: Your Honor, we would object to the admission of -- Well, first of all, let me ask the purpose for which they're admitted.

THE SPECIAL MASTER: Illustrative.

MR. SACHSE: They're admitted as illustrative of Dr. Willardson's testimony concerning the fractured sandstone, gravel and other observations that he made at Big Horn Flats.

MR. WHITE: Your Honor, we would object to the admission, even for illustrative purposes, since no foundation has been established as to the precise location that the photographs were taken of, and whether or not the, most importantly, the photographs are an accurate representation of soils and materials which underlie any particular field in Big Horn Flats. We know from the dialogue between the Court and the witness that these were taken somewhere around the periphery in a road cut, but these are not tied to any particular field, there's no indication that they're relevant, there's no indication that they're material, there's no indication that they're an accurate representation of what they purport to represent, and there's no indication that what they purport to represent is actually actual conditions which fall within or below any of Dr. Mesghinna's field.

* * * * *

THE SPECIAL MASTER: Their limit is precisely what you stated it is, and that's they are not for the purpose of showing there's a true consistency of strata throughout the Big Horn Flats or that that was seen when these were taken, but they may have some probative value regarding an opinion of a professional expert regarding that geology, and for that purpose and that purpose only I think they are permissible. They violate the five-day rule also, and I recognize that, but I ask your indulgence on something like that, Mr. White.

MR. CLEAR: Your Honor, may I ask Mr. Sachse to clarify, are these slides, are those photographs of Mr. Mesghinna's fields or Mr. Bliesner's fields?

THE WITNESS: Those are slides taken on Big Horn Flats. I don't know the name of the road. I can describe the road to you, and it's --

THE SPECIAL MASTER: There are programs on Big Horn Flats that Dr. Mesghinna recommended in one of his five areas and some that were --

MR. SACHSE: Well, I can answer the question.

THE SPECIAL MASTER: That's the trouble, you can answer it, but that isn't what the record shows.

MR. WHITE: That's right, and I would like to amend my objection, Your Honor, to adopt the observation, the excellent observation made by Mr. Clear by the

United States. We don't know which sets of parcels these refer to.

THE SPECIAL MASTER: Can you, Dr. Willardson, with some degree of certainty, point to where you think that road cut was where these pictures were taken?

THE WITNESS: Can I ask some help from Mr. Bliesner? Can you --

MR. WHITE: Your Honor, I would object to the witness having Mr. Bliesner assist him in developing his answer to the question. Dr. Willardson is on the stand, it's his opinion that is being developed. I think he ought to point out, if he knows, where the pictures were taken.

THE WITNESS: It's in this general area (indicating) east of the highway that comes down across Big Horn Flats, and I can't see the road that comes up the cut where I took the picture, but it's in this general area.

THE SPECIAL MASTER: It's east of the highway or west of the highway?

THE WITNESS: East of the highway.

THE SPECIAL MASTER: Now, if that map is north to the top and you are waving your hand over to the left, you are waving it to the west and not to the east.

THE WITNESS: Yes. It's west -- no, it's east. Oh,

that's right.

THE SPECIAL MASTER: I think your orientation to the north is due upward to the top.

THE WITNESS: Okay. Here's the highway (indicating), and the road goes off this way. That is why I can't find it. It's this road here.

Q. (By Mr. Sachse) Okay. Could you describe the section --

THE WITNESS: It's in Section 32, Range 1 West, Township 3 North.

MR. CLEAR: Dr. Willardson, could you identify what exhibit you are pointing to?

THE WITNESS: This is Tribes' Exhibit Number 15.

THE SPECIAL MASTER: Just one minute, please, gentlemen. I'm totally confused now. Off the record, please.

(Off the record discussion.

THE SPECIAL MASTER: Back on the record, please. In these exhibits, including Dr. Mesghinna's 245, there are an abundance of acres on Big Horn Flats included in the five future projects that you first conferred with him about when he came to see you for those three days in Logan. Now, can you say with certainty whether the pictures that you have just described to us apply to the lands I just referred to, or do they apply to

that portion of Big Horn Flats and Stagner Ridge which was omitted from the Mesghinna original submissions?

THE WITNESS: I can only speculate about it because what I saw of Dr. Mesghinna's map showed no drainage in this area (indicating). Whether he planned drainage and it was not shown, I can't say.

MR. SACHSE: Your Honor, I think to clarify this question, the Court needs to bear in mind, as we will show in a minute, that Dr. Mesghinna did plan fields for the area that we were referring to in Big Horn Flats, and that was later omitted in Dr. Mesghinna's final plans. So when you ask the question is this an area that Dr. Mesghinna had planned for, it's a question of whether you mean an area that he completed his plans for in the final.

THE SPECIAL MASTER: Well, I'm ready to rule on the objections. Notwithstanding the fact that they may very well could have been better identified, located, I'm going to admit them for whatever probative value they have.

MR. SACHSE: We will move on then.

THE SPECIAL MASTER: All right.

Q (By Mr. Sachse) Did you actually design a drainage program for the Big Horn Flats area shown in Tribes'

Exhibit Number 15?

A. This is a single interceptor drain that runs through the center at the change in elevation. I personally did not design it. I located the drain, and the technician sized the drain.

Q. The location of the drain you --

A. At that break in slope.

Q. All right. And did the technician work under your supervision?

A. Yes, initially. I left the country after I got him started. He completed the work in my absence.

Q. All right. Now, did you prepare a map or was a map prepared under your supervision that shows the drains that you planned?

A. We should look at the other map, the blue one.

(Whereupon, Mr. Sachse hands another map to the witness.)

THE WITNESS: This is the map that shows -- this is Sheet 3 of 7, drainage plan for the proposed irrigation project, Big Horn Flats unit.

MR. SACHSE: Now, this map was given an identification number yesterday. Can I ask the clerk if he can give me the identification number for Sheet 3 of 7 sheets?

(Brief pause.

MR. SACHSE: Tribal Exhibit 13-6.

Q. (By Mr. Sachse) Can you identify the map shown as Tribal Exhibit 13-6 that is on the board?

A. Drainage Plan for Proposed Irrigation Project, Big Horn Flats Unit, Sheet 3 of 7.

Q. Now, would you point out the drainage interceptor that is on there?

A. There's a short section here (indicating). There's a section through here and one here, and a section there (indicating). They are difficult to see on this map.

THE SPECIAL MASTER: I have a problem. What was handed to me as Tribes' Exhibit Number 13-6 is a different document than what you were using there, and I wonder if that could be corrected before we go any further, just in the event I will get more confused?

MR. SACHSE: Our mistake. This is a prior version of the map. We will put Tribal Exhibit 13-6 up.

THE SPECIAL MASTER: All right, fine. Thank you.

THE WITNESS: The interceptor drains show more clearly on this map.

THE SPECIAL MASTER: This is 13-6. Go ahead, sir.

THE WITNESS: That is all there is to say. This shows the location of that break in slope and the

position of the interceptor drains. The rest of the drainage we expect to be taken care of by the natural drainage from the area.

* * * * *

THE SPECIAL MASTER: Dr. Willardson, I just might as well take a few minutes to ask some questions now rather than wait. There is no way one can remove from the role of an arbiter in these proceedings a life of experience around one's native habitat. Mine is Wyoming. Some of the first two reclamation irrigation projects in this state were Enid Valley and Farson in Sweetwater County. Some were the early ones with the Mormon pioneers who settled around Bridger Valley on the way to the great Salt Lake Valley. The worst problem they had over the decades has been drainage. It is -- It has rendered unproductive hundreds of acres in both of those areas over the years, very difficult drainage problems and alkali problems.

With that thought in mind, is there a possibility that no drainage would ever, except the one line through here, is taking a chance on what might result from the first ten or 15 years of irrigating with the heavy systems of sprinkler irrigation that are proposed?

THE WITNESS: It's my --

THE SPECIAL MASTER: What's your professional observation on that?

THE WITNESS: It's my opinion that the natural drainage here will prevent any drainage problems on the

irrigated land. We are concerned about what might happen at the change in slope, and that's the reason for the single interceptor drain. The problems of salinity and excess water will occur around the edges of these areas where the water leaks out of the system. That drainage water has to go someplace, and it will either seep through the sandstone onto the shale and then come out or it will stay on top of the sandstone and come out, but it will appear in some place.

There will be numerous seeps and springs where these are in areas where they do not create any harmful condition. There'll be a growth of native vegetation there and some of the water will be used up and the rest will go back to the river.

In flatter areas that are not cultivated, seepage or salt seeps will develop and the soil will become white.

There -- the fact that we have not installed artificial drainage does not mean that the water will not be there, and so we expect that in numerous places this water will appear having followed the natural water courses, subsurface water courses that we can't see. There is a great deal of uncertainty in handling the drainage system in this way.

There is also the possibility that if we put a, an intensive relief drainage system, that is tile drains spaced at some interval to correct the drainage water, that the water table would never rise to the level of those drains because of the natural drainage capacity, so those drains would never function and we would have the natural groundwater movement to points of natural discharge.

We have added to the drainage cost a contingency factor of 20 percent to take care of these unforeseen problems. Within Big Horn Flats themselves there may be underground barriers that present lateral movement of water, that we could not detect with the intensity of sampling that was done, and so we need a contingency fund to take care of those problems, but until water is applied, there is no way to anticipate where they will occur.

The earlier irrigation projects that got into so much trouble were in lower flatlands where the natural drainage capacity was much less and that excess water raised the water table and caused problems. But here we are on a high mesa with what is, in effect, a big open drain all around the outside and gravel aquifer through which water can flow through the edges.

THE SPECIAL MASTER: I appreciate your answer and I thank you for it.

Q (By Mr. Sachse) You describe at Page 17 of Tribes' Exhibit No. 13 your comments on Big Horn Flats and the costs that you attribute for drainage there.

A What would you like me to respond? You want me to read this?

Q No, you --

MR. WHITE: He just wants a yes or no answer and I'll object to the question.

Q (By Mr. Sachse) Well then, would you tell me the amount of money that you did attribute as a cost of the drainage you've just described to the Master, for Big Horn Flats?

A Cost of the interceptor drain, based on the size of the installation of the pipeline to intercept the water at that change in slope if $129,000, but because of the uncertainty we have doubled that cost in order to make sure that we would have enough money to do construction should one of these other problems arise.

Q And what total drainage costs per acre does that come out to?

A It comes out to $28 per acre on 9,264 acres.

Q Is it your professional opinion that that's sufficient cost for the drainage there to make that a reasonable

secure project?

A That's why it's here; it is our professional opinion.

Q In determining the cost for the drainage there, how did you determine what that interceptor drain would cost?

A After the drain is laid out, then with the drainage coefficient and the area from which the drain absorbs water, we find the amount of water that the drain will have to carry and then with the slope of the drain, calculate the drain size and multiply that by the cost of the drain per foot and the cost, total cost as a result.

Q Did you make any modifications in the cost per foot figures that Stetson Engineers used for their drainage?

A We accepted Stetson Engineer's cost for six, eight and ten inch pipe diameters, but in the changes that we made and in this, perhaps in the case of this drain on Big Horn Flats, we had to have 12-inch pipe and so we made an extrapolation of Stetson's data to get a cost figure for 12-inch pipe.

Q Is that a techniques acceptable in your profession, that sort of extrapolation?

A Well, I had no other alternative, and so I just plotted the data and made an extrapolation.

Q Now, did you then examine the Stagner Ridge area of the

Reservation?

A Yes. During the time we were touring the project we visited Stagner Ridge and also drove around the edges.

Q Could you point out Stagner Ridge on Tribes' Exhibit No. 13-3?

A This is Stagner Ridge, and you can see from the contour lines it's a high mesa, and we put no drains in the Stagner Ridge.

The distance to the edges is short and it has, in our opinion, adequate natural drainage.

We did add a small cost, I think it's about only $14 an acre for Stagner Ridge in case one of these other problems arise, unforeseen problems with underground barriers that we could not anticipate, but it's just a small figure.

Q Now, did you visit the other, the future projects on the Reservation where drainage had been designed by Dr. Mesghinna?

A Yes. I think we covered about 80 percent of the project area. We didn't walk on every square foot, but we were able to get into places where we could see a large percentage of all the irrigated plots.

Q Now, would you describe in general the process you went through in evaluating these various plots.

A After looking at the profile information that was available from HKM's book and looking at the physical position and elevation and the surroundings of those pieces of land, on the basis of my personal judgement, I indicated on some map, some of the drainage maps, the areas that drainage, from which drainage could be removed entirely, the areas where the drainage intensity could be reduced and arbitarily reduced that to half of the design intensity.

THE SPECIAL MASTER: Wasn't your conclusion you drew at the time contradictory to your concurrence with Dr. Mesghinna of some six months before when he conferred with you about that?

THE WITNESS: Well, I can answer that -- Let me continue with the thing I was saying. And part of the area we left the intensity of drainage that had been designed by Dr. Mesghinna. When Dr. Mesghinna came to me for help he had the hydraulic conductivity of the soil profile and the depth to barrier and no further information on the character of that soil profile, and we could see from the contour maps that the land was high, most of the irrigated plots were high. So there would be drainage toward the areas. There was no hydraulic conductivity information other than in the

upper part of the profile. We only had a single value.

There was no hydraulic conductivity information available on the gravel that we saw in the slide or the gravel that exists under these other parts of the project. And so there was no way to take the high permeability and high storage --

* * * * *

THE SPECIAL MASTER: I have to interrupt because the slides you just alluded to have nothing to do with the area you are talking about. The slides you alluded to are these two areas, and not on the other areas Dr. Mesghinna did work on, unless you think that characteristic you referred to in the slides is prevalent throughout the entire flats.

THE WITNESS: But it isn't. It isn't prevalent throughout the entire area, and for that reason some of the areas of drainage designed by Dr. Mesghinna were left untouched.

THE SPECIAL MASTER: But some you reduced the amount of the drain pipe?

THE WITNESS: Yes, in some we took the drainage out entirely, based on the natural drainage capacity of these gravel aquifers.

Q. (By Mr. Sachse) Now, let me ask you this: why were you able to do that and Dr. Mesghinna didn't do that?

A. When HKM made their tests, they were unable to report hydraulic conductivity values for the gravel because it was too hard for them to measure, and since they --

MR. CLEAR: Objection, Your Honor. How does he know this? There's no foundation.

MR. WHITE: Your Honor, he took the very words out

of my mouth, and I'll join in the objection.

THE SPECIAL MASTER: Before I even rule on the objection, I would like to ask a question beforehand.

Was Dr. Mesghinna advised you were making some changes or you were doing these things with the project that he had consulted with you about a few months earlier?

THE WITNESS: It's my understanding that he knew that this was going to go on, and he didn't make any objection to me.

THE SPECIAL MASTER: But you did not consult him or contact him to let him know you were working with the project?

THE WITNES: No, I did not.

THE SPECIAL MASTER: I will sustain the objection.

Q. (By Mr. Sachse) All right. Now, I want to ask you again, what was there about your ability to go out in the field and determine that some of this drainage wasn't necessary that didn't exist for Dr. Mesghinna?

A. I saw these gravel aquifers under the land that had been drained or had had designed relief drains.

Q. Well, he must have seen those, too.

A. Well, perhaps he looked with different eyes. I looked with some drainage experience.

MR. WHITE: Your Honor, I would object to this line of questioning. It calls for the rankest form of speculation as to what Dr. Mesghinna did or did not see in the field. Dr. Mesghinna indicated a very careful description of what he did, it's in the record, there is evidence in this court of what he did, and instead of speculation by this witness as to what Dr. Mesghinna did, saw or thought, there ought to be some reference to the record and then the disparity between what this witness did and what Dr. Mesghinna did would be appropriate, but it seems to me this is an entirely speculative line of questioning.

MR. SACHSE: Your Honor, I will move --

THE SPECIAL MASTER: I believe there should be some comparison to the record of Dr. Mesghinna's testimony to tell with some degree of certainty exactly what we are talking about before he makes these glaring generalizations about his work.

MR. SACHSE: I will move off of this entire line of questioning and stick to just exactly what Dr. Willardson himself observed and did. What Dr. Mesghinna observed and did is already in the record.

Q (By Mr. Sachse) Now, you have testified that you looked at Dr. Mesghinna's maps, you were out in the field, you

had also looked at the HKM data.

THE SPECIAL MASTER: What maps, drainage maps or --

MR. SACHSE: The drainage maps he had prepared.

THE SPECIAL MASTER: He had seen no drainage maps, I believe he said, of Dr. Mesghinna's.

THE WITNESS: I didn't until we arrived at the project, but we had them in hand.

THE SPECIAL MASTER: Oh, but when he came to see you all you saw was the hydraulic conductivity, depth to barrier, and these facets that you have been supplied with and which you have discussed?

THE WITNESS: And some topographic maps. I was provided with zeroxed copies of topographic maps.

THE SPECIAL MASTER: Okay. I beg your pardon.

Q (By Mr. Sachse) Now, when you were in the field, as I understand your testimony, and I'm doing this to sum up so we can move on, and I hope it won't be subject to objection, you had Dr. Mesghinna's maps, you had HKM data and other data that you referred to, and you were looking at fields in deciding whether you thought there ought to be the same amount, a lesser amount or new amount --

THE SPECIAL MASTER: When you were looking at the fields, what were you deciding, if I may ask it that way?

MR. WHITE: I would object to the question, although --

THE SPECIAL MASTER: Mine, too?

MR. WHITE: No, it was a hell of a question. I have no objection to a summary question of an expert to wrap up his opinion. I think that is perfectly proper. What I do object to is a long characterization of what he was doing and what he was seeing. I have no objection to your question of when he was in the field what he did see.

THE SPECIAL MASTER: All right. The first three-fourths of Mr. Sachse's question I wish to stand, and if you can recall it, then my summary ending of merely what were your conclusions as you reviewed the material he asked you to, that he referred to?

MR. WHITE: Your Honor, I'm going to get in trouble, I know, but I'm going to object to your question on the grounds of foundation because you have asked --

THE SPECIAL MASTER: All right, let's go back and read Mr. Sachse's question.

MR. WHITE: Can I give you the rest of my objection, Your Honor?

THE SPECIAL MASTER: I have already overruled my question, so you don't have to. I have sustained you. Let's go back and catch Mr. Sachse's question.

(Whereupon, the reporter read back,
("Q. Now, when you were in the
(field, as I understand your testi-
(mony, and I'm doing this to sum
(up so we can move on, and I hope
(it won't be subject to objection,
(you had Dr. Mesghinna's maps, you
(had HKM data and other data that
(you referred to, and you were
(looking at fields in deciding
(whether you thought there ought
(to be the same amount or a lesser
(amount or --"

THE SPECIAL MASTER: All right, you had these maps in looking at other fields, and what did you decide?

THE WITNESS: I decided where the soils were underlain with gravel, and the elevation was such that there was a discharge point for the gravel that those areas did not need the intensity of drainage that was designed.

MR. SACHSE: Now, Your Honor, to illustrate this and to make it clear, I would like the clerk to give me, if he would, Tribes' Exhibit 13-4.

(Off the record discussion.

MR. SACHSE: If you will give us a minute, we will put these on the board.

(Brief pause.

MR. SACHSE: Now, for the sake of clarity of the record, the top map that we are showing is a map already in evidence in this case. It's the Stetson drainage plan for the proposed irrigation project, North Crowheart

Unit. The second map is one that was identified yesterday, it has not yet been offered in evidence, and it's the drainage plan for the proposed irrigation project of the North Crowheart Unit as modified by Dr. Willardson. It's Dr. Willardson's plan for that.

Q. (By Mr. Sachse) Now, can you illustrate, Dr. Willardson, some of the things you were just talking about, fields where you left Dr. Mesghinna's drainage as it was, fields where you reduced the drainage and fields where you took drainage out altogether?

MR. CLEAR: Your Honor, that would cover the whole map.

THE SPECIAL MASTER: Let him finish the question. Let him finish the question, why don't you.

Did you finish the question?

MR. SACHSE: I finished the question.

MR. CLEAR: Your Honor, the question was where did he reduce the drains, where did he leave them the same or where to reduce the sizes, and I think that would be the whole map, as I understand it.

THE SPECIAL MASTER: I believe the witness should answer, if he can.

MR. SACHSE: I think he can certainly point to a place and say, here I did that and here I did that,

if he can.

THE SPECIAL MASTER: Mr. White?

MR. WHITE: I would like to ask for clarification, is 13-4, to which Mr. Sachse was referring, admitted in evidence?

MR. SACHSE: No, it was not.

THE SPECIAL MASTER: 13-4 was held from evidence with the packet because it was anticipated you would have some objections to it being admitted. I think that is correct.

MR. WHITE: I would like to object to the question asked by Mr. Sachse then because it asks the witness not to identify the exhibit, which has already been done, but to testify from an exhibit which is not in evidence.

THE SPECIAL MASTER: That will be overruled. You may answer the question.

THE WITNESS: The top map here is Dr. Mesghinna's map. It shows the intensity of drainage that he designed for the project.

The bottom map is the redesigned map, and by comparing the number of drains in a given area you can see that in this area, for example --

THE SPECIAL MASTER: You were pointing to the north

west corner?

THE WITNESS: Yes.

THE SPECIAL MASTER: In the rectangle?

THE WITNESS: There are a number of drains indicated in this part of the project (indicating). We removed those drains entirely. Toward the center of the map you can see the drains are quite close together. In the new map they are somewhat farther apart. These are areas where we reduced the drainage intensity by 50 percent. There are other areas where the drainage intensity was not changed because there was no natural drainage and the physical condition of the soil was such that the intensity designed by Dr. Mesghinna was necessary.

Q. (By Mr. Sachse) Did you go through this same procedure in each of the future project areas?

A. Yes, we went -- We used all the maps and traveled throughout the project and made these judgments on all these areas that we saw.

MR. SACHSE: Could we have 13-10?

MR. CLEAR: Your Honor, could I have an off-the-record discussion with Mr. Sachse?

Those are my maps that he's using.

THE SPECIAL MASTER: Sure, off the record, please.

(Off-the-record discussion.

THE SPECIAL MASTER: On the record. Do you want to make an objection on the record, Mr.Clear?

MR. CLEAR: I don't want to make an objection, Your Honor. The only thing, I lent Mr. Sachse my copies of Dr. Mesghinna's drainage maps with the understanding he was going to --

THE SPECIAL MASTER: Give them back to you.

MR. CLEAR: Xerox them or something.

THE SPECIAL MASTER: And now you may find them getting into the record?

MR. CLEAR: No, no, they're in the record. I think they are.

MR. SACHSE: They'll be returned in five minutes,

Your Honor.

THE SPECIAL MASTER: All right, let's proceed.

MR. SACHSE: Now, can you identify these two maps?

A. This is drainage plan from proposed irrigation project, Riverton East Unit; and Exhibit 13-10, the new map, not the same area.

MR. WHITE: Do you have any objection if I stepped to the end of the table?

MR. SACHSE: No. It might be well if we all gathered around.

THE WITNESS: Here you can see an area that's southeast of Riverton from which the drains have been removed.

THE SPECIAL MASTER: Why were the drains removed from that area southeast of Riverton about two miles, why were they removed?

THE WITNESS: Because this, the river runs along here, the slope is good and there's adequate natural drainage to carry that water into the river.

THE SPECIAL MASTER: That's your conclusion?

THE WITNESS: That's my conclusion.

THE SPECIAL MASTER: You walked that ground?

THE WITNESS: Yes, or drove.

Q. (By Mr. Sachse) Now, compare that to this area in Township 2 North, Nebil Hill.

A. There's an area that the drainable intensity, the drains are very intense, and they were left in that area. Nearby we took the drains out of part of the field and reduced the intensity in another part of the field.

Q. Now, why did you do that?

A. Because the natural drain was judged to be sufficient here but not sufficient here, but there was some degree of natural drainage which did not require the intensity that was designed.

Q. Is this area, where you left the high intensity of drainage, lower lying land?

A. It's lower. As I recall, it's lower lying land and it's also flatter.

MR. WHITE: Your Honor, could I have a continuing objection to the testimony from exhibits which are not in evidence?

THE SPECIAL MASTER: You may. They were identified, however.

MR. WHITE: Yes, sir, but they're not admitted.

MR. SACHSE: Your Honor, just so the record is clear, that's the procedure we've used throughout this trial is to have evidence first from the exhibits proposed to be admitted and then admit the exhibits at the end.

Q (By Mr. Sachse) Now, I don't want to take the Court's

time for you to explain one by one the other drainage maps that you've done that are in the, your report, but I want to hand you what have been marked as Tribes' Exhibits No. 5, 6, 7 --

THE SPECIAL MASTER: 13.

MR. SACHSE: 13-5,-6, -7, -8 and -9, and I want you to take the time to look at each of these and tell me if you can identify them.

A. These show the revised drainage system that was done on the basis of our field visit.

Q. (By Mr.Sachse) Now, so far in your testimony, about the differences between the intensity of drainage that you proposed and that Dr. Mesghinna proposed, you talked about natural drainage and gravel and fractured sandstone. Is there any other major difference in your drainage proposals and his that led to a lesser intensity of drainage in your proposal?

A. No. It was a matter of judgment, professional judgment that I made on the site. As you can see, some of the areas we retained the intensity that he used.

Q. Did you use the same assumptions he did as to the number of months available from which to have the water drain out of the area?

MR. WHITE: Objection, Your Honor, foundation, there's

no evidence that this witness even knows the number of months that Dr. Mesghinna used.

THE SPECIAL MASTER: I'll sustain that.

Q. (By Mr. Sachse) Have you -- Did you form an opinion, in reviewing Dr. Mesghinna's work, as to the time period within which his drains were designed to remove the water from the irrigated fields?

A. In the drainage criteria that we set up together, the drainage coefficient used in the design is the peak drainage coefficient, and Dr. Mesghinna designed the drains to remove the water in the period of time between two irrigations, during the peak season, and this is the design procedure that you must use to protect the soil from a high water table. If you don't use that intensity of drainage, then a single irrigation could raise the water table to a damaging level in the soil, and so the system that he used was to remove that water, and in the areas where we did not change his design, I judged the physical conditions to be such that that type of water removal would be necessary.

In the area where we removed the drains, these gravel layers have a great deal of storage capacity. If they did not drain at all using the amount of water returned to the system irrigation, it would be seven years before

the water table rose to the point where it would be a problem to the agriculture. But because of the ability of these natural gravels to carry that water away, we could use, not the very short period between irrigations for the drainage coefficient, but we could take the total amount of water applied to the soil and divide that by 365 days, which considerably reduces the drainage coefficient, and that, in effect, gives the whole year for this water to drain out.

THE SPECIAL MASTER: A question naturally comes to my mind. If what you say is true regarding the soil characteristics that justifies removing some of his irrigation drainage facilities, why was not that apparent in the material you looked over from HKM regarding porosity of soils, absorption rates, depths to barrier and hydraulic conductivity on which you passed judgment earlier, which probably was the basis for him using some of the drainage that he did?

THE WITNESS: The information that he came with was the hydraulic conductivity of the topsoil.

THE SPECIAL MASTER: Yes.

THE WITNESS: In HKM's report, they report the hydraulic conductivity of the soil.

THE SPECIAL MASTER: It's also true of the root zone,

is it not?

THE WITNESS: It's in the root zone, but this aquifer, this gravel material is below the root zone.

THE SPECIAL MASTER: Well, that means a depth to barrier wasn't that much deeper, does it not?

THE WITNESS: Well, they bored through this gravel material and reported it as gravel until they reached what was either sandstone or shale and they called that a barrier, and they put the depth to barrier plus this profile description. I called HKM and asked them what the permeability of the gravity was and they said --

MR. WHITE: Objection, Your Honor,hearsay.

THE SPECIAL MASTER: No, I overrule the objection.

THE WITNESS: I personally called them and asked them what the hydraulic conductivity of the gravel was, and they said they could not measure it, it was beyond the capacity of their equipment. Since they couldn't measure it, there's nothing in the report about the hydraulic conductivity. Dr. Mesghinna had to assume that the gravel would be full of water --

MR. CLEAR: Objection, Your Honor, he's saying what Dr. Mesghinna assumed.

THE SPECIAL MASTER: I'll sustain that objection. What Dr. Mesghinna did, he did, and he can tell us.

THE WITNESS: Okay.

THE SPECIAL MASTER: All right.

* * * * *

MR. SACHSE: Well, go ahead with your conclusions from -- I suppose you have told us your conclusions, the information you got from HKM.

Now, when you were at the Reservation did you visit with the Bureau of Reclamation people for the Midvale District?

A Yes.

Q Did you discuss with them drainage problems and solutions to drainage problems?"

A Yes. We asked them what their drainage procedure was, if they installed all their drains at once, how they located new drainage problems because they are currently installing drains, and their procedure was to wait until the farmers came and told them they had a problem.

MR. WHITE: Your Honor, I would like to object to the answer and move that it be stricken. It is the grossest form of hearsay. What the Bureau of Reclamation people said is a fact, not an optimal fact, it's a fact for which there has been no foundation laid that falls within Rule 703, and it's a matter which they can testify to as to the truth of its contents, not this Witness.

THE SPECIAL MASTER: You may be right, but I'm going to overrule you.

MR. SACHSE: He is wrong.

THE SPECIAL MASTER: The probative value may be negligible, in any event. Go ahead.

MR. SACHSE: Just so the record is clear, one of the most important exceptions to the hearsay rule is that an expert be able to talk to other people and say what they said. Every expert in the case has done it, and Mr. White certainly knows enough to know that.

MR. WHITE: Your Honor --

THE SPECIAL MASTER: Gentlemen, please let's not argue. We have done so well over the months, we have only quarreled half a dozen times. Let's not argue now.

MR. WHITE: If you are going to accept argument after you have overruled my objection, maybe I can get my stick in. The next time I will -- I know you are tired of hearing about this one, but Mr. Sachse is wrong.

THE SPECIAL MASTER: I'm left with a grave problem with the nature of the analysis here. Maybe I tend to oversimplify this business of consulting engineering and results of consultants, but I'm troubled. Go ahead, Mr. Sachse.

Q (By Mr. Sachse) You were saying you did discuss with the Bureau of Reclamation personnel drainage problems

in the Midvale District. Did you take into account the problems that they discussed with you in making your reduction of the drainage as planned by Dr. Mesghinna?

A As we drove around we went through sections of their project and observed what their drainage problems were, and where they had installed drains and for what purpose those drains were installed. They were putting in interceptor drains in areas that had developed drainage problems. In general their soils are lower and flatter and do not have the natural drainage capacity that the areas have from which we removed the drains. Where our lands were similar, the drainage intensity designed by Dr. Mesghinna was left intact.

Q Did you find out the average number of feet of drains per acre that Midvale has?

MR. WHITE: Objection, Your Honor, and the objection goes to foundation and it goes not only to foundation, but to relevancy since in Midvale the drainage systems --

THE SPECIAL MASTER: To me it's also vague. Midvale is big and has many areas and goes -- and it may be that you have different standards and different parts of Midvale in mind.

MR. WHITE: It is also true, Your Honor, that Midvale has

lots of land which is inappropriate which was once irrigated, has been edited out, and I think the values ought to be carefully qualified to indicate whether this is the pre-editing or the post-editing or some other value.

THE SPECIAL MASTER: Try the question again, Mr. Sachse.

MR. SACHSE: Okay.

Q (By Mr. Sachse) Did you find out any information while you were with the Midvale people as to the number of feet of drains per acre in certain areas of the Midvale Reclamation District?

A The average drainage intensity --

THE SPECIAL MASTER: You should answer, first, yes, you did, or no, you didn't.

THE WITNESS: Yes.

Q (By Mr. Sachse) Now, could you tell us what you found out?

A The average drainage intensity in Midvale is 44 feet per acre. Our design is 43 feet per acre taken on an average in the whole project.

* * * * *

Q. (By Mr. Sachse) Now, if you are designing less per acre than Midvale has per acre, why?

A. That's only one foot per acre.

MR. WHITE: Your Honor, I would move to strike that answer concerning the average in Midvale on the basis that has not been qualified as part of the Rule 703.

THE SPECIAL MASTER: I will sustain that, but he may answer the question why he made the differences he did from Midvale.

THE WITNESS: We did not try to come close or in any way make a comparison. When our design was finished, we just divided our length of drain by the area that we drained, and it came out to be 43 feet per acre. It's a coincidence that there is 44 feet per acre.

Q. (By Mr. Sachse) Is there any relevance to the fact your drains are for sprinkler irrigation and Midvale's, as far as I know, largely are for gravity irrigation?

MR. WHITE: Objection, Your Honor. He is asking the witness to assume a fact not in evidence.

MR. SACHSE: Well, the fact is in evidence. I think the State has referred to it a number of times, that there is gravity irrigation in the Midvale Reclamation District, and that's a principal kind of irrigation there.

Q. (By Mr. Sachse) Now, what I am asking you is does the

intensity of drains depend in any way upon whether the irrigation is gravity or sprinkler?

A. The intensity depends on that drainage coefficient. Gravity irrigation is less amenable to good water management, and so the drainage coefficient is higher. So in the Riverton Irrigation Project they have a drainage coefficient that is higher than our drainage coefficient, which means that if we used their drainage coefficient, we would have -- if we used their drainage coefficient in this project, our drains would be much closer together.

THE SPECIAL MASTER: When you made these changes, did you increase the size of the drainage pipe?

THE WITNESS: Yes.

THE SPECIAL MASTER: And the size of the holes in them, too?

THE WITNESS: Not the holes, the size of the pipe.

THE SPECIAL MASTER: So you used larger pipe, but less footage?

THE WITNESS: Right.

MR. SACHSE: Your Honor, we have been going for an hour and a half now. I wonder if we could take a five-minute break?

THE SPECIAL MASTER: Yes. Do you want to go another hour?

MR. WHITE: Yes.

THE SPECIAL MASTER: All right. Let's take a five-minute break.

(Whereupon a short recess was
(taken.

* * * * *

THE SPECIAL MASTER: Mr. Merrill.

MR. MERRILL: Thank you, Your Honor. I simply want to point out on the record that we have permanently marked the Exhibit RB-11, RB-12 and RB-14, which were temporarily marked during my cross-examination of Mr. Ron Bliesner. I've returned the originals to Mr. Bliesner for his files and given Mr. Salazar the originals; marked copies and served copies on all the other Counsel.

THE SPECIAL MASTER: All right, thank you.

Okay, Mr. Sachse.

Q (By Mr. Sachse) Dr. Willardson, as a result of your works, did you recompute the -- Strike that.

Did you compute the cost of the drainage network that you proposed for these future projects?

A Yes, we did. When we reduced the number of drains we had to increase the size of the drains and therefore even though the length changed, the size also changed and we had to increase the size of the pipes. So we used Dr. Mesghinna's numbers for six, eight and ten-inch pipe and then did an extrapolation, as I explained earlier, to get a cost for 12-inch pipe. And we then began upstream, accumulating water in the drains using six inch as the minimum size until the capacity of that pipe was reached, and then increased the size to an

eight-inch pipe as necessary.

Q Would you look at Table 12, Page 33 of proposed Tribal Exhibit No. 13.

A This is a cost summary for the revised drainage plan. It shows the number of feet of pipe, of the various sizes in each of the areas and the cost of the pipe.

Q Was this prepared under your supervision?

A Yes.

Q And does this reflect the results of your computation of the prices?

A Yes.

Q Would you explain the 20 percent contingency figure that appears as a constant figure 48 across the five projects.

A In each of the sections of the project we have an individual cost per acre and we added the total project cost and took 20 percent of the total project cost as a contingency and spread that uniformly across the project. That's why each one of those numbers is $48. The reason for this contingency is the uncertainty of the location of these underground barriers and the work that will be -- have to be done at the discharge points that develop naturally because of the natural drainage. We need some money available to take care of those problems that are certain to arise.

Q Is it your professional opinion that the intensity of drainage that you have planned is appropriate for these projects?

A Well, the intensity varies from very intense to zero drainage, but the drainage that we have recomputed is appropriate for the areas on which the drainage is applied. Where there is no drainage it's my opinion that the natural drainage is adequate to take care of the amount of water that will be returned to the soil from the irrigation system. And there are areas where it will require the full intensity that was originally designed, and there are areas that are between the two.

MR. SACHSE: I have no further questions, Your Honor.

THE SPECIAL MASTER: All right, I thank you, Mr. Sachse.

Before we start cross-examination, why don't we pick this as a good time to recess for today. I have the afternoon, as I mentioned, with other things I have to do, and we can start at nine o'clock tomorrow morning and we can begin with cross-examination by the United States, Mr. Clear, cross-examination with you at nine in the morning. Is that satisfactory?

MR. CLEAR: Fine, Your Honor.

THE SPECIAL MASTER: And then you, Mr. White.

MR. WHITE: That's all right.

MR. SACHSE: Your Honor, there is one thing that we should do now, though the work on it I'm sure will be done tomorrow, and that is at this point we move --

THE SPECIAL MASTER: Exhibits.

MR. SACHSE: -- into evidence Exhibit 13 and a series starting 13-4 through 13-10, that are the drainage maps included in the pocket part of Exhibit 13.

MR. WHITE: If the Court or Counsel have no objections, I would reserve my voir dire on that, combine it with cross-examination and we might make things go a little faster.

THE SPECIAL MASTER: Very good.

MR. SACHSE: We have no objection.

THE SPECIAL MASTER: Very good. I thank all of you for your indulgence for convening early today. We'll reconvene at nine o'clock tomorrow morning.

(Proceedings recessed.

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INDEX TO EXAMINATION

INDEX TO EXHIBITS

	IDENTIFIED	RECEIVED
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REPORTERS' CERTIFICATE

State of Wyoming)
: SS
County of Laramie)

We, Merissa Racine and Mary Nelson, Registered Professional Reporters and Notaries Public in and for the First Judicial District, State of Wyoming, hereby certify that the facts as stated in the caption hereof are true; that we did at the time, date and place, as set forth, report the proceedings had before the Honorable Teno Roncalio, Special Master Presiding, in stenotype; that the foregoing pages, numbered 8490-8631, inclusive, constitute a true, correct and complete transcript of our stenographic notes as reduced to typewritten form under our direction.

We further certify that we are not agents, attorneys or counsel for any of the parties hereto, nor are we interested in the outcome thereof.

Dated this 29th day of July, 1981.

Merissa Racine
MERISSA RACINE
Registered Professional
Reporter

Mary Nelson
MARY NELSON
Registered Professional
Reporter

MERISSA RACINE - NOTARY PUBLIC
COUNTY OF LARAMIE
STATE OF WYOMING
My Commission Expires Mar. 10, 1984

MARY R. NELSON - NOTARY PUBLIC
STATE OF WYOMING
COUNTY OF LARAMIE
My Commission Expires March 23, 1985