IN THE SUPREME COURT OF THE UNITED STATES

Volume 1 of 25

STATE OF MONTANA

Plaintiff.

v.

STATE OF WYOMING

and

STATE OF NORTH DAKOTA

Defendants.

BEFORE THE HONORABLE BARTON H. THOMPSON, JR.
Special Master
Stanford, California

James F. Battin United States Courthouse
2601 2nd Avenue North
Billings, Montana 59101
October 16, 2013

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C O N T E N T S

P R O C E E D I N G S

(Open court.)

SPECIAL MASTER: Good morning, Counsel. You can be seated.

Since this is the first day of our evidentiary hearings, why don't we start out with appearances for the various parties. So we will start with plaintiff, State of Montana. So Mr. Draper.

MR. DRAPER: Thank you, Your Honor. Good morning. John Draper, counsel of record for the State of Montana. With me today is the Attorney General of Montana, Tim Fox.

GENERAL FOX: Good morning, Your Honor.

SPECIAL MASTER: The good morning, General Fox.

MR. DRAPER: Next to him is Deputy Attorney General, Cory Swanson.

MR. SWANSON: Good morning, Your Honor.

SPECIAL MASTER: Good morning.

MR. DRAPER: Next to me is Jeff Wechsler of our office, Montgomery and Andrews.

MR. WECHSLER: Good morning.

SPECIAL MASTER: Good morning.

MR. DRAPER: We also have Ann Yates,

the Chief Legal Counsel for the Department of Natural Resources Conservation of Montana.

MS. YATES: Good morning, Your Honor.

SPECIAL MASTER: Good morning.

MR. DRAPER: With her is Kevin Peterson, also of the legal office of the DNRC.

MR. PETERSON: Good morning, Your Honor.

SPECIAL MASTER: Good morning.

MR. DRAPER: And our assistant, Donna, Omerod.

SPECIAL MASTER: Good morning to all of you. So next then, defendant State of Wyoming.

MR. KASTE: Good morning, Your Honor. James Kaste, Senior Assistant Attorney General for the State of Wyoming. With me is the Attorney General for the State of Wyoming, Peter Michael.

SPECIAL MASTER: Good morning, General Michael.

MR. KASTE: Senior Assistant Attorney General Chris Brown.

MR. BROWN: Good morning.

SPECIAL MASTER: Good morning.

MR. KASTE: Assistant Attorney General

Andrew Coleman.

MR. COLEMAN: Good morning.

SPECIAL MASTER: Good morning.

MR. KASTE: Today we have the pleasure of having the state engineer for the State of Wyoming, Patrick Tyrrell.

SPECIAL MASTER: Then for defendant State of North Dakota.

MS. JENNIFER VERLEGER: Good morning, Your Honor. Jennifer Verleger for the State of North Dakota.

SPECIAL MASTER: Good morning.

So just a couple of administrative announcements at the very outset. The first is that the clerk's office downstairs has told me that they would very much appreciate if counsel could make most of their copies outside of the courtroom here, because they are apparently quite busy down there and would prefer not to have a lot of people coming in and asking for copies of various documents to be made.

If for any reason, however, you need to have a copy made in an emergency, or just one or two pages, and it makes a lot more sense to ask the clerk's office other than to go outside,

that's fine. But recognize they will charge you also 50 cents a page, and you don't have to bring quarters, they will actually keep a list, and so if you want to make copies, they will go ahead and make a list and then at the end of the proceedings you can toll it up and provide the federal government with some revenue, which if the federal government doesn't reopen fairly soon, the federal judiciary might actually appreciate it.

The second thing is that during the lunch hour, at least for part of that time, we'll be locking up the courtroom. I want to make sure that my deputies have an opportunity to catch a quick lunch, but as a general matter, what they are likely to do once the doors are locked, they will reopen them 15 minutes before court goes back into session, so you'll be able to get back in here and take care of things. If you want to work out any other special type of procedure, if you could just talk to the courtroom deputy during the morning break, and talking with them what time you would like to be here in the courtroom. Again, we are guests in this particular courtroom and they have a rule which

is totally understandable, that they would prefer not to have counsel in the courtroom by themselves without having a courtroom deputy here. And, again, the clerk's office is so busy on all the various other matters, it's basically for my courtroom deputies to take care of the courtroom during the lunch hour.

Next I understand from my conversations with both Mr. Draper and Mr. Kaste last week they would like to make opening statements. So unless there is any other matters to handle at the outset, then I would call on Mr. Draper at this particular point to make an opening statement. And I understand that he is going to be sharing that with Attorney General Fox from the State of Montana.

MR. DRAPER: That is correct, Your Honor. Thank you very much. And I would ask Attorney General Fox to begin.

SPECIAL MASTER: Good morning, General Fox.

GENERAL FOX: Good morning, Your Honor. May it please the court, I am, as you mentioned, Tim Fox. It's my honor to serve the people of Montana as their Attorney General. I want to

acknowledge and welcome our colleagues from Wyoming, in particular, Attorney General Pete Michael. We are very pleased to have them here in Montana.

Your Honor, as Montana's new Attorney General I have worked hard to carry on the duties and responsibilities of this office, and part of that work has been continuing the excellent legacy and work of my predecessors. This case over the interpretation of the Yellowstone River Compact and the use of the waters of the Tongue River has been more than a legacy case than nearly any other case that my office has handled since I have become Attorney General.

As you know, Your Honor, former Attorney General Mike McGrath, now Chief Justice of the Montana Supreme Court, first filed this case, and then former Attorney General Steve Bullock, now governor of the State of Montana, carried on the fight for four more years. As our team has brought this case to the trial stage, I have spent a lot of time on this case. I have read many of our expert reports, I have conferred with the trial team, I have reviewed our pleadings, and I was pleased to meet Your Honor

in Denver at our summary judgment hearings. As the case has moved along, I have regularly updated my predecessors on the status of the case and have sought their advice. In these conversations with Chief Justice McGrath and Governor Bullock, we agreed from the start on the importance of this case to the people of Montana.

It is important because the water of the Tongue River and the Tongue River Reservoir mean everything to the farmers and ranchers long the Tongue, to the people of Birney and Miles City, and to the members of the Northern Cheyenne Tribe. I have heard the members of the Wyoming trial team tell this court that the amount of water in dispute is small and insignificant, and I have even heard them use the phrase, a monumental waste of time and much ado about nothing in characterizing Montana's claims.

Well, the amount of water isn't small to the rancher who is irrigating 200 acres of alfalfa, trying to raise enough hay to get his cattle through the winter. It isn't small to the farmer who is raising corn and melons and alternative crops trying to diversify agriculture in this state. It isn't small to the Amish

community that works day and night to continue a traditional way of life. And it isn't small to me or to my predecessors, who have invested thousands of dollars and millions -- excuse me, thousands of hours and millions of dollars over the past six years in this case. And to individual and very real Montanans this case is not much to do about nothing, and to some it's much ado about their very livelihoods and well-being.

Finally, Your Honor, I don't think it's small to you. This case certainly has not been a monumental waste of your time. And it is not been all about nothing to you. It is an honor to have you in our great state and to have your experience on these water issues brought to bear to solve the problem between two neighbors, two good neighbors, and to render a fair judgment that we can implement.

So before I ask my trial counsel, Mr. Draper, to go into more details about the evidence and arguments that you will -- that will consume the better part of the next two months, I would like to leave you with our two main goals for the outcome of this trial.

First, we desperately need a ruling to clarify the meaning of the Yellowstone River Compact that will help us get the water we are entitled to and will also give us a clear solution that Montana and Wyoming can implement together. You have seen some of the evidence and you will see much more about the chronic shortage of water in the Tongue River, particularly in drought years. And water is our lifeblood, Your Honor, and we cannot have a river management system where we ask for water that we are entitled to and the upstream state delays, denies, and continues to use that water. That loss for a few weeks or even a few days can mean the difference between an adequate crop and a ruined crop. It means the difference between feeding your cows all winter or selling part of your herd in the fall.

So whatever Montana's rights under the Compact are determined to be, the people of Montana are asking for a ruling that is understandable, practical, workable, expeditious in its practical application, and enduring.

The second primary goal of our trial, Your Honor, is to uphold the sanctity and

validity of the Yellowstone River Compact. In 1950 our three states, Montana, Wyoming, and North Dakota, worked long and hard to craft an agreement we could all live with. Congress ratified the agreement. The people of our states relied upon that agreement, and they still want to rely upon it.

I grew up not far from here, Your Honor. My parents were small business people. They did business on a handshake for many years. When they met a customer or a supplier whose handshake didn't mean anything, they required a written contract, though, frankly, that contract often was not much better. That person soon got a reputation and no one wanted to do business with them.

I don't honestly believe we have that situation here, Your Honor. Montana and Wyoming have been good and strong neighbors. We share the same way of life, the same diversity of mountains, and plains, the same rugged work ethic, and sense of fair play and honesty. We cooperate on many issues, and I look forward working together on many more, particularly with General Michaels. So I don't believe this is an

instance of a handshake that cannot be good. But we are at an impasse. We need your help. We have a solemn Compact that needs to be interpreted. We need to have clarity. Both states need to understand and live by its terms.

As it stands now, no call for water has ever been met by Wyoming, and the Compact Commission is unable to resolve disputes. Those situations must be remedied. So this agreement formed in 1950 needs to endure for generations as long as the water flows and the crops grow.

We know our future will look a lot like our past. We will have many more years of drought, we will have more floods. We will have more winter ice jams in the river and we'll have to repair the reservoir dam. And we will have more coal-bed methane or other ground water disputes. We want to know, Your Honor, that this Compact will work for both states, and that we could work out our disputes by its terms as clarified in this proceeding.

We don't want to have to come back for more, long, and costly litigation between neighbors who truly want to work together in harmony. So, please, Your Honor, give us a

ruling and interpretation that will stand the test of time and that will lead to cooperation and fair use of this amazing river system.

Finally, Your Honor, thank you for being here, for bringing this case to trial, and for bringing the trial to Billings so the people who are affected by this decision, one of which, I believe, is here, Mr. Art Hayes, can witness this with their own eyes and their own ears.

I'm going now to turn over the opening to my trial counsel, John Draper, and after that we'll allow the proceedings to go forward. Thank you, Your Honor.

SPECIAL MASTER: Thank you very much, General Fox.

Mr. Draper.

MR. DRAPER: Thank you, Your Honor. Good morning, again.

SPECIAL MASTER: Good morning.

MR. DRAPER: My thanks to the Attorney General. His presence here reflects the significance of this case for the State of Montana. We also appreciate the expert attention of the Special Master has devoted to this case. This is a historic occasion for the people of

Montana. It is the trial of its dispute with the State of Wyoming over the Tongue River Basin and the Yellowstone River Compact, a dispute that can only be resolved in this court under the Constitution and the Judiciary Act of 1789.

Montana entered into the Compact as an alternative to seeking an equitable apportionment in this court. Yet Montana over the 60 years since the approval of the Compact by Congress has never received a drop of water from Wyoming because of the Compact. And it never will unless ordered to do so by this court.

Wyoming has continued to allow its citizens to establish new water uses since the time of the Compact upstream of Montana without any protection of Montana from those new uses.

Wyoming claims that its internal water administration to protect its own senior water users has the practical affect to also protecting Montana's pre-compact uses. The evidence will show this is not really the case in many instances, and without this court's intervention, such disregard of Montana's rights will continue.

The court granted Montana's motion for leave to determine the extent to which Montana's

claim of the Compact violation might be justified. This trial will allow the Special Master, in the first instance, and the court, in the final instance, to make the findings of fact necessary to determine just that. In particular, Montana's evidence will show the following:

And I will just mention, very briefly, the witnesses that you now will begin to hear. The first is John Tubbs, Director of Montana's Department of Natural Resources and Conservation, commonly known as DNRC. He will testify as to how and why this case is important to the State of Montana.

The second witness will be Dale Book, our expert engineer and a veteran of prior Compact cases. He will describe his analysis of the water supply and water uses in the Tongue River Basin in Wyoming and Montana and quantify the ways in which Wyoming has violated the Yellowstone River Compact to the extent existing records make this even possible.

Our third witness is Chuck Dalby a hydrologist at the NRC, who will describe the hydrology of the Tongue River Basin.

Following him is Tim Davis, the

Administrator of the Water Resources Division, sometimes known as WRD, which is contained within the Department of Natural Resources and Conservation. He will describe how water is administered in Montana in general and in the Tongue River Basin in particular.

Following Mr. Davis, Millie Heffner will testify. She is Chief of the Water Rights Bureau in DNRC's Water Resources Division, and she will describe specifics of the regulatory requirements to initiate and change the surface water rights in the Tongue River Basin.

Following her Mike Roberts will testify. He is also from DNRC. He will describe the training provided by DNRC for the water commissioners who administer water rights during times of shortage.

Our next witness is Jack Stults, Administrator of the Water Resource Division of the NRC from 1997 to 2006. He will describe actions he took to try to force Wyoming without litigation to comply with the Compact and the refusal of Wyoming water officials to cooperate.

Next Keith Kerbel, a former regional office manager for the DNRC for responsibility of

the Tongue River Basin, will testify to issues of the Tongue River Basin is essential to the resolution of the issues before the court and the history of the interactions between the two states during this period.

Following him we will hear from Gary Fritz, former Water Resources Division Administrator, and Yellowstone River Compact Commissioner for Montana, who is expected to testify with regard to certain documents showing communications of the need for water and shortages because of overuse in Wyoming.

Following him Kevin Smith will testify. He is Bureau Chief of the State Water Projects Bureau. He will testify with respect to the state water reservoir project and, in particular, the Tongue River Reservoir project and its operations.

Following Mr. Smith, Art Hayes Jr., President of the Tongue River Water Users Association, will testify regarding operations of the Tongue River Reservoir and his own direct flow and storage water rights.

Following Mr. Hayes we will have the testimony of Gordon Aycock, an expert who is a

former official of the United States Bureau of Reclamation, an expert on dam operations. He is expected to testify with respect to opinions on the historical and current operations of the Tongue River Reservoir.

Following Mr. Aycock, Christopher Tweeten, the Chairman of the Montana Reserve Water Rights Compact Commission, will describe the Compact approach in Montana to determining Indian reserve water rights and, in particular, negotiations and adoption of the Northern Tribe Compact.

Following Mr. Tweeten, Jason Whiteman, a member of the Northern Cheyenne Tribe with experience in Tribal water issues, will describe the implementation of the Northern Cheyenne Tribe Compact.

Following Mr. Whiteman our expert Dr. Douglas Littlefield, the expert historian, will describe the context in which the Compact was negotiated with a special focus on the remaining issues regarding intrastate administration requirements.

Following Dr. Littlefield Rich Moy will testify. He is a former DNRC official. He is

currently a Commissioner of U.S. International Commission for Boundary Waters with responsibility for the boundary waters between the United States and Canada. He will testify to his communications with Wyoming officials concerning Wyoming's failure to provide water to Montana under the Compact.

Following Mr. Moy, Mike Whitaker, former superintendent of Wyoming's Division II, has been subpoenaed by Montana to testify regarding Wyoming's lack of regulation to comply with the Compact during his tenure and other features of Wyoming water rights regulation.

Following Mr. Whitaker, Carmine LoGuidice, Wyoming's current Division II Administrator. By the way, his name is spelled L-o-G-u-i-d-i-c-e. He is, as I said, the current Division II Administrator. He has been subpoenaed to testify regarding Wyoming's lack of regulations to comply with the Compact and other features of Wyoming water rights regulations.

Following Mr. LoGuidice, Bill Napp, a Wyoming water commissioner, has been subpoenaed to testify to describe the results of his research and tabulation of water rights,

including post Compact water rights and other aspects of Wyoming's administration in the Tongue River Basin.

Following him we have subpoenaed Dave Schroeder, also a water commissioner of Wyoming, to describe water regulation within his jurisdiction, including regulation of post Compact rights.

Following Mr. Schroeder a further water commissioner of Division II, Pat Boyd, has been subpoenaed to testify with regard to his responsibilities for lower main stem Tongue River regulation just above the state line to describe past and current water administration within his jurisdiction.

Following Mr. Boyd we have subpoenaed John Engels, the ditch rider for the interstate ditch which crosses the state line, as the name implies, and he has been subpoenaed to testify with respect to the operations of that ditch and lack of regulation of post Compact rights in Wyoming on that ditch.

Then we will call Tana Ankney, also a water user with post Compact rights in Wyoming, and we have subpoenaed to describe her water

operations.

The next witness is Greg Benzel, he is manager of the Padlock Ranch near the state line. He has been testified to testify to water operations of the Padlock Ranch, including storage of post Compact water for irrigation purposes.

Following Mr. Benzel, Tom Koltiska, K-o-l-t-i-s-k-a, a Wyoming water user and manager of Kearney Reservoir, has been subpoenaed to describe Kearney Reservoir operations and related issues.

Next we will have Dr. Richard Allen, one of our experts, a world-renowned expert in the consumptive use of water by crops. He will testify as to quantification of consumptive use of water by crops in Wyoming in two examples years based on Landsat satellite data.

Then we will call three commissioners, water commissioners, who have served in that capacity in Montana on the Tongue River, Allen Fjell, Charles Gephart, and Charles Kepper, to describe the process for administering water for irrigation in the Tongue River Valley in Montana and the water administration affected by them as

water commissioners.

We will also have Jay Nance as a witness. He is the owner of the number one priority water right on the Tongue River in Montana. He will testify regarding his experience with his water rights and state administration on the Tongue River.

Following Mr. Nance we will call Roger Muggli, he is secretary and manager of T&Y Irrigation District on the lower end of the Tongue River. He is expected to testify with respect to the T&Y water rights and water use, which is the biggest early use on the river in Montana.

Following Mr. Muggli we expect to call Les Hirsch, a prominent water user and former member of the Tongue River Water User Association. He will describe the water supply and irrigation conditions in his area.

Following him John Hamilton will be called, another prominent water user just above the T&Y diversion. He will describe water supply conditions and irrigation operations related to his farm and ranching operation.

We will then call Art Compton, a former

state official with the Montana Department of Environmental Quality, who will describe the industry in Montana and in that region and the Tongue River Basin in particular.

Finally, we will call Steve Larson, a nationally known ground water modeling expert, also a veteran of prior interstate water cases, who will testify with respect to impacts of pumping in Wyoming on surface water of the Tongue River in Montana.

There you have it, Your Honor. That concludes my opening statement, and I understand we will hear from Wyoming at this point and then we will be ready to call our first witness.

SPECIAL MASTER: Thank you very much, Mr. Draper. Let me just say for benefit of both counsel, that I'm perfectly receptive to having also a little bit of running guidance along the way as to what the next phase of testimony is likely to be, so feel free to provide short guidance to me when switching into a new phase as to what the witnesses coming up are going to be testifying about, because, obviously, this will be a long trial, and although I have a good sense of where, for example, Mr. Draper, you're taking

your case along the way, it will be very beneficial also in the middle of the proceedings also to have an understanding where you are planning on moving in any direction.

MR. DRAPER: Very good. Thank you, Your Honor.

SPECIAL MASTER: Thank you very much.

Good morning again, Mr. Kaste.

MR. KASTE: Good morning, Your Honor. May it please the court, Counsel, General Michael, General Fox, again, I'm Jim Kaste, Senior Assistant Attorney General, Wyoming State, with the State of Wyoming.

This case is a very simple breach of contract case, and the evidence Wyoming intends to put on in this case will show that Wyoming never breached its Compact with Montana. As in most breach of contract cases, the parties agree on a great many facts and disagree on a few. As a result, credibility will be key to sorting out the truth on those few factual disagreements. The evidence will show that Montana's credibility is more than a little suspect on some of these very important factual issues.

In particular, the evidence will

demonstrate beyond doubt that Montana never made a call on Wyoming before 2004 as a claim. For example, the evidence will be consistent with the unequivocal statement in the 2006 Yellowstone River Compact Commission meeting minutes that this was the second time that Montana made a call for water on Wyoming. A previous call was made in 2004. And yet we stand before you arguing about years that precede 2004. There is a credibility problem there.

Unlike this clear statement in the official record of the body charged with administering the Compact, there will be no evidence documenting any call prior to 2004. And there will be other examples of Montana's claims that are also incredible. Such as Montana's very recent assertion that the original capacity of the Tongue River Reservoir is now 72,500 acres. The documents that will be introduced into evidence from 1937 to the present, most of which were created by Montana, indicate that the original capacity of the reservoir was around 69,400 acre-feet. Uniform reports of this capacity can be found from the original report of Compact Commission to the expert reports filed by

Montana's own experts in this case.

Because the evidence will show unequivocally that Montana never made a call before 2004, Wyoming intends to focus its presentation on 2004 and 2006. The evidence will show that after the expenditure of untold sums and seven years of looking around Wyoming, Montana claims to have found a few hundred acres of land that was irrigated with post 1950 water. To put this in perspective, there are approximately 70,000 acres of irrigated lands in Wyoming, and the amount of water that is at issue in this case is less than than 4 cfs in any year in issue. And in reality, it's even less than that. When you hear the facts and witnesses, like Doyle Fritz, you'll learn that the amount at issue is even less than 4 cfs in any in any given year.

The size of Montana's claim alone shows that Wyoming does an excellent job of following the doctrine of appropriation and that this work ensures that Montanans pre-1950 rights are protected.

You will hear evidence that Wyoming has full time professional hydrographer commissioners

whose sole duty is to manage the water use on the Tongue River in a manner that comports with the doctrine of appropriation.

These hydrographer commissioners, including Bill Knapp, Pat Boyd, Carmine LoGuidce, and David Schroeder will testify in these proceedings and explain how they respond to the contemporaneous demands based on the river in Wyoming, how they ensure priorities receive the water they are entitled to, and how they track direct flows and priorities, reservoir releases, and return flows.

They will testify, also, how they can satisfy multiple rights using return flows and how important reusing water is to properly administering a river under the doctrine of appropriation.

And they will show you the extensive records they create to document these activities. You won't see anything of the sort from the folks testifying about activities in Montana.

Wyoming will show that Montana cannot prove any of the five essential elements of its claim. You will hear from folks in Montana how about Montana fails to ensure that it is meeting

its contract obligation to follow the doctrine of appropriation.

The evidence from these individuals, including Montana's water commissioners, will be that Montana did not compile information from which we could fairly determine that its pre-1950 rights were not being satisfied after May 18, 2004, or July 28, 2006; hence, Montana's reliance on a flow model created after the fact by its expert Mr. Book.

The testimony of Montana's water commissioners, Mr. Kepper, Mr. Gephart, Mr. Fjell, will show that their methods do not ensure diversions of natural flow were made in priority, that diversions out of priority were curtailed, or they even made an accurate distinction between natural flow, storage water, and return flows. And they did not ensure the prevention of waste.

Montana will point to certain arbitrary numbers, some from Mr. Book and some from Mr. Hayes, and assert that when flows fall below these numbers only certain paper rights were satisfied, and, therefore, no action had to be taken before it called Wyoming.

Wyoming will show in contrast through

the testimony of witnesses like Mr. Hinckley, that these numbers do not reflect reality, and one cannot assume from these numbers that any particular set of facts existed on the ground. As a consequence of Montana's failure to follow the doctrine of appropriation, it never took any action to ensure that post 1950 rights were properly curtailed before making calls on Wyoming in 2004 to 2006. And we all know that this Compact provides protection for both states. There aren't different rules for Wyoming than there are for Montana.

Next, Wyoming will show through the testimony of witnesses like Doyle Fritz, that much of the very small amount of post 1950 use in Wyoming identified by Montana, either did not occur or the use came from a different source, such as coal-bed methane production, not from the Tongue River. And in these few places that Montana has identified as receiving post 1950 water, Montana cannot fairly ascertain when the water was applied to those lands. The evidence will show that Mr. Book made no attempt to figure out when water was applied to these lands, and Mr. Allen will testify that he didn't either.

And it is a necessary prerequisite for success on their claim that this water was applied after this date of their call. They made no attempt to do so.

Similarly, Wyoming will show through the testimony of Dr. Schroeder that the impacts from coal-bed methane production are indistinguishable from zero. And that Montana skewed the BLM model that its expert Mr. Larson relied to inflate the estimate of impacts from coal-bed methane production. When that skew is removed, any impact from coal-bed methane production is so low as to be undiscoverable.

Finally, the evidence will show that even if Wyoming had curtailed these diversions in response to a call, it is improbable that any additional water would have benefited the farmers in Montana. You will learn that both at Tongue River Reservoir dam and downstream at times willfully and at times negligently Montana permits substantial amounts of water to go to waste. You'll see that flows, which aren't in dispute in this proceeding, into the Yellowstone River, sometime even during the irrigation season, are excessive, and more than enough to

dwarf the water claimed to be due from Wyoming. Of course, the evidence will clearly show that voluntary bypasses from the Tongue River Reservoir are the primary driver of Montana's water problems.

In contrast, you will hear from multiple Wyoming witnesses that these profligate bypasses would not be tolerated in Wyoming, and neither Wyoming, nor any state, adhering to the doctrine of appropriation would permit a reservoir to forego storage opportunities at the expense of its upstream neighbor.

You will also learn since this litigation began, Montana has changed its operational practices on the Tongue River Reservoir. And, to no one's surprise, has found itself in recent years with adequate water.

The evidence will also show that the small post 1950 diversions in Wyoming during 2004 and 2006 did not cause any harm to the Tongue River Reservoir or the downstream appropriators because the reservoir never ran out of water. There was always water available to help these farmers.

In short, you will learn that while

Wyoming is devoting substantial resources to ensure its compliance with the Compact, Montana has done little more than spill its water needlessly into the Yellowstone River only to return to its neighbor and demand that we pay the bill.

At the end of this case, the evidence will justify a complete dismissal of Montana's claim for breach of the Yellowstone River Compact. Thank you.

SPECIAL MASTER: Okay. Thank you very much, Mr. Kaste.

I should just check to make sure, I assume you do not have a opening statement for the State of North Dakota.

MS. VERLEGER: No, thank you, Your Honor.

SPECIAL MASTER: Thank you very much. Thank you very much for those opening statements. They were very valuable. And since I have the Attorney Generals from both states in this room, I just wanted to say two or three things. The first was, as both of you, I think, know extremely well, particularly Mr. Michaels, since he was actually lead counsel in this case for a

number of years, the teams of attorneys here have done exceptionally well in guiding this case so far; in particular, in getting this case ready for trial in such short order after the hearings on the motions for summary judgment.

The second thing is that the Supreme Court takes these cases supremely seriously. One of the most important responsibilities the United States Supreme court has is to resolve cases between states over issues such as interstate waterways, and so you can rest assured, that both I, and the court as a whole, will take this case seriously and will weigh all the various issues carefully before coming to a final determination. So thank you very much.

With that, Mr. Draper, you are welcome start your case in chief.

MR. DRAPER: Thank you, Your Honor. We would call our first witness, John Tubbs, and Attorney General Fox will perform the examination.

SPECIAL MASTER: Actually, before that, as I mentioned yesterday, there's a various joint exhibits that the two sides have put together. Is there going to be a motion at some point to

have those exhibits admitted?

MR. DRAPER: We can do that at this moment, Your Honor. I think we would jointly move for the admission of the joint exhibits that have been provided to you.

MR. KASTE: That's correct, Your Honor.

SPECIAL MASTER: Okay. Thank you. Then at this point I will admit into evidence all of the joint exhibits that the two parties have stipulated to. So those are, just for the record, that's the exhibits that are on the Joint Exhibit List numbered J-1 through looks like J-71.

MR. DRAPER: That would be correct.

SPECIAL MASTER: There's a J-72 mentioned, but I assume there's no actual document corresponding to that.

MR. DRAPER: I think that's true, Your Honor.

SPECIAL MASTER: Thank you very much.

(Received.)

Whereupon,

JOHN TUBBS,

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

DEPUTY CLERK: State your name and spell it, too, please.

THE WITNESS: My name is John Tubbs, T-u-b-b-s.

SPECIAL MASTER: Good morning, Mr. Tubbs. General Fox.

GENERAL FOX: Thank you, Your Honor.

DIRECT EXAMINATION

Q (By General Fox:) Mr. Tubbs, will you please provide for the record your full professional address.

A The address is 1625 11th Avenue, Helena, Montana, 59620.

Q Would you please briefly describe your post secondary education?

A I received an undergraduate degree in forestry from the University of Montana. And then a master's in economics, also from the University of Montana.

Q And what is your current professional position?

A I'm the Director of the Department of Natural Resources and Conservation.

Q And can you, please, for the Court, describe your previous professional positions

that you've held prior to the current one?

A My first position was as an economist in the Water Resources Division of the Department of Natural Resources and Conservation, which I held for approximately five years. I then transferred to the Energy Division for nine months as an economist working on gas transportation issues for the State. I was promoted to Chief of the Resource Development Bureau, where for 16 years I administered the grant and loan functions of the DNRC. And then, again, I had the opportunity to receive a promotion with what was the Water Resources Division Administrator for three years from 2006 to 2009. At which point I was appointed by President Obama as the Deputy Assistant Secretary for Water and Science of the Department of the Interior, where I served for three and a half years with Assistant Secretary Ann Castle and Secretary Salazar, overseeing the Bureau of Reclamation and the U.S. Geological Survey. And in January of 2013 I was sworn in as the Director of the DNRC.

Q Mr. Tubbs, have you had any direct involvement with the Tongue River Basin during

your time as a state or federal official?

A Yes, I have. Initially, as Chief of the Resource Development Bureau, I assisted the department in financing the local debt for the rehabilitation of the Tongue River Reservoir and its dam. I then provided through the grant program funding for research by the Bureau of Mines and Geology for the methane coal-bed development in Montana. When I was promoted to Administrator of the Water Resources Division I had line authority over the state water projects bureau, which manages all state projects, including the Tongue River Reservoir, and certainly updated on operational issues as well as litigation. And currently I'm the Director and also oversee the Water Resources Division and its functions.

GENERAL FOX: And with the Court's invitation earlier, and with your permission, Your Honor, I neglected to give the overview that you asked, but you are about to hear from Mr. Tubbs, through his experience as an administrator and state official and his experience with the Tongue River Basin a little bit about the importance of this case to the people of the

State of Montana in the context of his experience in the organization of which he is the administrator of the Department of Natural Resources.

Q (By Geneeral Fox:) Mr. Tubbs, you have in your possession an exhibit labeled M-232, do you not?

A Yes, I do.

Q And have you reviewed that exhibit in the past, and I'll offer it here in a moment.

SPECIAL MASTER: I think we need to toggle the screen a little bit so we can project them.

Q (By General Fox:) Everyone has it. Mr. Tubbs, have you am reviewed Exhibit M-232.

A Yes, I have.

Q And are you familiar with that exhibit?

A Yes, I am.

Q And is that an exhibit that's been generated by the Department of Natural Resources and Conservation?

A Yes, it is.

Q And is it true and accurate to the best of your knowledge?

A With minor changes, yes.

Q Okay. And as I understand it, the date of this particular exhibit is March, 2002; is that correct?

A 2012.

Q Excuse me, 2012.

GENERAL FOX: Your Honor, we would offer Exhibit M-232.

MR. KASTE: No objection.

SPECIAL MASTER: Then Exhibit M-232 is admitted into the record.

(Received.)

SPECIAL MASTER: And just to remind people for the future, if we can get one hard copy of each of these so that I can write on it, that would be fantastic.

MR. DRAPER: Your Honor, at your left hand in a box on the floor are exhibit tabs for each of the exhibits that will be referred to.

SPECIAL MASTER: Okay. Thank you very much, Mr. Draper. I have not spotted that box earlier when I sat down here. That will be very helpful. Thank you.

Actually, Mr. Kaste, is it okay if I use this particular copy?

MR. KASTE: Yes.

SPECIAL MASTER: Okay. Thanks.

Q (By General Fox:) Mr. Tubbs, can you explain for the Court what Exhibit M-232 is?

A Yes. It's an organizational chart showing the structure of the Department of Natural Resources and Conservation.

Q And where, sir, are you on this organizational chart?

A Right next to the bottom just above the governor.

Q And can you explain for the Court what your responsibilities are, Mr. Tubbs, as Administrator of the Department of Natural Resources and Conservation?

A Yes. We oversee the policy and budget for the department. Its four management divisions are the Trust Lands Division, the Conservation and Resource Development Division, the Forestry Division, and its Water Resources Division, as well as administratively attached commissions, including the Reserve Water Rights Compact Commission and the Board of Oil and Gas Conservation.

Q Mr. Tubbs, are those divisions and those administratively attached organizations

depicted on Exhibit M-232?
A Yes, they are.
Q And are the people -- are there people in the Department of Natural Resources and Conservation who have responsibilities related to the Tongue River?
A Yes, there are. Some of the key officials include Tim Davis, the Administrator of the Water Resources Division; Kevin Smith, State Water Projects Bureau Chief; Chuck Dalby, a Surface Water Hydrologist; Mike Roberts, who is also a hydrologist and trains court appointed commissioners in Montana; and if a water right change is necessary, Millie Heffner, the Chief of the Water Rights Bureau.
Q And do these individuals or their positions appear in the organizational chart depicted in Exhibit M-232?
A Yes, they do. And Administrator Tim Davis will go on to their duties in more detail.
Q Mr. Tubbs, is this case important to State of Montana and its people?
A Yes, it's very important.
Q Can you for the court explain why?
A Well, as this chart indicates, as a

state employee we serve the citizens of Montana. It's about people like Art Hayes, Roger Muggli, and the farmers and ranchers of the Tongue River Valley and their ability to continue farming and ranching in Montana. It's about neighbors getting to an agreement and receiving their water rights under those agreements. The Tongue River system in Montana is a very simple system. By the 1st of July in most years only two rights of direct flow are in force. Those neighbors can work together to make sure that they divert what is their water right.

The Tongue River Reservoir is a critical life line, a water supply that provides for late season irrigation throughout out the valley. That reservoir and its operation make it successful for farmers to continue living there.

Our irrigators have invested substantial sums of money in laser leveling their fields, investments in center pivots, to use every drop as efficiently as they can. Every acre-foot is important in Montana. It makes the difference between if you can eek out your direct flow rights to July 15th and not draw on your storage rights out of the reservoir, you might

get a third cutting. If you have to go to your storage right earlier, your crop in the end may not be there, and you may have consequences, as your opening indicated, selling cattle when you otherwise you would be over winter them.

So while some people would consider it a small amount, to the ranchers and farmers of the Tongue, it is very important.

Q And is there -- do you have any recollection or experience in the workings of the Compact and the Compact Commission?

A Montana's been very frustrated for a number of decades with the administration of this Compact. The Commission itself is ineffective in resolving those disputes. To my knowledge, Wyoming has not delivered a drop of water to Montana as administered by the Compact, and we don't expect Wyoming to deliver any water unless this court sets up a set of rules and directs the State of Wyoming to do so.

This interstate dispute will continue unless it is resolved in these proceedings.

Q Mr. Tubbs, what do you understand to be the primary objectives of the State of Montana in this litigation?

A First, to resolve this long term interstate dispute. To set up a set of applicable rules that are easy to administer; rules that are practical; rules where Montana's water right holders with pre-1950 water rights receive the water they are entitled to under the Compact; rules that can be enforced without our water right holders in the State of Montana appealing through the Commission. In short, we need an enforceable decree directing Wyoming to deliver the water we have a right to under this Compact.

GENERAL FOX: Your Honor, I have nothing further on direct. Would reserve the right to redirect in the event that Wyoming wishes to cross.

THE COURT: Thank you very much, Mr. General Fox.

Mr. Kaste.

CROSS-EXAMINATION

Q (By Mr. Kaste:) Good morning, Mr. Tubbs.

A Good morning.

Q We just met this morning, right?

A That's correct.

Q Okay. I think you said in the course of your testimony, every acre-foot is important to Montana?
A Yes, it is.
Q So Montana should be very careful with the water that's within its borders, should it not?
A Yes, we are.
Q All right. Now, I understand at some point in the past you served as the Water Resources Director?
A Administrator, yes.
Q Administrator, I'm sorry. From 2006 to 2009?
A Correct.
Q And during the course of that service as the administrator you had the opportunity to attend Yellowstone River Compact meetings?
A I believe I attended one.
Q Was that on December 6, 2006?
A I don't remember the date.
GENERAL FOX: Your Honor, I believe this is beyond the scope of direct.
MR. KASTE: He said he had knowledge of the Yellowstone River Compact and the Compact

Commission by virtue of his employment.

GENERAL FOX: Your Honor, I believe there was no mention to any Compact Commission meeting.

MR. KASTE: He said he had knowledge. He opened the door. He talked about his employment. I have a couple quick questions about his employment.

SPECIAL MASTER: So I'm going to allow these questions at this particular point, because I do believe he opened up the inquiry on this, and the alternative is actually calling Mr. Tubbs back to the stand later.

MR. KASTE: Thank you.

May I approach the witness, Your Honor?

SPECIAL MASTER: You may, Mr. Kaste.

Q (By Mr. Kaste:) I'm going to hand you Joint Exhibit 56. I apologize, it's not bound. That's the report of the Yellowstone River Compact Commission for 2006, correct?

GENERAL FOX: Your Honor, if we may have a moment to obtain a copy.

Q (By Mr. Kaste:) Am I right, that's the only report from the 2006 Yellowstone River Compact Commission meetings?

A It appears to be so.
Q On page IX of that report --
A Yes.
Q -- does it list the attendants of folks at that meeting?
A Yes; it does.
Q And are you one of those folks?
A I am.
Q Does that refresh your recollection about whether this was the meeting you attended?
A This must be the meeting I attended.
Q All right. Turn to the next page, please. About three quarters of the way down there's a sentence there in that report that says, this is the second time we made a call on Wyoming. We did this also in 2004. Do you see that sentence? One sentence all by itself, it's not part of a larger paragraph.
A Yes, I do see that sentence.
Q And I read it correctly?
A Correct.
Q Do you have a recollection of who made that statement at that meeting?
A No.
Q Well, maybe I can help you with that.

May I approach, Your Honor?

SPECIAL MASTER: Yes, you may.

Q (By Mr. Kaste:) Mr. Tubbs, I've handed you a transcript of those proceedings. It's not marked as an exhibit in this case, so you're not going to read it out loud. But would you turn with me to the page, you see a Bate stamp says WY 02716, should be about the eighth or ninth page in there?

A Yes.

Q The only one that has highlighting on it, correct?

A Correct.

Q If you would read for yourself the portions that I have highlighted and let me know when you're done.

(Pause.

A I've read them.

Q Does that refresh your recollection about who made the statement, this is the second time we made a call?

A According to this transcript, Commissioner Sexton.

Q Who is Commissioner Sexton?

A Commissioner Sexton is Mary Sexton, she

was the Director of the Department of Natural Resources and Conservation at that time.

Q Was she your boss at that time?

A She was.

Q Okay. Now, after she made that statement, did you go tug on her shoulder and say, boss, boss, that's wrong?

A I don't remember.

Q You don't remember. Did you have an opportunity to review these minute -- the minutes of this meeting before it was converted into the final report?

A I don't recall, but certainly would have seen e-mail traffic on it.

Q Do you remember anybody saying we should change that sentence, it's wrong?

A No, I do not.

Q Thank you.

MR. KASTE: No further questions, Mr. Tubbs.

SPECIAL MASTER: Attorney General Fox.

GENERAL FOX: If I may have just a moment, Your Honor.

SPECIAL MASTER: You certainly may.

REDIRECT EXAMINATION

Q (By General Fox:) Mr. Tubbs, you were asked some questions by Mr. Kaste concerning your involvement in a Compact Commission meeting; is that correct?

A That is correct.

Q And in particular he asked you about the statements concerning two formal written calls made to the State of Wyoming; is that correct?

A That is correct.

Q And to your recollection have there been other conversations between the State of Montana and Wyoming, and as you sit here today, are you aware of any such conversations in which Montana has made requests or expressed concerns concerning the delivery of water across the state line?

A Yes, as I was an employee of Rich Wein, in the Water Management Bureau and then his peer as the Chief of the Resource Development Bureau, I was aware of continued discussions within the department about concerns over Wyoming's delivery of water under this Compact for many years.

Q And as I understand it, the comment concerning the two written formal calls that are

in the transcript that Mr. Kaste referred to are comments by your former boss, Administrator Sexton; is that correct?

A That is correct.

Q And those were not your comments, correct?

A Those are not my comments.

Q And do you know whether or not those comments were made in the context contemporaneously with that meeting or historically over the entire length of the Compact since 1950?

A I don't know the answer to that.

Q In fact, Commissioner Sexton is not here today, so none of us know, correct?

A That's correct.

GENERAL FOX: Nothing further, Your Honor.

THE COURT: Thank you very much.

MR. KASTE: May I go again?

SPECIAL MASTER: You're fine.

MR. KASTE: I'm fine.

THE COURT: At this stage, then, Mr. Tubbs, you're excused.

And, Mr. Draper, if you want to call

your next witness.

MR. DRAPER: Thank you, Your Honor.

With that, I would call our next witness, Dale Book, Your Honor.

Whereupon,

DALE BOOK,

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

DEPUTY CLERK: Please state your name and spell it for the court reporter, please.

THE WITNESS: Good morning. My name is Dale Book, D-a-l-e, B-o-o-k.

DIRECT EXAMINATION

Q (By Mr. Draper:) Good morning, Mr. Book.

A Good morning.

Q What is your professional address?

A I am a consulting engineer with the firm Spronk Water Engineers, and that is at 1000 Logan street, Denver, Colorado, 80203.

Q I'd like to ask you a few questions about your background. And in that regard, I would ask everyone to turn to Exhibit M-5, which contains primarily your report of January 4, 2014, but at the back is your resume, the last

six pages. Looking at your resume, Mr. Book, would you briefly summarize your education and experience relevant to this proceeding?

A Yes. I am a civil engineer. I have a bachelor's degree in civil engineering from the University of Illinois. And I have a master's degree in civil engineering from Colorado State University. Both of those degrees are specialized in water resources. Since 1976 I have been a consulting engineer in the field of water resources engineering.

Q And in that regard have you worked in various consulting positions and founded an engineering firm?

A Yes. After working at three prior firms, in 1984 I was one of the founding principals of the firm Spronk Water Engineers. We are a water rights engineering firm practicing out of Denver, Colorado. We specialize in surface water supply, water rights engineering. We do work in a variety of states throughout the west doing work related to the prior appropriation system and water supply and water projects.

SPECIAL MASTER: So, Mr. Book, I notice

you have a glass of something in front of you, but if you need any additional water, was that even your glass there?

THE WITNESS: I'm not sure if it was.

SPECIAL MASTER: Why don't we get you some water.

THE WITNESS: I do have water, though.

SPECIAL MASTER: I see you do. I just wanted to make sure. I didn't see it cross the bench there. Sorry, Mr. Draper.

MR. DRAPER: Thank you very much, Your Honor.

Q (By Mr. Draper:) Can you give some representative examples of the type of work that you have performed in the past relevant to this proceeding?

A Yes. The work that I do relates primarily to the water rights acquisition and evaluation of water rights for various water users, primarily in the State of Colorado, but in other states as well. I assist in quantification of historical use of water rights which forms the basis for water rights changes, which are necessary in a lot of western states to obtain water supplies.

As part of that, I have developed, and my firm has developed over the years, a lot of experience in evaluation of irrigation use of water, since irrigation forms the larger component of use of water rights that form the basis for new water supplies.

In addition I have worked for municipal water providers both to determine water demands and water use characteristics and to develop plans to develop water supplies for municipalities. That work has primarily occurred within the State of Colorado.

We have what are termed plans for augmentation in Colorado, which typically involve the conjunctive use of ground and surface water, the combination of development of ground water as well as reservoir water supplies, and the basis, in a lot of instances, be changes of water rights from senior water rights that had a history of irrigation use.

As part of our work we are often involved in documenting both the historic use and development of irrigation as well as technical analysis of irrigation, irrigation management, things such as conveyances, losses, and

deficiencies and crop water use, things of that nature. Those are largely the technical issues that are involved in water rights engineering.

Q In the course of your career, have you had any experience with hydrologic issues related to interstate relations or interstate Compacts?

A Yes, I have, going back for a period of approximately 25 years I have been involved in several large interstate compact litigation cases. Two of those have been working for the State of Kansas. One compact was the Arkansas River Compact. This is a case that began back in the mid 1980s, and involved extended periods of trial, both on liability as well as remedy. My role in that case involved data collection, evaluation of consumptive use, mapping of irrigated area, preparation and development of hydrologic modeling to determine impacts of upstream use, as it related to the state line flow and the delivery pursuant to that compact.

I have continued to be involved in that compact in the post-trial phase, I refer that as the implementation of decree which was entered in that case. And that involves actively updating on an annual basis the hydrologic modeling that

was developed as part of that case of water uses in the State of Colorado. Those updates are performed annually.

I have been involved in the post-trial activities for the Arkansas River Compact now for about ten years, and continue to assist the State of Kansas in that. And that involves, in addition to the modeling, interacting with the state water officials from the State of Colorado as that Compact implementation moves forward.

In addition to the Arkansas River Compact case, I have spent considerable time working on the Republican River Compact, which is a Compact between the three states of Nebraska, Colorado, and Kansas. This was a case that was filed in the mid 1990s, and then was resolved by a stipulation which involved, among other things, the development of a basin ground water modeling to implement the settlement. I was part of the committee that developed that ground water model, which then became documents as part of that decree in the year 2003.

Since that stipulation and decree were entered, I have continued to be involved as the proceeding was renewed during the last several

years related to compliance and enforcement of the Compact, and moving forward with the trial, the case moved forward relating to both liability, remedy, and damages. I participated in that trial. It occurred last summer. And I continue to be involved in the other compliance issues with the Republican River Compact on behalf of the State of Kansas.

Q In those two interstate cases, were you accepted as an expert in water resources engineering and related subjects?

A Yes, I was. I provided expert witness testimony in both of those proceedings before special masters.

Q Is the resume that appears at the end of Exhibit M-5 a true and accurate representation of your experience?

A Yes, it is.

MR. DRAPER: Your Honor, I would offer Mr. Book as an expert in water resources engineering, water rights, hydrology, and hydrologic modeling.

MR. KASTE: I don't agree that it's necessary, but I don't object.

SPECIAL MASTER: Then you can proceed to

question the witness for his expert opinions.

MR. DRAPER: Thank you very much.

Q (By Mr. Draper:) Did you prepare a report, Mr. Book, in the context of this proceeding?

A Yes, I did.

Q Is that the report that makes up most of Exhibit M-5?

A Yes.

Q What were you asked to do by the State of Montana?

A I was asked to evaluate the water use in both of the states as it is relevant to and pertains to Article 5 A of the Yellowstone River Compact. Specifically, that related to the pre-1950 water uses and water rights in the State of Montana, and then to evaluate -- investigate the post 1950 uses within the State of Wyoming in the Tongue River Basin.

Q How did you go about performing those duties?

A I began by compiling the available information that had been compiled in public domain reports; compilations of water use records in each of the two states; evaluation of aerial

photography to determine irrigated acreage; evaluation of federal reservoir records as well as federal stream flow records to determine stream flow characteristics of the basin. I evaluated water rights information that was available from the two states for the water rights both within the State of Montana and the State of Wyoming.

Q I would like to direct your attention to Figure 1 of your report, and I believe that is one of the maps that is enlarged and standing here in the courtroom; is that right?

A Yes.

MR. KASTE: I think there might need to be a point of clarification. It's not an identical map.

Q (By Mr. Draper:) Would you describe what has been enlarged in its relationship to Figure 1.

A This map is a map of the Tongue River in the State of Montana extending from, on the bottom, the Montana-Wyoming state line, and Decker is indicated there at the state line next to a stream flow gauge indicator. The counties are indicated. There's three counties within the

State of Montana that are within the Tongue Basin, the Bighorn, Little Coyote, and Custer County.

The Tongue River is indicated with the blue line as well as tributaries within the State of Montana. The tributaries that are named are Hanging Woman Creek, Otter Creek, Pumpkin Creek.

The Tongue River Reservoir is located near the bottom of the map, just about 15 miles downstream of the state line, just downstream of Decker. The river then flows for approximately 180 miles from the reservoir down through various towns that are indicated on that map, down to Miles City. The towns indicated are Birney, Ashland, Bandenberg. Down near the bottom end of the basin near Miles City is also shown on the map, the location of the diversion and the upper reach of the canal, or the T&Y Canal.

SPECIAL MASTER: If I could interrupt for a moment, just go back to Mr. Kaste's question.

MR. KASTE: I withdraw that.

SPECIAL MASTER: The only thing that looks different to me is the emblem on the bottom left-hand corner.

MR. KASTE: Figure 1. There was a Figure 1 that I was looking at incorrectly. I apologize.

SPECIAL MASTER: Thank you.

Q (By Mr. Draper:) Mr. Book, is the enlarged version of Figure 1 the same except for its size as the Figure 1 that appears on page 45 of your report?

A Yes.

Q We also have an enlargement of Figure 2. I would ask you to describe that and confirm that this is an enlarged version of Figure 2 from your report, dated January 4, 2013, appearing on page 46.

A Figure 2 is a companion map showing the Tongue River Basin streams and basins, towns and reservoirs within the State of Wyoming. It picks up where the other map left off at the Tongue River Reservoir at the top of the map, and shows various tributaries within Wyoming, including the main stem of the Tongue River, which extends up from Decker through the towns of Ranchester and Dayton to the west, as well as the significant tributary Goose Creek, which includes Big Goose Creek and Little Goose Creek, which enters the

Tongue River just to the north of the City of Sheridan. Also, shown on this map is the Prairie Dog Creek out to the east side of the Goose Creek Basin, which flows into the Tongue River near the state line.

Also shown on this map in addition to the various tributaries, are a series of reservoirs at the bottom of the map there, which are high in the Tongue River Basin up above Sheridan. Those are a series of reservoirs which I have referred to as the Compact reservoirs. Those are a series of reservoirs which are documented what their pre and post 1950 storage capacity is in the annual Compact reports, and those reservoirs are named on this map. There's a more detailed map later in the report, which will show those in more detail.

Q Does this map show stream gauges?

A Yes, it does. There is a symbol indicated for various stream flow gauges.

Q That's the circle with black and white subdivision within the circle?

A Yes.

Q And are those gauges also indicated by their USGS number?

A Yes, they are.
Q Is that the unique way in which the USGS identifies gauges throughout the United States?
A Yes.
Q Does this map show any towns?
A Yes, this shows Ranchester, Dayton, and Sheridan in Wyoming. Decker is also noted here at the top of the map in Montana.
Q And Dayton and Ranchester are located on the main stem of the Tongue River over to the left side of the basin as we see it here?
A Yes.
Q I'd like to turn your attention to Appendix A of your report. Can you describe where that appears in your report and what it shows?
A Appendix A it begins on page 68 of the report. This is a compendium of air photos with the mapping of the irrigated area within the State of Montana. This set of maps contains 19 sheets. It is organized to go from the bottom end of the basin beginning at the diversion point for the T&Y Canal and it extends up to the state line up above the reservoir on sheet 19. This

set of maps, the irrigated area delineated for diversions out of the main stem of the Tongue River in Montana, it is based on 2009 aerial photography.

Q And how did you use this information in your analysis?

A This information was compiled to document what the currently irrigated area is within the State of Montana, taking water out of the Tongue River upstream of the T&Y Canal.

Q Let me turn your attention to Tables 1 and 2, and ask you to describe where they appear in your report. I believe it's page 26 and 27, if I'm not mistaken. What that data and information, what relationship that has to the work you did.

A Table 1 is identified on page 26 in the report, and this is a tabulation of the stream flow at the state line on the Tongue River at the Decker gauge. This extends for the period of record specifically for this Decker gauge, which begins in 1961. This is tabulation of monthly acre-feet of flow at the gauge. It is organized in a USGS water year format October through September, and this extends through the year

2007.

Q And this is from the gauge with the number indicated at the bottom of the Table?

A Yes, it is.

Q And that corresponds to the number shown on the maps we just looked at?

A Yes.

Q And the next page, Table 2, does that relate to what you were just describing in Appendix A?

A Table 2 is a tabulation of the irrigated area from Appendix A. This, again, is the 2009 based aerial photograph interpretation of the irrigated area located upstream of the T&Y Canal. And I've got the acreages listed between various reaches. I've got it segregated in four reaches. The total irrigated as well as partially irrigated off the photograph interpretation for that year was 14,380 acres. In addition to that, the T&Y Canal irrigated land from two different sources is indicated also on this Table, that's approximately 10,000 acres. I did not map the irrigated area for the T&Y Canal as part of this effort, but I note the irrigated acreage under two different sources, including

the 1914 Miles City decree, and the water resource surveys, completed by the State of Montana in the mid 1940s, what the acreages were that they had determined for the T&Y Canal.

If you combine the total, the 14,380 plus the T&Y Canal, that represents the amount of acreage actively served from Tongue River flows in Montana.

SPECIAL MASTER: Mr. Draper, if you don't mind, occasionally if I may have a clarifying question.

MR. DRAPER: I welcome them.

SPECIAL MASTER: Could you just quickly tell me the difference between irrigated an partially irrigated acreage?

THE WITNESS: Yes. The aerial photo interpretation -- interpretation involves judgment about what is irrigated, and some of the other studies in the Tongue River Basin, both in Montana and Wyoming, had separated partially irrigated from irrigated, partially irrigated meaning either the field does not appear to be fully irrigated at that given point in time, or the water supply does not appear to be complete. But, again, that's from an air photo

interpretation. So it's probably more generally related to specific fields where the coverage didn't appear complete over the field.

So this was our interpretation of part of the acreage from air photo inspection appears partially irrigated.

SPECIAL MASTER: Okay. Thanks.

Q (By Mr. Draper:) Mr. Book, did you also investigate irrigated acreage in the Tongue River Basin in Wyoming?

A Yes, I did.

Q Is the results -- do the results of that investigation appear in Table 3 on page 28 of your report?

A Yes, they do. On page 28, Table 3 is a summary of the irrigated area in the Tongue River Basin in Wyoming. This shows four different points in time, three previous studies, and the mapping that I did as part of this investigation. The last column to the right in this Table references 2006 is the mapping that I prepared for this report based on 2006 aerial photography and using the metric results, which I'll describe a little bit more later, but the metric ET mapping, which was prepared by Mr. Allen, was

used to help quantify the irrigated acreage in 2006.

The three other points are from prior investigations. Those are, starting from the left, the acreages that are considered to be representative of the acreage irrigated in the basin at the time of the Compact, or prior to the time of the Compact, pre-1950, this was a map -- a set of maps that was developed by the United States Bureau of Reclamation, and it corresponded to conditions in 1939 to 1942. The total as part of that mapping was almost 69,000 acres. The second study indicated here is from a State of Wyoming study, it is referenced in Footnote 2 on this Table, an inventory that Wyoming completed, and they quantified 64,000 acres irrigated at that time.

The third column in this Table is the what I have been referring to as the basin plan, it was a study that was completed for the State of Wyoming by HKM in about 2002, and they performed GIS-based mapping and classification of the lands in Wyoming and quantified the irrigated area based on their mapping at 70,000 acres. These are all considered comparable by me for the

total acreage in Wyoming.

The reason that the 2006 number is lower in this Table is due to water supply. After a series of dry years, some of the lands that had been being irrigated primarily as mapped in the basin plan were either not actively irrigated in 2006 or the metric results indicated partial irrigation.

I should clarify that the basin plan mapping that's referred to is 2002, that's when the study was published, but that mapping was actually based on 1996 conditions, which pre-dates the very dry years that we are talking about.

Q I should mention the basin plan to which Mr. Book is referring is joint Exhibit 58.

Is the information shown on Table 3, is that described in the body of your report at page 6 and shown in Figures 3-A and 3-B further back in your report. When I refer to 3-A and 3-B, I'm looking at pages 47 and 48.

A Yes. The analysis and the process that I went through to map the irrigated area in Wyoming is described on pages 5 and 6. The mapping of the irrigated area is shown on the

Figures 3-A and 3-B which are at pages 47 and 48 of this report.

Q Looking at Figure 3-A on page 47, could you describe a little more detail about what is shown there and how it relates to Figure 3-B on the next page?

A Yes. You are looking at now both Figures 3-A and 3-B, this is a two-part map. 3-A is on the north part of the basin from the state line down to just a little bit south of Sheridan, and then Figure 3-B is the upper part of the basin to the south of Sheridan primarily in the Little Goose/Big Goose Creek Basin as well as the upper part of Prairie Dog Creek.

What I have indicated on this map is in the dark green, the irrigated land which corresponds to the 61,000 acres shown on Table 3, and then I have also indicated another category of lands, the idle limited irrigation lands that were determined for this year.

The basis for this mapping started with the basin plan mapping that was developed as part of the 2002 HKM study for Wyoming, and then if additional parcels were identified as developed or irrigated, those were added to the coverage

that had been prepared as part of the Wyoming basin plan mapping. That combination forms the GIS coverage for this map, and then the lands were classified in either of the two categories that I've indicated.

The other thing that I've included on this map is some of the more significant ditches on the various tributaries. Those are in light blue, so you have to look a little bit harder to see those on the map, but there are a number of ditches that are included on this map.

Q Did you refer in your investigation to what's known as the Division 2 tab book as part of your work?

A Yes, I did.

Q The Division 2 tab book has been introduced into evidence as Exhibit J-63. We might turn to that for a moment, if you would. The document about two inches thick.

MR. DRAPER: And, I believe, Your Honor, you have a copy of that available. I guess it's on the side table, Your Honor, to your left.

SPECIAL MASTER: Okay.

MR. DRAPER: It's about two inches

thick.

SPECIAL MASTER: It's which number?

MR. DRAPER: It's next to the box, I understand.

SPECIAL MASTER: Go ahead.

Q (By Mr. Draper:) Mr. Book, do you have a copy of Exhibit J-63.

A Yes, I do.

Q Would you identify it, please?

A This is the 1999 tabulation of adjudicated surface water rights for Division No. 2 for the State of Wyoming.

Q What is included in the tabulation of adjudicated surface water rights, Division 2?

A This is the basic tabulation of water rights in Wyoming as of the time of the publication listing the various elements of the water rights that are adjudicated, including the aim of the original appropriator, the permit number; the priority date; the type of use; the amount, whether it's in cubic feet per second if it's a direct flow right, or acre-feet if it's a storage right; the number of acres served as well as a location of the point of diversion.

Q Is there an index in the beginning of

the tabulation book?

A Yes, there's an alphabetical index that starts on the third page of the exhibit and extends for some number of pages listing all of the sources of water.

Q I might ask you to turn to page 46 as identified in the upper right corner of each page next to the October, 1999 date. There are page numbers.

On page 46, which is part of the index, is the Tongue River listed on the left-hand side of that page?

A Yes, it is. It appears that that's referring to page 545 of the tabulation.

Q So if we turn to page 45 in this document as those pages are numbered in the upper right-hand corner, on page 45 do we see the listing at the bottom of that page identified as Tongue River tributary of Yellowstone River?

A Yes.

MR. DRAPER: Your Honor, did you find that?

SPECIAL MASTER: Yes, I'm following. Thank you.

MR. DRAPER: Great.

Q (By Mr. Draper:) Could you give us an example of the type of information by looking at this or a nearby page, Mr. Book.

A Well, just looking at the first record under the Tongue River, this is indicated under the permit number as a territorial right, which means the date predates statehood in Wyoming. You need to get down some number of lines further into the entries before you hit a permit number there, which occurs starting after 1890, I believe it is, partway down the next page. Anyway, back on the record. I was looking at the Tongue River No. 1 is the ditch on the Tongue River, in this case the appropriator was Mr. Henry Baker. The priority here is not listed as a date but as a season. It's spring of 1882 for use of irrigation, and the flow rate and acreage are indicated. Most, if not all, of these acreages correspond to 1 cfs per 70 acres.

Q So under the column cfs for Mr. Baker's right, 2.43 refers to the number of cubic feet per second that that right is adjudicated to take?

A Yes.

Q And the acres in that case are 170

acres?
A Yes.
Q And what is HGLOC refer to?
A Headgate location. And that's a township range, should be section township range.
Q And so for the pages following the one that you've referred to here is a listing of the water rights as shown in the tabulation Book?
A Yes, these are listed in order of priority on a source by source basis. So we are in the list now of appropriations from the Tongue River.
Q And would that be the main stem of the Tongue River?
A Yes. One thing I should point out, or additional thing I should point out, is that there will be numerous appropriations within a single ditch, and each of those appropriations are listed separately, but if you scan the list, you will notice that there are multiple entries for a ditch, and the total water right within any given ditch will be the water rights, the various water rights combined from this list.
Q And do the main stem rights continue from page 545 on through the end of page 550?

A Yes.
Q And then after that --
A The last entry on page 50 was a 1989 water rights right, the Addleman sprinkler.
Q And then on the next page you begin with other sources. The last page, 50, looking at the priorities there, those appear to be post 1950 water rights, all of them on page 550, for instance. Would that be a correct way to read that?
A Yes. The break between the pre and post 1950 happens to correspond to this page. So the first entry on this page is 1951.
Q Now, on this page I notice that in the cfs column that you described earlier a little bit to the right of the center of the page, there are some entries instead of a number, which would be the number of cubic feet per second, there is the abbreviation, S.S. What does that refer to?
A That refers to supplemental supply, and for those water rights which are permitted as supplemental supply, there is generally a note in the tabulation which indicates where the original supply was from. So, for example, in the first entry on this page, it's the enlarged interstate

ditch, and there are two components to this water right. The first is what I refer to as original appropriation, it's for 12 acres with the appropriation date April 23, 1951. And then there is a supplemental components of this water right and the note indicates that this is for a 35 acres on land that was served from the other source indicated in the note here, which is the enlarged grade water ditch, which takes water from Young's Creek. Young's Creek is a minor tributary on the north side of the river, very near the state line, and it enters the river around the service area of the interstate ditch, which is the ditch at the state line.

So in this example the water right includes supplemental supply which is an unquantified amount of cfs for use on this 35 acres.

Q And is that water taken from the Tongue River main stem?

A Yes, through the interstate ditch.

Q And we see several entries there related to the interstate ditch with the acreages that were added at the priority dates there. Are there other entries as you go down the page that

refer to the enlarged interstate ditch? For instance, about seven or eight or nine entries down, enlarged interstate or Pernoyer ditch, the appropriator Ralph DeLapp?

A Yes, that's a 1963 priority. I see about five entries there for the interstate or Pernoyer ditch on this page.

Q And the acreage is associated or shown in the acreage column on the right?

A Yes.

Q Did you utilize this tabulation in your work in this case?

A I consulted with this tabulation. I am aware of the status of the tabulation as 1999 status of the water rights. As I'll describe for the purpose of the specific tabulations that I made, I relied on a version of this tabulation that was prepared by Mr. Napp in the Sheridan office, where he developed a tabulation of the water rights in an electronic database, which was sourced from the tabulation, as well as other information.

Q Did you in your work, also, refer to hydrographer reports prepared in Division 2 in Wyoming?

A Yes, I did.
Q And is a set of those hydrographer records contained in Exhibits M-458 through M-480?
A Yes.
Q And that brings, as I understand it, the hydrographer reports from their inception in 1980 through 2005, and is the hydrographer report for 2006 identified as Exhibit J-62, in other words, a joint exhibit?
A Yes.
Q Do you have a copy of Exhibit J-62?
A Yes, I do.
MR. DRAPER: Your Honor, I believe you have a copy of J-62.
SPECIAL MASTER: I do.
Q (By Mr. Draper:) Is this an appropriate example of what are contained in the hydrographers annual reports?
A Yes, it is.
Q Would you describe what types of information appear here, particularly the types of information that you found useful in your investigation?
A Yes. This is an annual compilation of

data for Division 2. It is separated into two parts. It is prepared by the state water officials in the Sheridan office, or various offices related to that. It is separated between the Powder River drainage and the Tongue River drainage. Of particular interest for my work in this case was the data that was compiled for the Tongue River drainage. The water districts are listed on the third page of the exhibit, Bates number that ends in 885. This is a listing of the water districts adjacent to a map of the water districts, in particular we are interested in Districts 4 and 5, and District 11, which is the Prairie Dog drainage tributary basin.

The general information that's contained in these reports is stream flow records, diversion records for selected ditches, as well as reservoir records for selected reservoirs.

If you turn to Bates number 887, just a couple of pages in, that is a listing of the tabulations for the Tongue River drainage. For example, at the top this lists under Section 5 the reservoir records. This is a set of records that I relied upon for these various reservoirs,

which I refer to as the Compact set of reservoirs. There's a list that begins at Cross Creek Reservoir and ends at Saw Mill Reservoir. The information available for those reservoirs is included in these reports.

There are also stream flow records at various gauges maintained by the State of Wyoming that are compiled in this report. And then there are recorded ditch diversions for those ditches listed in Section 7. I think that's a summary of the types of information and data and records that are contained in these reports, which form the basis for a lot of the data that I have relied upon.

In addition to the data, there are short narratives for each of the two basins, the Powder and the Tongue. These narratives provide a general description of the water supply conditions in the basin for that given year.

Q If we could turn to page 92, please, I believe that's the page that begins the Tongue River drainage section of this report.

What is shown there?

A Did you refer me to page 92?

Q Yes.

A Yes, that's a map of the Tongue River Basin, which shows the various streams, tributaries. This is for the Goose Creek drainage on the right side, or the east side, as well as the main stem of the Tongue River. And for frame of reference you can see the towns of Ranchester and Dayton shown there, that's the Tongue River going through that. There are a couple of tributaries indicated on the north side, Columbus Creek and Smith Creek. There are gauge numbers indicated on this map which show the locations of ditch diversions and stream flow gauges where data are reported.

Q Are there the district numbers shown on this map?

A Yes. We are interested here in Districts 4 and 5. Any records related to Prairie Dog Creek are included, I believe, in the Powder River Basin earlier in the report.

Q I see. And District 6 is shown on this map. Is that of any relevance to our proceeding here?

A No, it's not. That's a tributary to the Bighorn River, not part of the Tongue Basin.

Q And do the numbers given specific

features on this map, are they related to the numbers shown on the next two pages of gauging stations and reservoirs?

A Yes.

Q And what follows that listing on page 95?

A On page 95, extending on to 96, is the narrative that I mentioned. In this case it's written by Mr. William Napp for this year describing the water supply conditions in the Tongue basin.

Q And then in the following pages we get into the detail of the reservoir records, stream flow records, and ditch diversions that you mentioned when we were looking at the Table of contents?

A Yes.

Q And then for your purposes of your work it was important to also look at Prairie Dog Creek, which is in the Powder River drainage?

A Yes.

Q And why was that important?

A Prairie Dog Creek is a tributary to the Tongue River and the water use in Prairie Dog Creek is relevant to this analysis.

Q Are there any immediate conclusions that can be drawn from this and similar tabulations with respect to the extent of regulation?

A The narrative that's contained in this report includes information either directly or indirectly that relates to regulation activities in the basin. I think most notably would be references to when reservoirs begin releasing during the year. The reservoirs up high in the basin, describe those in a little more detail later, but that kind of information is indicative when regulation begins in the Goose Creek drainage. Occasionally there will be some discussion or comments about dates of regulation in some of the dryer years. I don't particularly see one here in 2006. I know those in some of the reports such comments have been made.

Q And does it lead to any inferences or conclusions about the extent of regulation on the main stem of the Tongue River?

A Yes. The references to regulation that I have noted relate to the Goose Creek Basin. They don't document that water rights were regulated on the main stem of the Tongue River

below Goose Creek and up the Tongue and the north side tributaries.

Q You referred to a tabulation of water rights by Mr. William Napp, one of the water commissioners in Division 2. Let me turn in that regard your attention and the court's to Exhibit M-20. Mr. Book, do you have a copy of Exhibit M-20? If not, I have one that I could provide you.

A I don't believe I do.

MR. DRAPER: Your Honor, may I pass a copy of the exhibit to the witness?

SPECIAL MASTER: Yes, you may.

MR. DRAPER: Thank you.

Q (By Mr. Draper:) Mr. Book, what is Exhibit M-20?

A M-20 is what I have been referring to as the Napp tabulation of water rights in the Tongue Basin. This is indicated in the lower left-hand corner as an excel spread sheet. It's an electronic database. It contains generally the information from the tabulation that we looked at previously for the water rights, the adjudicated water rights. In addition, it contains some other information related to the

location of use. If you'll notice, there's a series of boxes out to the right which contain Xes in locations. That's the location of the water use.

Q When you referred to the earlier tabulation were you referring to the Division 2 tab book which is Exhibit J-63?

A Yes. There's more information on this -- in this tabulation. If you look at the second page, it's on the back of the first page, it's referred to as page 2 of 18. The record continues on. In addition to the information on the first page, it contains the source listed in the remarks, which are narrative descriptions of the status of the water rights, documenting the status of various transfers that have occurred. My understanding is that this narrative was developed by Mr. Napp from reading the underlying documents for the water rights or the records in the county courthouse that related to various transfers of these water rights. So in addition to the tabulation, this Napp tabulation contains information in the remarks column that is helpful as well as information about the location of use.

Q How does the first page relate to the

second page?
A When I printed out this tabulation, I kept the first, looks like about seven columns on the left-hand side, which contain information about the source of records, either from the county records or from the State's files. Those are referred to as the order book and page -- the order record, the certificate record, book and page, and the proof number, and then the permit number and the name of the ditch have been carried over. And then on the second page would simply put the source and the remarks. So the records are the same for two consecutive pages.
Q In other words, the second page is an extension, or shows extended material that was too far to the right to print on the first page?
A Yes, that's correct.
Q So the first, just to be sure we understand, the order record book is Book No. 1 and the page is 246?
A Yes.
Q And on the second page we see at the top of that page also order record Book 1 page 246, and that's the same water right?
A Yes.

Q And you've repeated a few of the columns that are at the left of the first page?
A Yes.
Q And what do we see on the third page?
A On the third page then starts a new set of records.
Q I notice that the first one on the third page, just for clarification, also has the same book and page number order record but it has a permit number of 776 as compared to the first we were looking at which was 772. Are those two different water rights?
A Yes, those are proof numbers that you were referring to. I think at the front of the tabulation there are territorial rights.
Q So the entry under the permit number is territorial?
A Right.
Q Are these in priority order, these water rights?
A Yes, by source. So each source is listed. It's similar to the way the tabulation is organized. It's first broken out by source and then from each source it's listed in order of priority.

Q And as we go down that list, the territorial designation under the permit number become actual permit numbers after statehood; is that right?

A Yes.

Q What in this tabulation was important for your work?

A This was a tabulation that I used to prepare a listing of all of the post 1950 adjudicated water rights in the Tongue River Basin in Wyoming and included as part of my report. And then that formed the basis for those water rights that were further evaluated.

Q So this information formed part of the basis for the tabulation in Table 3 in your report and the corresponding mapping in Figures 3-A and 3-B that we discussed earlier?

A I was thinking more in terms of the tabulation of water rights that we had prepared which follow up later, both the storage and direct flow water right permits.

Q What other information did you rely on for purposes of establishing the irrigated area in Wyoming?

A As mapped on Figures 3-A and B, I think

we've described most of the basis for that. It was a combination of the mapping that was available from the basin plan report, the aerial photography that I evaluated for 2006 conditions, and the metric ET mapping that was provided by Dr. Allen.

Q And you relied also on the HKM basin plan that you referred to earlier, Exhibit J 58?

A Yes.

Q Did you also rely on mapping by the Bureau of Reclamation?

A The Bureau of Reclamation mapping, that was the source of information that was shown on the first column in Table 3, it was the basis for the quantification that was made for the period prior to the Compact.

Q And was the basis of that mapping, the survey map of the Yellowstone River Basin by the Bureau of Reclamation dated 1944 which has been marked as Exhibit M-17?

A Yes.

Q Did you also rely for this purpose on the Banner and Associates report of 1985, entitled, Tongue River Level One Final Report that's been identified as Exhibit M-21 in this

proceeding?

A The information that was relied upon from that report was primarily the tabulation of water rights that were included in that report. There was a set of maps that were developed.

Q And did you also rely for purposes of your analysis on Exhibit M-22, which is the Wyoming Water Planning Report No. 7, Irrigated Lands Inventory for Wyoming, dated January, 1971?

A Yes, that is referenced in footnote No. 2 on Table 3, which is page 28 of my report, and I was simply citing the quantification of acreage that was developed as part of that study and reported in that report.

Q I'd like to turn now to your analysis of crop consumptive use in Wyoming. Do you describe that in your report beginning on page 6?

A Yes, I do, in a section of the report entitled, background, hydrologic and crop ET data. I have a description of the quantification of potential crop evapo- transpiration that I completed for this investigation.

Q In that process did you rely on either the stream flow data or the diversion data showed in appendices B and C of your report?

A Those are separate tabulations of data in Wyoming compiling information in Appendix C from the approximately ten ditches. Appendix B is a compilation of stream flow data.

Q And the Appendix C begins on page 105 of your report, I believe. Briefly, what does that contain and how did you use that data?

A Appendix C begins on page 106 in this report. The first page is a listing of the ditches. This is a compilation of the available diversion records, at least for ditches that have complete diversions reported from the annual hydrographer's report. I generally included in this tabulation the available period of record, which the available records generally started in 1971. This provides background information for the various ditches in the Goose Creek drainage basin in Wyoming.

From this information you can determine the variability of the water supply for the various ditches from year to year, as well as the season of use.

Q What methodology did you use in order to determine crop consumptive use? And you might explain for us, if you would, the term ET that

you just used.

A Yes, the crop ET was determined separately from a weather data, compilation of the weather data, and a method, analytical method to calculate potential crop evapotranspiration, based on the availability of weather data, the method that was selected was the Hargreaves method. This is a methodology that relies on temperature data only.

The results of this are documented in appendix D.

Q Which appendix?

A D.

Q D as in --

A B.

Q How do you spell Hargreaves, by the way?

A This is a trick question. I'll spell it the way I have it my report. H-a-r-g-r-e-a-v-e-s.

Q I believe that's correct. Turning to Appendix D, which is entitled, Crop Evapotranspiration, and ET is an abbreviation of that word, evapotranspiration; is that correct?

A Yes, it is.

Q And that begins on page 120 of your report; is that right?

A Yes.

Q And using Appendix D, would you describe how you went about applying the Hargreaves method to determine crop ET?

A Yes. We compiled available data for the period 1990 through 2011 at several weather stations, both in the Tongue and Powder Basin. There's a map shown on page 128 of Appendix D which is a listing of the various locations that weather data was available for. I did the potential evapotranspiration calculation for eight weather stations. The primary locations that I ended up relying upon for this analysis were the Miles City station in Montana and the Sheridan station in Wyoming.

The Hargreaves method is a daily time step calculation of evapotranspiration potential using max and minimum temperature. Typically, if you have more complete weather data, such as wind run, humidity, and solar radiation, then you would apply a Penman Monteith type analysis. In this case because that type of data did not exist for this study period, the Hargreaves-Samani

methodology was used that has generally been found to give comparable results to Penman, relying only on temperature data.

Q Just for the record, Penman Monteith, how do you spell Monteith? Another quick trick question.

A I don't know if I can refer to something for that.

Q How about M-o-n-t-e-i-t-h?

A That sounds right.

Q Then when you just referred to the Hargreaves method, you used the term Hargreaves-Samani, is that hyphenated reference to essentially the same method as the Hargreaves method?

A Yes, it is.

Q And the name Samani, is that spelled S-a-m-a-n-i?

A Yes.

Q I interrupted your description of how the information shown in Appendix D was used to apply the Hargreaves method to determine crop evapotranspiration. If you would complete that, that would be great.

A The last step in the calculation of

crop evapotranspiration incorporated the precipitation. When you're calculating potential evapotranspiration, that is a total of evapotranspiration, and when you're evaluating irrigation use, either crop demand or depletions associated with irrigation water use, it's necessary to account for the contribution of precipitation in meeting that crop demand. That is typically referred to as effective precipitation, and so the last step in this analysis was to incorporate precipitation data and make a calculation of effective precipitation to convert the total evapotranspiration to what we refer to as the consumptive irrigation requirement, or irrigation. That was done, also, for this analysis to result in the consumptive irrigation requirement at these stations for this period of record.

The analysis is conducted for several crops. The crops that were determined to be the primary crops in the two states are primarily grass and alfalfa in the Wyoming part of the basin, and as you move downstream and into Montana there becomes more corn included with the alfalfa and grass mix. The crops that we

quantified evapotranspiration for were small grains, corn, alfalfa and grass at these stations.

Q So the specific crop is a factor in your determination of the evapotranspiration?

A Yes, it is. There are -- the evapo-transpiration calculation is a basic calculation driven by the weather data, but then as an integral step in that calculation is a crop coefficient, which is developed through research and is different for various crops and different for the various parts of the season. The calculation is done on a daily time step, and so there's a varying crop coefficient that is published and applied on a daily basis for each of the crops.

Q And is a crop coefficient needed in order to convert a reference crop evapotranspiration into the specific evapotranspiration associated with a certain crop other than the reference crop?

A Yes, it is.

Q What are the typical reference crops used?

A Either alfalfa or grass.

Q So these methodologies, like the Hargreaves, produce, first, a reference ET, and then you have to convert that using a crop coefficient to your particular crop mix?

A Yes, that's correct.

Q All right. And you have shown examples of the type of data you used in applying the Hargreaves method in Appendix D; is that right?

A Yes, Appendix D is a compendium of the data and the calculations and the results.

Q We've been talking about what's contained in Section 3.1 of your report, which is on pages 6 and 7. The other heading under crop ET is metric analysis. Would you describe that part of the work that you did?

A Yes. This is a satellite imagery based quantification of crop evapotranspiration, as well as just generally evapotranspiration not limited to a crop. This is an analysis that was performed by Dr. Richard Allen for two years within the State of Wyoming. The two years at issue in his quantification are indicated on page 7 of my report, which is a short description of the analysis that Mr. Allen -- or Dr. Allen performed and will be testifying to. He

quantified the evapotranspiration for the two years, 2004 and 2006.

This result is comparable to the total evapotranspiration that I was describing with the Hargreaves method, and it's before any adjustment for precipitation contribution to those values. I indicate on page 7 of my report that in addition to providing the evapotranspiration results, which comes in the form of database that you can map, Dr. Allen also provided what he terms background ET rates, which would be the evapotranspiration rate based on precipitation only. That information, then, I used to convert the evapotranspiration rates to a comparable value to the consumptive irrigation requirement. In other words, the consumption of irrigation water.

Q And why did you rely on Dr. Allen's work in addition to the Hargreaves analysis that you provided?

A When you calculate the potential crop evapotranspiration and convert that to consumptive irrigation requirement, that is only the first step in a quantification of irrigation depletions. The essential step in that analysis,

after you quantify a potential, is to determine what the actual was based on water supply and what the available water is to satisfy the crop irrigation demand. In this basin in Wyoming in the types of years that we are looking at, there were parts of the basin that did not receive a full water supply due either to limited water supply under water rights or due to limited stream flow, which resulted in the actual evapotranspiration due to crops being less than the potential. If you had a full and complete set of records, either through records maintained by the agency, or some other way to determine the amount of water diverted and applied to the fields, then you could conduct a water budget analysis with standard assumptions to quantify the amount of consumptive use, which would be less than the potential.

In this case we had metric results available which incorporated the actual water supply, and on a parcel-by-parcel water-right-by-water-right basis, then you were able to determine what the actual supply limited evapotranspiration was in these two years. Based on the location of where we were looking in the

basin and the availability of records, limited records for the water rights that we were looking at, I concluded that the metric analysis provided a viable way to determine the parts supply consumptive use.

Q And when you say parts supply consumptive use, do you mean the actual consumptive use?

A Yes, the actual, which would be, in some cases, not all cases, supply limited. So what the metric does is it gives you've an integrated result over the entire season. Again, Dr. Allen can give you the specifics, but I believe he was integrating an entire year's worth of information from January to December. I'm interested in the irrigation season, of course, which in this situation is primarily May through September or October. But the metric analysis will give you an integrated result over the time frame that you're compiling the data and processing the data.

Q How does potential evapotranspiration, which I think you're call PET, how does that compare to actual ET?

A It's the upper limit. Now, you will

find certain situations, because ET is variable and the calculation of potential evapotranspiration is, of course, based on the scientific derivation of those formulas, and there is a variability once you get out in the real world. So you may see metric results that from time to time exceeded the calculated potential evapotranspiration. But in concept, the potential is the maximum amount of evapotranspiration, and then water supply limited irrigation will result in less evapotranspiration actually occurring.

Typically, the season -- the irrigation season is basically May through September. The runoff occurs in May and June, and then stream flows start to drop off in July. Then depending on the seniority of your water right and the source of your water right, your water supply late in the season is going to depend on the type of year you're having and where you're at in the basin. If you're on a small tributary, those streams will drop off, or you won't have water late in the season, in which case the crop evapotranspiration will basically end in July, accounting for some soil moisture carried

forward.

Other places in the basin where the ditches have reservoir supply and senior water rights on flowing streams, they can continue irrigating through the season. The diversion records that we looked at on Goose Creek indicate some of those ditches will have a fairly stable supply through the season in most years, which would be through September.

Q Did you use in your application of the methodologies provided by Dr. Allen, did you utilize the reference evapotranspiration calculation software for FAO and ASCE standardized equations that we have identified as Exhibit M-29?

A Yes, I did.

Q And how did you use that?

A That's a basic software package that allows you to input weather data and generate potential evapotranspiration from a variety of equations. That was basically developed by Dr. Allen and maybe some associates of his. We used that to do the calculation for Appendix D.

Q And do you show the results of that work in Figures 4-A and 4-D in your report?

A Figure 4 in the report, which is a set of maps beginning on page 49, is a plot of the metric results that were developed by Dr. Allen. So what I have done on these figures is present a banded mapping of the results, and the metric ET results are shown on lands that were mapped as either irrigated or previously irrigated lands, and then this shows the results broken out in five bands, color coded. These are the same map layout as on the irrigated area mapping, and it's using the same GIS coverage as the irrigated area mapping. It simply displays the metric results by location for the two years. Figure 4-A and 4-B are for the year 2004. Figure 4-C and 4-D are for the year 2006.

Q So there are four maps that make up Figure 4; is that right?

A Yes.

Q They cover two years, and each of the two years has a map corresponding to the two maps that we see as Figure 3-A and 3-B that we talked about earlier?

A That's correct.

Q And how did you use this information in your investigation?

A This is the source of the information that I used to apply to the post 1950 irrigated area for those parcels in Wyoming that I identify and describe later. The quantification of evapotranspiration and irrigation consumptive use were taken from the metric results.

Q Now, on page 8 of your report you have headings 4.0, pre-1950 water use in Montana, and under that 4.1 irrigation development, what analysis did you do with regard to those subjects?

A As I previously described, I documented the actual irrigated area in Montana, which is shown in Appendix A, and tabulated the irrigated area for various reaches shown on Table 2.

Q And did you rely in that regard on the document which has been identified as Exhibit M-16, entitled, Water Resources Survey, Montana State Engineer and State Water Conservation Board, History of Land and Water Use On Irrigated Areas for Big Horn County, Rosebud County and Custer County?

A Yes, I did.

Q And that's dated 1947 and 1948; is that right?

A Yes.

Q Also, in your report on page 8 you have a section entitled, Tongue River Reservoir. Would you summarize the information that you gathered and the analysis that you made with respect to Tongue River Reservoir as set out in that section?

A Yes. The Tongue River Reservoir was operational as of 1939. This is used primarily for irrigation water supply in Montana, serving the users between the reservoir and Miles City. Current capacity of the reservoir is approximately 79,000 acre-feet. The reservoir stores water during the winter and runoff season, and then is relied upon for late season supplemental irrigation supply, primarily through the management and operation by the Tongue River Water Users Association. Virtually all of the acreage divert water out of the Tongue River has access through reservoir through contracts, including the T&Y Canal which serves approximately 10,000 acres at Miles City. I tabulated the hydrologic data for the reservoir that is on a set of tables beginning on Table 4-A on page 29. I have tabulated the storage

contents of the reservoir on a monthly basis for the period of record through 2008. In addition, I tabulated the reservoir balance of outflows, inflows stored, and releases from the reservoir for the period 1987 to 2007.

Q And how are those tabulations designated?

A Tables 4-A through 4-E, these are all expressed in acre-feet. As will be described by others, the reservoir was enlarged in 1999, so on the Table 4-A I include averages for the period of record as well as post '99 averages after the reservoir was enlarged.

The Table 4-B is a tabulation of the reservoir outflows, which is simply the stream gauge below the reservoir, so this is the physical flow out of the reservoir, and there's a graph on the bottom which shows the monthly distribution of these outflows in acre-feet. It shows that the pattern applies, you know, over a range, ranging from the maximum to the minimum. The peak outflows generally occur in June, and then May, June, July are the most significant months of water flowing out of the reservoir.

Table 4-C is a tabulation of the amount

of water that was stored. This is based on my interpretation of the records of inflow, outflow, and reservoir content. So I've included a graph at the bottom of that Table also which shows the monthly distribution of when inflows are stored in the reservoir. By storage, I mean accrual to storage in those months.

Table 4-D is a calculated number of water released from storage. So that is distinct from the Table 4-B, which is the reservoir physical outflow. This is calculated actual release of storage. So you can see that the primary months of releases are July, August, and September, which is representative of the use of the water for irrigation, late season irrigation, as was described.

Table 4-E is a tabulation of bypasses. And this is the amount of inflow passing the reservoir.

MR. DRAPER: This might be a good place to break, Your Honor. It's exactly noon. According to the schedule, you wanted us to follow, it's time to break for lunch.

SPECIAL MASTER: That will be fine.

So why don't we then adjourn for the

lunch hour. So we will start up again at 1.

GENERAL FOX: Your Honor, with Your Honor's permission, I would like to excuse myself for the remainder of the day. I would like to come in on occasion. Again, thank you, Your Honor, for your time and effort.

SPECIAL MASTER: I appreciate your being here this morning. And I'm sure as Attorney General you probably have some other things you also have to attend to.

So we will, again, be back in session at 1 p.m. I'll actually use this great gavel here.

(Recess.)

SPECIAL MASTER: I understand that security downstairs is particularly good at its job?

MR. DRAPER: Yes. They are being very thorough.

SPECIAL MASTER: Okay. So, Mr. Draper, you can continue your direct examination.

Q (By Mr. Draper:) Thank you. We will figure out the courtroom sooner or later.

DEPUTY CLERK: When you're ready, do you want to tell me when you're ready to display?

Q (By Mr. Draper:) Looks like we've got the screen working.

Good afternoon, Mr. Book.

A Good afternoon, Mr. Draper.

Q Just before lunch we had begun to hear about your analysis of Tongue River Reservoir. Would you pick up where you were? I think you were you were ready to describe, if I'm not mistaken, Figure 5 on page 53, although I don't actually see the page number. It's the page between 52 and 54 in your report. What is Figure 5?

A Figure 5 is a bar chart plot of the maximum content at the end of the month for Tongue River Reservoir for the period of record, 1940 through 2008.

This chart specifically shows for the period that I have been concerned about, for the years after the enlargement and repair on the spillway at the reservoir, that the reservoir did not fill in the four years, as indicated by the bars not achieving the 79,000. Those are the years 2001, 2002, 2004, and 2006.

SPECIAL MASTER: Again, just as a matter of clarity, so this shows the maximum amount

stored in the reservoir over the entire storage year from November to October?

THE WITNESS: Yes, that's correct.

SPECIAL MASTER: Okay. And for 2008, that would be November, 2007, through October, 2008?

THE WITNESS: Yes.

SPECIAL MASTER: Thank you.

Q (By Mr. Draper:) Do you draw any conclusions from this bar graph?

A Just those that I just stated about the reservoir not having filled in those four years. And in the other years, since the year 2000, it did achieve a fill.

Q Let me direct your attention two pages later to Figure 7, page 55. What is shown on that and does it relate in any way to Figure 5?

A Figure 7 is a plot of the state line flow at the Decker gauge showing the average monthly values. These are monthly acre-feet that are plotted. And also shown, in addition to the average, are the four specific years that I just mentioned showing what the monthly flows at the state line were. It's apparent from here the flows for these four years were significantly

less than the average for the runoff season, April through July.

Q And is the Decker gauge located at or near the state line?

A Yes.

Q And how did you use this to do your analysis or to illustrate your analysis?

A This illustrates the state line flows for those years when the reservoir did not fill, that there was a significantly reduced available flow in the river.

Q Let me turn your attention, if I may, to Figure 6 on the page before, page 54. What is shown on Figure 6?

A Figure 6 is a comparison of the wintertime flow at the Tongue River Reservoir. It shows the combined flow for the months of November through March for two different time periods. The first is the pre-1950 for the years prior to the Compact, from the time when the reservoir was operational, starting with water year 1942. And the second period is for the years since the enlargement and repair of the spillway was completed, for the year -- starting in the year 2000 through 2006. This is a

comparison of the reservoir outflow during these five months of November through March, comparing the reservoir outflow and the reservoir inflow as represented by the state line flow. So that's the Decker gauge on the X axis. And these are totaled for the season, for the five-month season. So the plot is of the total values listed in the Table below the plot.

This shows the outflows at the reservoir for the pre-1950 period in diamonds, ranging from approximately 70,000 acre-feet on the low end, to one year it was up to 108,000 acre-feet. I'm comparing that with the symbols for each of the individual years for the post-2000 period, showing that the outflows over that period were less.

Q And what does this graph allow you to conclude?

A This is indicative of the operation of the reservoir prior to 1950 during the winter months as to how much of the inflow was passed through the reservoir unstored.

Q And it allows you to compare it to the period after the reservoir enlargement?

A Yes.

Q And --
A Each of the four years that I just discussed are included in this set of years.
Q And so what does is the comparison shown in this graph tell you?
A This demonstrates that the wintertime bypass or pass-through the reservoir since the year 2000 has resulted in comparable quantities of water passing through the reservoir in the winter months as had occurred prior to 1950.
Q So it's a comparison of the period in question here versus the pre-Compact period?
A Yes.
Q And what is your conclusion about that comparison?
A That the operations in this post-2000 period are comparable to the operations that were occurring during the winter prior to the Compact at the reservoir, as it related to pass-through.
Q Let me turn your attention now, if we concluded everything important with respect to your Tongue River Reservoir analysis, I'd like to go on to the direct flow demand section of your report that begins at the bottom of page 9. Could you describe how you went about making your

analysis with respect to direct flow rights?

A Yes. The purpose of the analysis was to make an estimate of how much water is needed in the river to supply the demands for direct flow water for pre-1950 water rights in Montana. This was done on the basis of an irrigated acreage above the T&Y Canal at the time of the Compact, and I relied upon the acreage that was delineated in the county surveys that we discussed earlier this morning to quantify that acreage.

The full demand for pre-1950 water rights includes the T&Y Canal diverting near Miles City, which has a specified water right of approximately 187 cfs for the 9900 acres that are irrigated under that canal, plus the direct flow rights for the -- direct flow water rights that exist between the state line and the T&Y Canal. For the purposes of this analysis I used the duty of water on those water rights that I obtained from the Miles City decree, which was a 1914 decree of water rights in Montana which had set water rights at the rate of 1 cfs per 40 acres.

Q How did you do that analysis and how did you reach your conclusions?

A The analysis was done, rather than simply assuming that the demand for all of the direct flow water rights is equal to the sum of the water rights, I made a calculation to account for the existence of return flows, and I also developed a monthly calculation which allowed for some reduction of the water rights for the months of May, June, and September.

The analysis was done for the months of May through September. I assumed that the full amount of the water right calculated, as I previously mentioned, was the measure of the demand for the two peak growing seasons, month of July and August, and used lesser amounts for the months of May, June, and September. I then made a calculation of the amount of return flow in the stream that would assist in satisfying a demand for direct flow diversion to partly reduce the amount of water that would be indicated as needed flowing into the system at the reservoir.

I've provided the detailed calculations for this analysis in Appendix E.

SPECIAL MASTER: Do you have a page number?

THE WITNESS: Starts on page 265.

Q (By Mr. Draper:) The title page for Appendix E is on 264?
A Yes.
Q And what does Appendix E contain?
A Appendix E contains a set of background information and tabulations calculating through the steps that I made to calculate the direct flow demand. The analysis considered the consumptive use demand for the acreage between the reservoir and the T&Y Canal, to estimate based on a diversion rate the amount of water that would be returned to the stream. Another component of the analysis was to compute the lagged effect of return flows to the stream, so that return flows were determined to occur over a schedule that is delayed from the time when the diversions occur. So the calculation was simply to determine how much water was necessary at the top end of the system at the Tongue River Reservoir in order to supply a series of diversions between the reservoir and the T&Y Canal, including the T&Y Canal.
Q What assumptions did you make about return flows?
A I made a calculation based on the

characteristics of the irrigated area along the Tongue River as it relates to the distance from the stream, based on the irrigated area mapping that I had done to make a calculation of the delayed return flow pattern that would occur when water is applied to the irrigated lands. This allowed me to compute a response function, which I then applied to the seasonal diversions that I was applying to the land. I separated the reach into four reaches. These are shown on page 273 of Appendix E. It's Appendix E-6. I have reaches that include -- a short reach above the reservoir and then three reaches between the reservoir and the T&Y Canal headgate. And then the demand at the T&Y was for the amount of the water right for the T&Y.

As part of the calculation of the return flows I determined the crop distribution for the three counties included in Montana. This is described on Appendix E-5, page 272, to developing crop distribution, which then allowed me to calculate a composite consumptive irrigation requirement based on the analysis I described this morning using the Miles City and Sheridan weather stations. This allowed me to

compare the amount of water assumed to be diverted in this analysis with the crop demand and compute the return flow associated with that, such that the diversion minus the crop consumptive use is equal to the return flow.

Q How does the return flow occur physically?

A As deep percolation from the lands back to the river.

Q When you say deep percolation, are you talking about water that goes into the ground water system and then discharges from the ground water system into the river?

A Yes, seepage from the ditches and the irrigated land to the river.

Q So a return flow that occurs by seepage and deep percolation is kind of the opposite of a depletion due to ground water pumping?

A Yes, it is. It's return flow and accretion to the stream.

Q So you're counting ground water flow that adds to the stream; is that right?

A Yes.

Q And you're reducing the demand that you otherwise calculate at the state line by those

ground water-induced additions to the stream?
A Yes, that's correct.
Q Are there other parts of Appendix E that should be brought to the master's attention?
A Yes. On Appendix E-7, page 274, this is a plot and table of the calculated consumptive irrigation requirement based on the combination of the Miles City and Sheridan weather stations for the crop distribution that I determined here. This indicates -- for this study period of 1987 to 2007, indicates a consumptive irrigation requirement ranging from 20 to 21 inches. That's a pretty standard consumptive irrigation requirement for this area for the crops that are grown. And this shows the monthly distribution of that, as well.
Q And, again, what is the consumptive irrigation requirement?
A That's the total crop evapotranspiration and subtracting out the effective precipitation to result in the amount of irrigation water that's consumed by the crop.
Q Please go ahead.
A On page 276, Appendix E-9, is a plot of the response function that I computed to apply to

the return flows. And this is shown both in a monthly response function in the top graph and a cumulative curve on the bottom graph, which shows the effect over the ensuing months of these return flows. This was based on characteristics of the formation along the Tongue River in Montana.

Q And do these graphs, again, show the ground water discharges to the river that you counted in your analysis?

A Yes. These graphs are referred to as unit response functions, and so they are applicable to varying amounts of water at a monthly time step. So the calculation is to compute a unit response function based on the aquifer characteristics and the distance, and then to apply that to the amount of return flow to compute the timing of the return flow back to the stream.

Q And that's the return flow, again, through the ground water system?

A Yes.

Q Please go ahead.

A On Appendix E-10 on page 277, this is data related to the T&Y Canal. It's referred to

in this table as the Tongue and Yellowstone Canal, and these are the diversions for the records for the years 1997 through 2005, actual diversions by the T&Y Canal. This shows the total quantities as well as the monthly distribution. This canal has been operated historically over the months of May through October. I show a monthly distribution of those diversions on the bottom. The peak months tend to be July and August.

I think that's the primary information. The results of the calculations are shown on page 11 of the report.

Q Is the table on page 11, is that taken from Table No. 5 on page 35?

A The corresponding demands are listed on the bottom of Table 55. That's correct.

Q And would you describe the results that you obtained through that analysis that are shown on Table 5 and in the smaller Table on page 11 of the text?

A Yes. As I mentioned, the calculation was done on a monthly time step and the demands for the direct flow water rights were reduced in the months of May, June, and September from the

total amount of the water right.

Just to repeat, the amount of the water right was determined as the sum of the duty of water for the acreage above the T&Y Canal at 1 cfs to 40 acres, plus the 187 cfs for the T&Y Canal. This, then, was considered to be the demand for diversions in this reach, and then the calculation was made to determine how much water would be necessary flowing at the state line in order to satisfy these direct flow demands downstream at the levels used for each month.

For example, for the month of May I used a 55 percent of the water right amount as the basic demand, and then determined how much water would be necessary at the state line to satisfy that. That result is 195 cfs.

For the month of June I used 90 percent of the water right amount, and the amount necessary to satisfy that would be 325 cfs.

The total of the water rights were used for the months of July and August. The calculation for July is 350 cfs, and that can be compared to the total of the water rights, which is something in excess of 450 cfs, which is what you get when you combine the T&Y Canal plus the

duty of water for the balance of the acreage.

The reason that July is larger than August, both of those were calculated at the full water right demand because the return flows tend to increase as the season goes by, and so the amount of return flow available for diversion is increased later in the season.

These figures on page 11 represent the amount of water that would be necessary to satisfy the direct flow pre-1950 rights in Montana as determined at that duty of 1 cfs to 40 acres, if there was demand for all of that water, if there was a full demand occurring.

Q You mentioned different percentages of the rates that you used in different months. What was your reason for changing the percentage from month to month?

A Typically, when you look at operations of ditches, and specifically if you look at the T&Y Canal diversions that we looked at on page 277, what you'll typically see over the irrigation season is what I refer to as a bell-shaped curve. Peak operations tend to occur in the middle of the irrigation season. If you look at the upper limits of the T&Y Canal

diversions during June, July, and August, there are some months where the full month of diversion is up at the full water right amount of 187 cfs. Diversions during the shoulder months of May and September are typically at lower amounts, and so these estimates were based on my judgment of the pattern of diversions.

Q And the pattern of diversions you're referring us to is on page 277, Appendix E-10, the graph showing average monthly acre feet diverted?

A Yes.

Q And that's the historical pattern for the T&Y water right?

A Yes.

SPECIAL MASTER: So, Mr. Draper, if I could ask one or two quick questions. So the first one is on -- I missed the percentage that you used for the month of May. And this is in the table on page 11.

THE WITNESS: Yes. Those percentages are actually shown on page 280, which is Appendix E-13, and I have a block of data in the center of that page which shows the demand percent.

SPECIAL MASTER: Okay. Thank you. And

then the second question is: So for the non-T&Y diversions, for the direct flow demands, there those were calculated figures. Was it also a calculated figure for the T&Y, direct flow demands?

THE WITNESS: The analysis is based on the water rights. So it's a calculation of what the -- how much water would need to be in the river in order to satisfy the amount of the water right, the direct flow water right. So for the T&Y, I used 187.5 cfs, and for the other acreage above the T&Y I used the 1 cfs to 40 acres for the amount of acreage that was documented in the survey at the 1950 edition.

SPECIAL MASTER: But the table on Appendix E-10, which is on page 277, those are the actual --

THE WITNESS: Those are historical diversions on a --

SPECIAL MASTER: In the --

THE WITNESS: -- monthly basis.

SPECIAL MASTER: I'm sorry. I interrupted you. You were saying that it's the historic diversions on a monthly basis?

THE WITNESS: Yes.

THE COURT: For the years shown?

THE WITNESS: Yes.

Q (By Mr. Draper:) Let me turn your attention, if you are finished answering the Master, to Table 5. This relates to the smaller table that you've directed us to on page 11 of the report, but it shows more information. What is shown here?

A Yes. Table 5 is a comparison of these monthly demands for direct flow rights for the months of May, June, July, August, and September, with the actual mean monthly flow in the gauge at Decker, at the state line gauge. And this is a comparison which shows by shading the months when the mean monthly flow is less than the calculated demand. This provides an indication of how the demand for direct flow water in Montana compares to the flow at the state line over the season.

Q And the blue shading indicates what?

A Those are months when the demand exceeded the mean monthly flow historically, comparing the historic flow at the gauge with the calculated demands.

Q Under those conditions, what does that mean as a practical matter?

A That means that during the months of May and June, which are the runoff months, there's effectively enough water coming into Montana to satisfy the direct flow rights. These are the months when storage is normally still occurring in the Tongue River Reservoir, meaning that there's enough river flow to satisfy direct flow rights, and there's generally, not always, but generally not a need to release storage water in those months.

July is the month which is approximately half the time when flows are below the calculated demand. July would be the peak demand month for irrigation. July is also the month when the runoff starts to drop off in most years. July will typically be the month when the flow is declining by the steepest amount, over the month of July. Then by the time you get to August, the hydrograph is flattened out. By the time you get to August here you see that the state line flow is pretty much normally below the calculated demand for direct flow rights.

Q There's one year in which all of the months are shaded; is that right?

A Yes. That's 2004.

Q And what does that mean, that they are all shaded?

A The maximum mean monthly flow at the state line in that year was -- actually occurred in May, but it was less than 200 cfs. It's 192 cfs. Less than the demand even for the month of May here. It's very close to the demand for the month of May.

Q And there are some years that have no shades; is that right?

A Yes, that's correct. Those are probably extremely high flow years where the hydrograph held up. Those would be considered unusual years.

Q Those are 1968, 1978, and 1998; is that right?

A Yes.

Q So what overall conclusion did you draw from the analysis shown in this graph, or this table?

A This generally confirms what I have been told consistently, the way the Tongue River operates in Montana is that the hydrograph and the runoff is sufficient to satisfy the direct flow water rights during the runoff season of May

and June, and then when you get to July and the demand increases, typically they will start releasing water out of the reservoir to compensate for shortages to the direct flow rights. In other words, you need to supplement your direct flow diversions with storage water to at least some users in the basin. The calculations that I did here and the comparison of those calculations to the historical data support that information about the operation of the reservoir.

Q And is there an implication whether the direct flow rights are being satisfied when releases start to be made from the reservoir?

A Releases would occur at times when the direct flow rights are not being satisfied. It may not be universally across the entire set of water rights, but that's the general situation, is that the stream has declined enough that the direct flow rights, some direct flow rights are being shorted. It just depends on how much water is in the stream compared to the demand. But somewhere along your list of water rights there will be a shortage and unavailable for other water rights that are more junior down the list.

Those correspond to times when additional water at the state line would provide additional water available to direct flow rights.

Q And you've been referring to direct flow rights. Is that all direct flow rights, or just pre-January 1, 1950, direct flow rights?

A This calculation was done for pre-1950 water rights, the level of water rights in Montana at the time of the Compact.

Q So the water rights you analyzed here do not include any water rights with priorities after January 1, 1950?

A Yes. I'll describe later in more detail the analysis I did of specific water rights. This calculation was done on the basis of pre-1950 acreage using the duty of water of 1 to 40.

Q Let me ask you to turn to page 56 of your report. You have there a Figure 8-A, and that page and the following pages contain certain figures labeled as frequency curves. What do those show?

A This series of figures is a comparison of the monthly demand with the frequency of the flow for any given month. So Figure 8-A

corresponds to the month of May, and this just graphs up all of the daily data for the month of May and shows where the demand -- calculated demand falls on that graph. So, for example, the May demand of 195 cfs is exceeded during the month of May 97.4 percent of the time.

If you go to the next page for June, that flow rate is exceeded 90.3 percent of the time.

When you go to Figure 8-C, for the month of July, that was the one I indicated is about half the time. The calculated demand of 350 was exceeded approximately 50 percent of the time.

And Figure 8-D is for the month of August. That's, again, a comparison of all the daily flows in that month with the calculated demand, showing that the flow rate was exceeded 8.5 percent of the time.

And, finally, September is also shown on Figure 8-E, and that flow rate was exceeded 19 percent of the time.

Q And is the information shown on these frequency graphs consistent with the shading shown on Table 5?

A Yes, it is. It's just a different way to display the results of comparing the demand and the state line flow.

Q So, in other words, if we take Figure 8-A, which has a 97.4 percent exceeded rate, if I'm saying that correctly, corresponds to the May column on Table 5, which is largely unshaded?

A Yes. The percentages won't work out exactly because one table is comparing mean monthly flow and another one is tabulating all of the daily data. So you won't get the same percentage. It's two different ways to look at the results.

Q But they are generally consistent?

A Yes.

Q So looking at page 11 of your report and the heading there 4.4, what generally were the conclusions that you drew regarding pre-1950 uses in Montana?

A With respect to the pre-Compact water right for the Tongue River Reservoir, the test is was that water right fulfilled or satisfied during the year, and for the four years that I identified that the reservoir had not filled after the improvements on the spillway and the

enlargement were completed, in those four years depletions due to post-'50 uses in Wyoming reduce the amount of water available for storage that could have been stored in the reservoir.

With respect to the direct flow demand, what the analysis shows is that in most years, in about half of the time during July and in most years in August and September, the state line flow is insufficient to satisfy direct flow rights in Montana, meaning that pre-1950 water rights would benefit from additional water at the state line under those conditions. So those are periods of time when post-'50 uses, to the extent they are occurring in Wyoming, would have an effect on the availability of flow to those direct flow water rights.

Q Did you analyze post-1950 depletions in Wyoming?

A Yes, I did.

Q This, I think, is discussed beginning on page 12 of your report. Would you generally describe how you conducted that analysis?

A Yes. The analysis consisted of three aspects. Analysis of reservoir storage in Wyoming as it related to post-1950 storage, and

within that there were three different categories of storage that were considered based on the availability of information and the nature of the use of those, as well as the magnitude.

The second aspect related to direct flow uses by post-1950 permits for irrigation. That was limited to a certain part of the basin for quantification purposes. It was limited to the areas where Wyoming had not regulated surface water rights for the benefit of Wyoming water users, particularly in the Tongue main stem, the lower tributaries on the Tongue, and Prairie Dog Creek.

The third aspect that I investigated related to use of ground water in the basin and potential impact of post-Compact ground water use. Again, that was separated into two different categories. The first was any uses of ground water for irrigation or other uses from the shallow aquifers in the basin; and the second related to impacts to stream flow of coal-bed methane.

Q And would you describe each element of your analysis in a bit more detail, please?

A Yes. The analysis of reservoir

operations, the first category is what I have referred to as the Compact reservoirs. And I have a tabulation of those reservoirs on Table 6, which is page 36 of the report. And these are reservoirs for which storage amount is reported by the State of Wyoming in the hydrographers' reports. There are 11 reservoirs total, of which not all but some of them have a mix of pre-1950 and post-1950 capacity as reflected in the priorities. I simply adopted the priority date as the basis to allocate capacity between pre and post 1950.

Table 6 lists each of these reservoirs and provides the priority dates as well as the permitted capacity on each one of those.

The first one listed on the top is Bighorn Reservoir, as an example. The last two priorities are 1960. Those are the post-1950 priorities. So that means that the Bighorn Reservoir had a split between pre and post-Compact capacity in the ratio of those two, or of those water rights between pre and post.

At the bottom of that table I have summarized the pre and post capacity for all of these reservoirs. It's 14,000 acre-feet of

pre-1950 and 10,000 acre-feet of post-1950.

Q Could we take a look, since we visited Park Reservoir on the basin tour, could you describe how that series of priorities works out? I think that's shown just below the middle of the table.

A Yes. There is the approximately 7300 acre-feet of pre-1950 priority capacity with this reservoir, meaning something just under 4,000 acre-feet of post-1950 capacity in this reservoir.

Q And there are a number of increments by which the storage capacity was increased over the years?

A Yes. This also happens to be the largest reservoir of the group.

Q It has a total of 11,000, approximately, acre-feet of storage out of a total of 24,000; is that right?

A Yes.

Q In round numbers?

A That's correct.

Q Let me ask you to look at Figure 9 of your report on page 61 in this regard. What is shown on page 61?

A This is a map at a larger scale from the map that we looked at this morning in Figure 2. This shows in more detail the upper part of the basin with these reservoirs located.

Q And where does Park Reservoir appear on that? I think it's also called Big Goose Park Reservoir.

A Yes. That's located right in the center of the map.

Q A little bit right of center there?

A Yes.

Q So these are the reservoirs, by and large, that are contained in the table that we were just looking at?

A Yes.

Q And did you determine whether any depletions were being caused -- post-1950 depletions -- by virtue of storage in these reservoirs?

A These reservoirs that include post-1950 storage tend to exercise enough storage in most years, if not all years, that some of the storage accrues to the post-1950 use on capacity. The available information on these reservoirs is a little bit limited because of access to the

reservoirs. In the hydrographers' reports, basically the maximum amount of storage is reported each year, which is generally determined in either May or June as the reservoirs become accessible.

In addition to that, at the end of the year the reports include the amount of carryover, again, total for the reservoir. So it's possible for each of these reservoirs to determine, based on if and when they filled, or how much they filled, if they didn't totally fill, and the amount of carryover to determine the amount of water that was stored each year. The depletion calculation relates to the amount of water that was stored in these reservoirs and allocated to the post-1950 priorities.

Q How did you determine whether to allocate storage to a pre-'50 right in the reservoir as opposed to a post-'50?

A The amount of carryover is recorded each year for these reservoirs, and the carryover then is allocated to either pre or post 1950. In this situation I assumed that the carryover would be allocated first to the post-1950 water right, meaning that the pre-1950 water is the first

water used from the reservoir, and subsequently the first water to be refilled into the reservoir, for those reservoirs which had pre and post-1950 capacity. So the convention that I used was to assume that the carryover was assigned to the post-1950 priority. And so this maximizes the amount of storage that accrued to the pre-1950 water right.

Q Is that analysis consistent with standard engineering practice, in your experience?

A The situation with reservoirs with multiple priorities can tend to be variable depending on the documentation in the reservoir and ownership of space in the reservoir. If you have a reservoir with multiple priorities and a single user, typically the water right for that situation -- and I'm speaking in general now -- would be allocated the same way that I have done, where the senior water right would be the first water considered to be used, meaning the carryover would be assigned to the more junior priority.

Q Did you perform --

SPECIAL MASTER: We'll be getting to

this in a moment. Just so I know, so in the years in which one of the reservoirs did not fill totally, how there do you allocate between pre-1950 and post-1950?

THE WITNESS: The storage was assigned first to the pre-1950 up to the amount of the pre-1950. And I can show you that through the table that I put together where I show the assignment. But it went first to the pre-1950.

SPECIAL MASTER: Okay. Thank you.

Q (By Mr. Draper:) Which table is that, do you know?

A That's actually in Appendix F, which is at page 283.

Q So Appendix F starts on page 282, with a title page, and then which table are you referring us to?

A The first table in that Appendix is Appendix F-1, and this is a template of the analysis that I did for each of the reservoirs that has post-1950 storage capacity based on the information I just described about the carryover and the amount of water stored during the year. This analysis begins in 1981. I developed allocations of storage for each of the years 1981

through 2008, and I have -- Appendix F contains the backup for this, which is the detailed calculations. The reservoirs that are listed are only those reservoirs that have post-1950 storage.

This table, just to go from left to right across the table, the first contains the amount of the relative water rights for each reservoir, the pre-Compact and the post-Compact, as well as the total capacity in column C. The total carryover from the prior year is listed in column D. And then the assignment of the carryover between the post and the pre capacity, post-1950 and pre-1950 capacity is next shown, being assigned first to the post and then to the pre.

Q Can you walk us through an example of how you specifically did that on one of the reservoirs?

A Yes. For 1981, I'll look at the Bighorn Reservoir, which has both pre and a post. The total carryover for the year was zero. Going into the year it had been emptied. So the available pre-Compact space is the full amount of the pre-Compact, 2750.

The next column, H, is the actual reported information for that year. It is the maximum content. And then after column H, you allocate the storage. First, you determine the amount stored from the maximum content, and that's the maximum content minus the carryover. That gives you the total stored during the year. And then the last two columns, J and K, are the assignment of the amount stored during the year to pre-Compact and post-Compact.

So in this year on the Bighorn the reservoir was filled and it was allocated to both pre and the post-Compact based on the amount of storage capacity in each. That was a relatively simple calculation.

For each of these years I then total the pre-Compact storage and the post-Compact storage over these reservoirs so you can see how the amount of post-Compact storage compares, for example, with the amount of the post-Compact storage capacity. So for this year, 1981, the post-Compact storage total for these reservoirs was 3,388 acre-feet. The post-Compact capacity for these reservoirs is 8,144.

Q Just before we leave the Bighorn

example in the second line of figures, is it true that you assigned inflows to pre-Compact up to the maximum available pre-Compact storage space, in that case of 2,750 acre-feet, and then whatever was left over was assigned to post-Compact storage?

A Yes.

SPECIAL MASTER: Just one quick question before we move on. I could probably figure this out if I sat down and looked at these more closely, but I notice that the bottom line capacities for these tables in Appendix F do not seem to total the same as on page 36. I assume with respect to the pre-1950 capacity that it might reflect the fact that you don't have those reservoirs on here that are purely pre-1950 rights. But it's not clear to me why the post-1950 water rights don't total the same.

THE WITNESS: Yes, I was just noticing the same thing myself.

SPECIAL MASTER: Again, the post-1950 rights increase over time. So you would expect -- because some of those rights did not come in until the late 1980s and 1990s, but you still never get up to the 10,000 figure.

THE WITNESS: Yes, that's correct. I don't have the answer for that right now. I was just comparing the data with my table.

SPECIAL MASTER: No reason to address it right now if you don't know the immediate answer to that. My guess is you'll probably still be on the stand first thing in the morning. So if you could clarify that point, that would be great.

Thank you.

Q (By Mr. Draper:) Mr. Book, in your analysis of the so-called Compact reservoirs, did you draw any conclusions from that analysis?

A I should point to one more table. This is the overall summary, which is Table 7 on page 37 of the report. This shows the summarized post-1950 storage for all the years that I analyzed. One conclusion I draw from this is that this is a routine aspect of these reservoirs with their blend of pre and post-1950 storage as it relates to their exercise in use each year. So in every year there is consistently some post-1950 storage that occurs. The storage that occurs would occur during the storage season, which would be some combination of storage during

the wintertime as well as during the runoff. The exact allocation of when storage occurs in these reservoirs is not documented because of access to the reservoirs. There are not records which extend month to month across the winter and the spring. So we don't know when the storage accrues in these. The best we can do with these records is that we know storage does accrue sometime between the time when the releases stop and when the reservoirs reach a fill and start being operated for releases.

Specifically, the years that we've evaluated with respect to the Tongue River Reservoir are shown here, 2001, 2002, 2004, 2006. This provided the basis of the quantification of impacts from these reservoirs for those four years.

Q Are you referring to Table 8?

A Yes, Table 8 is one more step in the process. It has one additional element it. On Table 7 what is summarized there is the amount of actual storage that occurred in each year.

Q And what does Table 8 add?

A There was one more step in the analysis that I conducted, and that was to make an

estimate of the amount of what I term post-1950 return flow. Each of these reservoirs has a use. Most of them are used for irrigation supply, supplemental irrigation supply, during the season after the runoff drops off and the Wyoming canals start using the water out of these reservoirs. Based on the allocation of storage, I was able to discern between the pre-1950 storage and the post-1950 storage and, again, using the same convention, that water is first -- first water used is pre-1950 and then subsequently post-1950, I was able to determine the amounts of releases of post-1950 water.

The purpose of that analysis was to compute how much return flow was generated from the use of the post-1950 water for irrigation.

Q And why did you make that determination?

A On Table 8, page 38, I have determined the amount of return flow based on the calculations that I have made for the return flow that would accrue during the wintertime. This would be return flow back to the stream, the Goose Creek and Little Goose Creek streams. I have segregated that out between estimated return

flows during the wintertime, which would impact state line flows, and return flows during the irrigation season, which would impact -- and by impact, I mean add to the supply of other ditches in Wyoming. The amount of return flow that I determined to accrue in the offseason, or during the winter months, is shown on column 2, and I have netted that off of the amount of storage that occurred.

Q And how did you use that information?

A The last column in that table is what I'm using as the net effect at the state line, which is the post-1950 storage reduced -- yes, reduced by the amount of post-1950 return flow that would be in the stream during the times of the year when it would accrue to the state line. The storage that occurs here is occurring at times when water rights in Wyoming are generally satisfied. That's the way the priority system works. Storage accrues when the reservoirs are in priority, meaning that the storage, if it hadn't occurred, would have been available downstream.

Q So did you draw any general conclusion with respect to the impact of the post-1950

storage and Compact reservoirs?

A Yes, for the four years at issue here, that are itemized here, these are the quantities of storage, as well as post-1950 return flows, which would result from releases from these reservoirs to produce a net effect at the state line.

SPECIAL MASTER: Excuse me. When you said these figures, which figures are you referring to?

THE WITNESS: The Table 8 figures.

THE COURT: Column 3?

THE WITNESS: Yes.

SPECIAL MASTER: Thank you.

Q (By Mr. Draper:) Did you also analyze the Wagner and Five-Mile Reservoirs?

A Yes, I did.

Q How did you go about -- well, first of all, what are the Wagner and Five-Mile Reservoirs?

A These are two reservoirs that are located along the Tongue River near the north end of the basin, near the state line. These are reservoirs -- in the case of the Wagner Reservoir, it is primarily post-1950, although

not totally. And with respect to the Five-Mile Reservoir, I believe that is all post-1950 storage. On these particular reservoirs additional information was obtained through deposition of the ranch manager. These reservoirs are used on the Padlock Ranch, which is located north of the Tongue River near Ranchester. The reservoirs are used to irrigate about 2000 acres of land.

Q Is that shown on Figure 10, page 62 of your report?

A Yes, Figure 10 is a detailed map showing the location of the reservoirs and the irrigated area that is served by these reservoirs. As I mentioned, this area is located near Ranchester north of the Tongue River. This shows the detail of the property relative to the Columbus Creek and Five-Mile Creek. This is land that's irrigated with center pivot sprinklers and the sole source of supply is from the reservoir, supply for this ranch. Information was obtained through deposition for the amount of water available and used from storage for the two years. That was used as the basis for the amount of water used by these reservoirs for the two

years.
Q So Figure 10, the circles, those are center pivots?
A Yes.
Q And the water for those center pivots comes from where?
A The two reservoirs.
Q That's the Wagner Reservoir shown center left, and the Five-Mile Reservoir, top right of that Figure 10?
A Yes.
Q And is most of the storage rights in these two reservoirs post-Compact?
A Yes, virtually all of the storage is post-1950.
Q What analysis did you make of the water uses associated with the Wagner and Five-Mile Reservoirs in these post-Compact center pivots?
A The primary analysis was to document what the irrigated acreage is. It's something on the order of 2000 acres. And then, based on the information provided at the deposition, to determine how much water had actually been available in the reservoirs and released for irrigation. The reservoirs apparently did not

fill in the two years that I had information for, which was 2004 and 2006. So there was something less than a full amount of the reservoir capacity that was available and used that year. Based on the available information about the amount of water that was available for irrigation and used, I made a calculation of the consumptive use of that water by multiplying the amount of water delivered as irrigation supply times an efficiency appropriate for center pivot sprinklers.

Q What is the efficiency appropriate for center pivot sprinklers?

A 85 percent is the value that I used, based on my judgment.

Q What conclusions did you draw with respect to the Wagner and Five-Mile Reservoirs on the Padlock Ranch?

A Well, first of all, I concluded that these lands were served solely by the reservoir water and not by direct flow water rights, based on the information that was provided. That the total capacity of the reservoirs, including a third small reservoir, which is referred to as the Padlock recovery reservoir, the total

available capacity is 1200 to 1250 acre-feet. The amount of water used -- reportedly available and used in the years 2004 and 2006 was somewhat less than that. After multiplying by the efficiency applicable for center pivot sprinklers, I arrived at the results of 780 acre-feet for 2004 -- excuse me, 610 for 2004 and 840 for 2006. This would be post-1950 storage.

Q And those numbers are documented on page 15 of your report?

A Yes.

Q Did you also separately investigate reservoir evaporation in post-1950 reservoirs in Wyoming that you did not have information about whether it was used for irrigation or not?

A Yes, I did.

Q Is that described on pages 15 and 16 of your report?

A Yes, I have a tabulation of the reservoirs involved. This is on Table 9, which is page 39. This is a tabulation of storage rights that are post-1950 and greater than 20 acre-feet. And in addition to that, there were some other storage facilities that were excluded from this list on the basis that they were on

stream ponds high up in the Goose Creek Basin. So this is the list that remained after those exclusions.

What is significant in this list is that the priorities are post-1950 and the acreages are listed. I simply calculated an evaporation loss for these reservoirs without the benefit of records or acreages involved for irrigation use. Some of these reservoirs, maybe not all of them, are permitted for irrigation use, but absent the information about specifically how they were used or to what extent they were used, I made a calculation of the evaporation based on a measured surface area. The total amount of surface acres for this list is 215 acres.

Q When you say the acreage is 215 acres, that's the surface area of the reservoirs in the table?

A Yes.

Q Combined?

A Yes.

Q It's not an irrigated acreage?

A No.

Q If you had known or had information

showing one or more of these reservoirs was used for irrigation purposes, how would that have affected your calculation of the consumptive use associated with that reservoir?

A That would have increased the amount of consumptive use. The replacement of evaporation based on water surface conditions that we could document is effectively the minimum amount of water that would have to be replaced by storage. So assuming that the reservoirs were in a position to be filled during the runoff season, then the evaporation would be the minimum amount that would have to be replaced, not accounting for any water that may have been released from these reservoirs for other use.

Q Such as irrigation?

A Such as irrigation.

Q So to the extent that any of this water in Table 9 stored in these reservoirs is used for irrigation, the calculations you did, based on Table 9, underestimate the total consumptive use; is that right?

A That's correct.

SPECIAL MASTER: Mr. Draper, if you are going to go on to the calculation of the

post-1950 irrigated acreage -- I'm looking at the clock. It's about 2:30 right now. This might be a good time for the afternoon break.

MR. DRAPER: Very good, Your Honor.

SPECIAL MASTER: Just so we can plan ahead, do you have a sense of how much longer your direct examination is likely to be?

MR. DRAPER: I have the feeling by the end of the afternoon, or early tomorrow morning, we would be finished with direct examination.

SPECIAL MASTER: I just wanted to make sure Mr. Kaste had a sense of when he might be able to begin cross-examination. One of the things I probably should have covered at the outset is that what I've been thinking about doing in terms of my own questions of the expert witnesses is generally while you're conducting your direct and Mr. Kaste is doing his cross, to only interrupt for quick clarifications.

And then I have been accumulating some questions that I'd also like to ask the witness, and my thought is that probably at the end of each of your examinations, before you actually sit down, would be a good time to ask any questions that I accumulate during that period of

time. That way if you have any additional questions you want to ask as part of that, you can.

And it also means, for example, that if I have some clarifying questions, Mr. Kaste would have an opportunity to ask any questions in follow-up and, of course, you'd have an opportunity in any redirect to address any of the questions that I raise. But I wanted to see whether that was okay with both of you, or if you have any other suggestions.

MR. DRAPER: However you want to do it is fine with me.

MR. KASTE: That's fine with me. It's very reflective of the way we handle jury questions in these kind of cases or other kinds of cases. Wait until the end and then the jury passes up their questions to the witness and then each counsel has an opportunity to follow up.

SPECIAL MASTER: Okay. Great. Then when you're finished with your direct questions, then at that point I'll ask some questions of the witness before you actually sit down.

Let's break now. Let's come back at 10 minutes to 3 o'clock.

(Recess.)

SPECIAL MASTER: Mr. Draper.

MR. DRAPER: Thank you, Your Honor.

Q (By Mr. Draper:) Picking up where we were at the beginning of the break, Mr. Book, you were discussing reservoir operations which is on your report pages 15 and 16. We talked about how you went about that analysis. What was the result of your analysis?

A Yes, the summary from that analysis is on page 16. I took an evaporation, lake evaporation rate, of average annual conditions from the Wyoming Climate Atlas, and after applying a pan co-efficient to the pan evaporation and netting out the precipitation, the net annual lake evaporation rate that I applied is 21 inches. Applied to the 215 acres, this results in 376 acre-feet per year.

Q Is that an average figure?

A Yes, I consider that to be an average.

Q So that became one part of your depletion analysis?

A Yes.

Q You then have a section of your report entitled, Post 1950 Irrigated Acreage. And just

to say one thing about our convention, assuming you as a witness, and I'm saying that I as a counsel, when we say post '50 or post 1950, we mean post January 1, 1950, just to be clear about that.

A Yes.

Q What kind of analysis did you perform that is summarized in section 5.2 of your report on pages 17 and 18?

A The first thing I did was to prepare a tabulation of post 1950 water rights in the Tongue River Basin, and this is included as Appendix G which starts on page 320. This is a tabulation that was derived from the Napp tabulation that we discussed earlier this morning, but limited to post 1950 water rights. And there are several groupings of these water rights listed on page 321, generally consistent with the way they were organized in the Napp tabulation. So that the first Table G-1 is for the Tongue River. The second Table G-2 is for all other tributaries of the Tongue River, not counting the Goose Creek, Wolf Creek, and Prairie Dog Creek. The last two tables in Appendix G are Prairie Dog Creek, main stem, and then

tributaries of Prairie Dog Creek.

This tabulation includes all of the post 1950 water rights, including primary or original supply, which contain a direct flow cfs rate and acreage associated with that, as well as supplemental supply water rights, which refer to an acreage. And also included in this tabulation are reservoirs, which are indicated by the reference to acre-feet, or AF in the column under cfs. So if you see an AF, a number with an AF behind it, that is referring to a storage right.

Q Can you give us an example of that, just so I'm sure I'm following you?

A The first one that I see is on page 323, which is the beginning of the tributaries of the Tongue River. And this is the Watson, that would be the reservoir, 11.85 acre-feet.

Q Looking at the previous page, 322, I see some about six or seven entries where there's the AF and the acreage column, cfs column, is that an indication of a reservoir?

A Yes, it is. The first one I see there is the Monarch Slough Reservoir.

Q How did you go about analyzing these post Compact rights?

A I prepared a summary of the contents of Appendix G, and that is in Table 10, which is on page 40.

Q What page is that?

A Page 40 of the report. This is a summary of the direct flow water rights, not including supplemental supply rights, just limited to original irrigation. This shows, for example, that on the Tongue River Basin there are 425 acres of post 1950 adjudicated water right, and on the tributaries there are 343 acres. Those acreages are obtained by summing the results in the respective tables in Appendix G.

The total amount of acreage for these post 1950 water rights in the basin is 4,320 acres. The analysis to evaluate the impacts of direct flow water rights in the years when the Tongue River Reservoir did not fill was to quantify in more detail the use of these post 1950 permits on locations in the basin where they would have an effect at the state line. And those two locations are considered to be on the Tongue River and its tributaries and on Prairie Dog Creek and its tributaries. The reason for that is that these are areas that have not been

subject to regulation in Wyoming for the benefit of other Wyoming water users; therefore, there has not been times when the water rights were regulated off or curtailed based on their priority date in these two locations in the basin.

Q What are those two locations?

A The Tongue River and the tributaries to the Tongue River, which are the lower tributaries, and Prairie Dog Creek and its tributaries.

The assumption for this analysis was in the Big Goose Creek and Little Goose Creek basin where there are approximately 2,000 acres of post 1950 water rights would be that the regulation for the benefit of Wyoming water rights would effectively have precluded the use of these post 1950 water rights at times when they would have affected the availability of flow for the Tongue River Reservoir.

The next step in the process was to develop a list of permits, which are listed on Table 11-A and 11-B for those two areas. Table 11-A contains parcels with permits totaling 388 acres out of the 425 in the Tongue River and

248 -- excuse me, 237 acres out of the 343 total on the tributaries of the Tongue River. So in Table 11-A I have the list of permits that covers those two areas, the Tongue River and the tributaries. And what I have done, then, is based on the available information that I had from the aerial photographs as well as the metric mapping, evaluated these permits for their irrigation status in the years 2004 and 2006.

Q And how did you go about doing that analysis?

A That was based on the first step here was to have the permitted acreage and then to evaluate the aerial photograph to see if we could discern where this acreage was within the irrigated area mapping that I had prepared, and to assess based on that, and the metric results, the irrigation status and the acreage associated with it.

So, for example, the first entry in this Table referred to as permit 5555 under the name Verely, that would be one of the post 1950 permits. It's a 12-acre permit. I concluded that that one was not irrigated those years 2004 and 2006.

The various other permits listed here had various quantifications of acreage based on my best information I had at the time related to the location of these permits within the irrigated area mapping to determine the acreages in the column. The irrigated acreage that I had determined was 248 acres for those permits when you total them up.

The next step in the process was to extract out what are referred to in this Table as the ET rate. Those are the mapped metric values. These corresponded to the metric values that were applicable to polygons within which these permits occurred.

Q What do you mean by polygon?

A Mapping area, the mapping of the irrigated area is based on digitized polygons which are areas that delineate irrigated area that's classified.

Q This polygon is either a field or a collection of fields?

A Yes, it's a field or collection of fields. It depends on the discretization of the mapping.

Q And by metric what are you referring

to?

A The evapotranspiration rates that were provided to me by Dr. Allen in mapped form. So you are able to determine on a polygon by polygon basis what the ET rate was for the growing season that would be applicable to these permits.

Q And that's using the methodology you described earlier?

A Yes. Using the results provided by Dr. Allen, basically his metric mapping of the basin.

I then took the ET rates, which are expressed here in inches, and, again, keeping in mind that these correspond to rates of total evapotranspiration, the next step was to apply a reduction in the total evapotranspiration for the precipitation to convert this from total evapotranspiration to what I here have termed net ET, which is the amount of consumptive use that occurred by deducting out the precipitation.

To do that I used the background rates of ET that were provided to me by Dr. Allen. Those rates were approximately 12 inches for each of the two years.

The calculation that is occurring here on Table 11-A is to convert the total ET in

inches to an acre-foot value by deducting the background ET from the total ET and multiplying that by the irrigated area I determined. And that converts the inches to acre-feet, what I have termed net ET.

Q And this is total ET for the irrigation season in each of those two years?

A Yes.

Q For each water user?

A Yes. For each of these permits.

Q All right. And then what did you do?

A These values were converted then, as I mentioned, to acre-feet values of net ET, after which I summed them up. I have expressed them down at the bottom of each of these sub-tables as rates of inches per acre, which is simply the acre-feet divided by the irrigated area. The result here was 10.7 inches for 2004 and 16.4 inches for 2006.

I did the same exercise for the permits listed below. These permits on the tributaries were primarily north side tributaries near the state line. The permitted acreage for these parcels was 237. That is out of the 343 permitted acres that are listed in Table 10 for

this grouping. I had concluded, based on the information I had available, that other permits in this category were not irrigated for these years, and so they were not included in this Table.

The 237 acres of permits was then interpreted, again, from the air photo interpretation and the metric results, and the digitizing that I had available to me, to be 131 acres irrigated.

Again, following the same process that I described before, this was converted to 87 acre-feet for 2004 and 162 acre-feet for 2006.

The other entry on this Table, the Wolf Creek Cutter water right, subsequent to submitting this report, it was concluded that was actually a pre-1950 water right, and that has been eliminated from the totals when I get to my rebuttal report.

SPECIAL MASTER: Mr. Draper, if you don't mind, again, I hate to interrupt, but just figure quick clarifying questions will be valuable at this stage.

MR. DRAPER: Perfectly fine, Your Honor.

THE COURT: First question, on page 18 where you talk about -- this the third paragraph on page 18, you talk about water rights situated on the Tongue River or on north side tributaries, and you say that the water rights total 768 acres. And I notice on page 41 and Table 11-A, that the total is 626. Is that because -- well, why is that?

THE WITNESS: Yes, the 768 acres that I'm referring to there is the total of the permits in Table 10 out of the Napp list. When I got to Table 11-A, I had eliminated some of the permits based on my conclusion about non-irrigation, that some of them were not irrigated. So the difference between 768 and the 626 is due to some of the permits being eliminated before I got to this Table.

SPECIAL MASTER: Okay. So you had already come to a conclusion that some of those were not irrigated, and then after you actually reduced the number down to the 626 acres, then you also concluded that some of them had also not been irrigated?

THE WITNESS: That's correct.

SPECIAL MASTER: Okay. And then the

second question I had, it was not clear from what you said earlier, in calculating which acres were irrigated, you said, number one, you relied upon the metric analysis; is that correct?

THE WITNESS: Yes.

SPECIAL MASTER: And then you also said you referred to the aerial photos.

THE WITNESS: Yes.

SPECIAL MASTER: Is that separate from the metric analysis?

THE WITNESS: Yes, it is, the 2006 aerial photos give you information about the irrigation status of particular tracts. So I used both sets of information, the metric as well as the air photo interpretation.

SPECIAL MASTER: And then just a question on that, then, Appendix A, which has a group of aerial photos, talks about the aerial photos being photographs from 2009. Is that different from the 2006 photos that you're talking about?

THE WITNESS: Yes, that's the Montana mapping. A little bit confusing. I did different years for the two states. Montana's acreage was based on 2009 aerial photographs, and

the Wyoming on 2006.

SPECIAL MASTER: The final question, just to clarify, you base the number of acres irrigated on that 2006 number, and the reason why there's a variance between the 2004 water usage and the 2006 water usage is because of the differences in the ET rates?

THE WITNESS: Yes, we had metric mapping for each of the two years.

SPECIAL MASTER: Okay. Thank you. Mr. Draper.

MR. DRAPER: Thank you.

Q (By Mr. Draper:) Just to be totally clear on the master's first question, relating to the 768 acres on page 18, third paragraph, that number appears in Table 10, does it not?

A Yes.

Q That is the total permitted acreage for the Tongue River and Tongue River tributaries in that first grouping on Table 10?

A Yes.

SPECIAL MASTER: I'm sorry, Mr. Draper, just one more question on this.

MR. DRAPER: You bet.

SPECIAL MASTER: Which is on Table

11-A, on that column of irrigated acreage, you said you relied both upon the 2006 aerial photos and the metric analysis. Could you explain how you use those two together?

THE WITNESS: Yes. It's a combination of considering all the information available to you. We had metric thresholds established, below which I considered the water supply to be too low. That was at a threshold of about 1.5 times the background ET. So if I had a parcel that was coming in at less than 18 inches, I considered it not irrigated. The air photo itself will tell you about whether water was applied to the field, just visually, you can determine that, as well as activities, if you can see irrigation activity or harvesting, crop harvesting, things like that.

I've been using air photos for interpretation of irrigated area for a long time, so that's my primary basis for determination of irrigated area. But the metric then provides additional information about availability of water that you need to combine the two.

SPECIAL MASTER: So if there -- were there situations where, for example, your aerial photos suggested it was irrigated and the metric

analysis given the criteria you've just stated suggested they were not?

THE WITNESS: Yes.

SPECIAL MASTER: And in that type of a situation, would you have counted the acres or not counted the acres?

THE WITNESS: I would not count it. In other words, I would let the metric set the threshold below which I would not go for irrigation.

SPECIAL MASTER: Thank you. Mr. Draper.

MR. DRAPER: Thank you.

Q (By Mr. Draper:) And in doing this work, did you rely on what's been designated M-14, Exhibit M-14, the Martner 1986 study, or 1986 publication titled, Wyoming Climate Atlas?

A That sounds right. Yes, that was the source of my evaporation information.

Q In that regard let me direct your attention to a couple of figures that may illustrate the testimony you've been giving here with respect to evaporation and also post 1950 use. Figure 11 in your report is on page 63.

SPECIAL MASTER: Mr. Draper, either I have suddenly begun going deaf or you're not

speaking up quite as much as you were a moment ago.

MR. DRAPER: Thank you, Your Honor.

Q (By Mr. Draper:) Mr. Book, does Figure 11 on page 63 show a map of some or all of the reservoirs that you analyzed and listed on Table 9?

A Yes, that is a companion figure that shows the reservoirs from Table 9. It also shows the location of the Five-Mile and Wagner Reservoirs located up near the north part of there. But it also shows the reservoirs for which I calculated evaporation for.

Q And the neighboring figures, Figure 12 series, do those relate to your analysis of post 1950 acreage in Wyoming?

A Yes. Figures 12-A through 12-C actually refer to permits that were analyzed on Prairie Dog Creek. These are summarized on Table 11-B, which provides a list of permits, or groupings of permits, on Prairie Dog Creek, whether they were irrigated either from a tributary or from Prairie Dog Creek. These were permits that were direct flow water rights to divert water either from the tributary or from

Prairie Dog Creek for original irrigation. The 604 acres on Table 11-B compares to the total on Table 10 of 1,178. So that is the reduction that I had already incurred when I put this list of permits together. And then the irrigated area was further reduced down to 362 acres.

The figures that I have included because of the complexity of the permits on some of these areas on Prairie Dog Creek, were provided as backup for the determination of area and the delineation of the permits. So the figures 12-A, 12-B, and 12-C correspond to entries in Table 11-B, basically providing mapping detail of the permits.

Q And what was the result of your analysis of the post 1950 irrigation shown on Tables 10 and 11 and in the Figures 12-A through C?

A The calculations were made of the consumptive use under these permits based on the metric results for the acreage I had determined to be irrigated. And that total, then, was used in my summary of net impacts at the state line.

Q All right. I think we are ready, then, to turn to your analysis of the impacts of ground

water pumping. Did you analyze the impacts of ground water pumping?

A I reviewed the information available, primarily from the basin plan report, the HKM 2002 report. The issue of to what extent there was ground water being used, either for irrigation or for other uses in the basin from the shallow aquifer, I concluded that there was not a significant amount of that type of pumping occurring in the basin in Wyoming. 18 permits were documented in the basin plan report, which exceeded capacities of 50-gallon per minute. The information we obtained through deposition was that ground water use, to the extent it occurs in the Tongue Basin, is not regulated for the benefit of senior water rights. Primarily on the basis that it is considered small, or de minimus. In my review of those permits, I looked at each of those 18 permits to evaluate where they were located in the basin, to what extent they're being used presently based on aerial photo interpretation, and what the nature of the pumping facility was, and concluded that it would not have significant effects downstream in the basin. That's primarily because of where they

are located in the upper Goose Creek part of the basin.

And I did not prepare any quantification of impacts attributable to that type of use.

Q Did you include any other ground water pumping impacts such as CBM pumping and impacts?

A Yes, I have tabulated the coal-bed methane pumping impacts on the stream flow based on the modeling and results that Steve Larson obtained and provided to me.

Q I believe we have now covered the various types of impacts that you analyzed. What general conclusions did you draw, and where do you show those?

A The quantification of the impacts that I derived applicable for the four years, 2001, 2002, 2004, and 2006, are summarized on page 43 on Table 12.

Q Would you take us through Table 12, page 43, part by part to show what impacts are compiled there?

A Yes. The first part of the Table relates to the post 1950 storage, and it is separated out into three parts, based on the

various analyses that I described earlier today.

The top part relates to the analysis of post 1950 storage in the so-called Compact reservoirs, which have combinations of pre and post 1950 storage, and the evaluation of the storage records that I made, as well as the return flows from post 19 -- releases of post 1950 water.

I have tabulated the results here for each of the four years, 2001, 2002, 2004, and 2006, both for storage as well as for the storage minus the return flow. I have one more adjustment that I have made to these figures. In translating them to the state line, I have reduced the various net impacts that I describe in this Table by a factor of 10 percent, to account for incidental losses being conveyed through the basin. The 10 percent is a figure that I actually obtained from State of Wyoming administration of water in the basin. It's a typical administrative loss that is assessed primarily on reservoir releases in the basin where they are delivering water released from reservoirs to ditches. There is normally an administrative loss that's assessed. The normal

amount is 10 percent. I concluded that 10 percent probably overstates the amount of loss in the stream, but there would be some loss involved. Typically, it's referred to as a conveyance loss.

So the numbers are netted between storage and return flows, and then multiplied by 90 percent.

The second category here is the discussion I had earlier related to the Wagner Five-Mile and Padlock recovery reservoirs. The two figures I have for the years '04 and '06 are tabulated here. Again, there is an amount released from storage and a return flow amount that results in a net at the state line, which is the difference multiplied by 90 percent. I've used the two years, 2004, 2006, and have derived an average from those two years, which I then applied to the other two years that are involved in this Table, 2001 and 2002.

The third category under the post 1950 storage relates to the reservoir evaporation calculation. The number I mentioned earlier of 376 acre-feet, again, is translated through to the state line, resulting in 339 acre-feet.

That's an average.

The second category in this Table is the post 1950 acreage, and this information is collecting and summarizing by Table 11-A and 11-B, again restating the irrigated area as well as the depletions, and then translating the depletions to the state line using a 10 percent reduction.

I express these, then, as an average, which I have used for 2001 and 2002 below.

The last part of this Table is a summary of each of these components. In addition, there is one more component added. This is referred to as CBM effects, acre-feet per year. These are results that were provided to me from Steve Larson, which were the result of modeling CBM impacts on Tongue River flows. So I have included those here as either depletions or accretions, depending on how the effect was computed.

The results are listed for each of the four years, either using an actual value where it was available, or using the average where it was not available for the two years, 2001 and 2002.

These are depletions at the state line

at times that I have concluded impacted Montana water rights. These were the years when the reservoir did not fill. So these would have occurred at times when the storage could have occurred.

Q And you note the net at the state line is 90 percent of depletions. I believe you stated you felt that loss was overstated; is that right?

A I do that as a conservative estimate of transit loss. Typically, transit loss is bank storage, a combination of evaporation at the stream channel and bank storage. Bank storage will tend to come back in a lagged pattern. Administrative transit losses account for both when they are applied for administrative purposes, but bank losses are typically not a loss to the system but just a retiming. And then part of that 10 percent, in my opinion, would be bank storage that would be retimed back later.

Q So in that regard, using the transit losses you did, tends to understate the impacts at the state line?

A Yes.

Q You also state that CBM impacts at the

state line did not have transit losses.
A That's correct. Those impacts were computed very near to the state line.
Q That's why you did not include a transit loss there?
A That's correct.
Q This Table 12 summarizes your quantitative conclusions based on your initial expert report?
A Yes.
Q Did you prepare a rebuttal expert report for this case?
A Yes, I did.
Q And why did you do so?
A There were certain issues pointed out, data put forward by the Wyoming experts that I needed to consider and reconsider and re-evaluate some of the calculations that I made here with the additional information. And that was done as part of the rebuttal report.
Q And is your rebuttal report, dated June 4, 2013, and designated Exhibit M-6 in this proceeding?
A Yes.
Q Briefly, how did you organize your

rebuttal report?

A This report was prepared in response to two expert reports that were provided by the State of Wyoming. I've separated this into two sections, responding to each of those two reports. The first report that I'm responding to is from the firm WWC Engineering, Mr. Doyle Fritz provided that analysis, and that dealt almost exclusively with the quantification of impacts within the State of Wyoming.

The second report that I was responding to was prepared by Mr. Vern Hinckley. That report in large part addressed issues from my report related to the analysis of Montana pre-1950 water rights. So I organized this report in two parts. First, responding to WWC Engineering and the additional information I received as a part of that. And the second part responding to the issues regarding Montana pre-1950 water rights.

Q Looking first at the WWC report and your response to that, what general opinions did you draw in response to WWC report?

A The quantifications that I had made of post 1950 uses in Wyoming were challenged in

several instances with additional information, and I considered that additional information, and made some revisions to my estimates that I had described earlier. In addition, the report discussed administration or regulation of water rights in Wyoming as it related to historic regulation of water rights throughout the basin. I concluded certain things. There were certain conclusions I was able to make about that documentation of the regulation when it occurs in the basin and how is that affects post 1950 uses in Wyoming.

There were two specific issues discussed in that report. One related to use in the basin specifically in Prairie Dog Creek that is derived from water that is imported from the Powder River Basin. Water is supplied to lands along Prairie Dog Creek from a couple of ditches that import water from Piney Creek, in that area. Included in that is a water that is supplied from Kearney Lake Reservoir, which contains, in addition to pre-1950 water rights, a water right that is also considered to be post 1950. WWC had analyzed the amount of water that was generated as return flow from the use of post 1950 Kearney

Lake Reservoir water in the basin. I addressed that.

In addition, some of the acreage that I had identified as post 1950 acreage was described or documented as having been irrigated with coal-bed methane-produced water in lieu of water from the natural flow water right in the analysis that I did. So I addressed that as well.

Q What analysis did you perform with regard to the criticisms based upon Kearney Lake Reservoir.

A Kearney Lake Reservoir is a reservoir located in the head waters of Piney Creek, and supplies some water to the lands located along Prairie Dog Creek. Prairie Dog Creek is unusual in the Tongue River Basin in that much of the water supply in that basin is imported from the Powder River Basin through several ditches. These are all pre-Compact, pre-1950 facilities. There's approximately 13,000 acres that are irrigated now along Prairie Dog Creek, and much of this is irrigated with this water from outside the basin.

In addition to that, there are numerous direct flow water rights using Prairie Dog Creek

water, as I documented in my Appendix G. A number of those water rights are post 1950 permits.

The calculations that WWC made with respect specifically to Kearney Lake Reservoir post 1950 water, was to identify return flows from the use of that water so that it could be included in the post 1950 return flows that I had calculated for the purpose of netting that out against the impacts that I had calculated for a post 1950 storage. So it was essentially an add on of return flows for that calculation.

I reviewed the analysis and the data that Mr. Fritz relied upon for his analysis, and made some adjustments to his calculations, but accepted the premise that there would be some return flow from post 1950 Kearney Lake Reservoir irrigation and Prairie Dog Creek. The net effect of that was to increase the amount of return flow by some amount that is netted out against the post 1950 storage in my analysis.

This is described in more detail in Appendix C of this report.

Q Does that begin on page 117?

A Yes.

Q And what is contained in Appendix C then?

A Appendix C is effectively the return flow calculation that I had described in my primary report of January, with the same format, and it has included an extra column, if you will, for returns from Kearney Lake Reservoir irrigation water and Prairie Dog Creek. These estimates of Kearney Lake Reservoir returns are based on assumptions that were made about how much water was released and brought over into Prairie Dog Creek from Kearney Lake Reservoir, how much of that was post 1950, and then how much of that would have been delivered for irrigation, and what the irrigation efficiency would have been for that water in order to calculate a return flow.

Q And did this affect your results?

A Yes, it did. Mr. Fritz made several assumptions regarding the quantification of this quantity of return flow. I disagreed on the basis of information and records available about several of these assumptions, and made modifications to those assumptions, and made revisions to Mr. Fritz's numbers and then

included them in my calculation of net post 1950 storage.

Specifically, the issues were the irrigation efficiency for irrigation of lands in Prairie Dog Creek; the amount of water that would have been delivered from Kearney Lake Reservoir to lands in Prairie Dog Creek. I believe those were the two primary assumptions that I made modifications to.

Q And how did you differ with Mr. Fritz on the irrigation efficiency?

A The return flows that I had been using on the post 1950 storage in the Goose Creek Basin were derived from the basin plan issued in 2002 based on irrigation systems in the Goose Creek Basin. My review of Prairie Dog Creek Basin specifically is that there's a large incidence of center pivot sprinklers over there, more so than basin wide, and on that basis I did a summary of the amount of sprinkler irrigation in that basin and derived an efficiency that corresponds to the split between gravity irrigation and center pivot sprinkler irrigation in the Prairie Dog Creek Basin.

Q And did that differ from the way Mr.

Fritz had done it?

A Yes, that came up with a higher efficiency and a lower return flow rate for that specific water.

Q And you had a disagreement with respect to the amount of water delivered from Kearney Reservoir. Will you describe that?

A Yes. Kearney Lake Reservoir supplies water to water users on both sides of the divide, primarily to water users in Prairie Dog Creek, but also to some limited extent to water users up on Piney Creek. I believe the assumption had been made that all of the water indicated as used out of the reservoir, as allocated to post 1950 priority, had been delivered to lands along Prairie Dog Creek using a 10 percent reduction. I modified the factor of 10 percent for two reasons. Number one, to account for some of the water most likely being delivered to water users in the Piney Creek Basin and not into the Prairie Dog Creek basin, number one; and, number two, to account for higher loss conditions that likely occur in the Prairie Dog Creek, which is a combination of the conveyance ditch from Piney Creek to Prairie Dog Creek incurring loss, and

then Prairie Dog Creek being more of a low flowing, losing stream. So those two factors combined caused me to reduce the factor from 10 percent to 20 percent.

Q Now, Kearney Reservoir is located in the Powder River Basin?

A Yes.

Q Is that also true of Piney Creek?

A Yes.

Q Whereas Prairie Dog is a tributary of the Tongue River?

A Yes.

Q Did you review the criticisms of your analysis of post 1950 water rights in Wyoming?

A Yes, I did.

Q And what was the result of your consideration of those criticisms?

A Mr. Fritz had responded to my quantification of direct flow depletions for post 1950 permits with several factors. I would describe those into three categories. First, was that he had concluded that some of the permits that I had concluded were irrigated were not in fact irrigated. Second, was that there had been alternate water supplies provided on some of the

permits, specifically coal-bed methane-produced water, or water from the Piney Creek Reservoir storage in lieu of diversions on the Prairie Dog Creek permits. Those were the three primary issues. And so I investigated each of those three issues with respect to the permits that I had analyzed in Tables 11-A and 11-B of my first report.

Q How did you go about analyzing those criticisms then?

A With respect to the first about the irrigation status of these various permits, I analyzed the actual permit area based on the mapped permits for each of these permits, which had modified in some instances the specific tract that I had been evaluating on these permits. When I lined up the specific permit boundaries with the metric results, and on the air photo, some of the irrigated area that I had previously quantified in Table 11-A and 11-B was modified, as reflected in Tables 2-A and 2-B of my rebuttal report.

Q It was 2-A and B appear in your rebuttal report on pages 25 and 26?

A Yes.

Q If you would turn to those, please, so we can see how you adjusted your analysis.

A The adjustments in this Table that I made are of two types. I have tabulated here the original irrigated area that I had derived, and then I have tabulated the irrigated area that Mr. Fritz had determined and the revised irrigated area that I determined in response to the information that he provided. The metric results in terms of ET rate would have been modified slightly on some of these permits, to the extent that the boundaries of the irrigated area, or the permit, were modified for purposes of this rebuttal analysis.

I've provided both the original ET and the revised results, and those changes are rather minor. That's fine tuning the mapping of the metric of the modified polygon boundaries.

Q And just what were the corrections that you made?

A They are documented line by line. And in addition, I have a narrative on each one of these permits contained in the report where I describe the analysis that was developed by Mr. Fritz and my response to that. The bottom line

comparisons can be reviewed by comparing the original SWE acreage, which is my acreage, with the revised SWE acreage. So, for example, on the main stem of the Tongue River the irrigated area was reduced from 248 down to 202.

The primary reason for these reductions related to the specific digitizing of the permits, where before I had been using the larger polygons from the HKM basin plan report. For this rebuttal analysis I had the specific permit area for each of these permits digitized and specifically used that for the air photo interpretation and the metric results.

Also shown on this Table under the main stem is an entry for the DeLapp permit. This is a permit that was described to us and documented for us through mapping, that this permit had been irrigated with coal-bed methane water at least for some part of this period. It's not clear to me exactly which year or years that occurred. But I've indicated that the 35 acres of the DeLapp parcel were documented to have been served with coal-bed methane-produced water, and so I've calculated the bottom line effect, reducing the total for that permit as well.

More of the coal-bed methane water shows up on Table 2-B, which is Prairie Dog Creek. There was one set of permits over there related to the Pilch permits that was also documented from mapping to have been irrigated with coal-bed methane produced water.

Q What were the overall results with respect to the Prairie Dog Creek analysis?

A Those results are shown on Table 2-B. The column labeled as irrigated Fritz, which is claimed by WWC, those are zeros because of alternate sources of water. There were two sources of water that were stated. One was the coal-bed methane. The second was reservoir water from Piney Creek, primarily from Kearney Lake Reservoir, as well as Lake De Smet.

I have not reduced the post 1950 depletions to account for water that was stated or reported to have been supplied from those reservoirs on these lands in Prairie Dog Creek.

Q I would like to have you turn our attention --

SPECIAL MASTER: Sorry, could I interrupt for one second? Again, just clarification, this should help me. So looking

at Table 2-A, if you look down to the DeLapp line, you'll see that the original SW estimate was 35. The Fritz estimate was zero. You have the revised SWE estimate is zero.

THE WITNESS: Yes.

SPECIAL MASTER: So why does the total main stem, when you take that zero, does it go down from the 202 that you have listed up above down to 160?

THE WITNESS: That is the difference between 202 minus 42. So if you look up in the fourth line in this Table, I had 42 acres irrigated on the DeLapp parcel.

SPECIAL MASTER: Okay.

THE WITNESS: So I included the 42 acres on the top part of this Table.

SPECIAL MASTER: I see.

THE WITNESS: Show it as irrigated.

SPECIAL MASTER: Okay.

THE WITNESS: Then deducted out the coal-bed methane.

SPECIAL MASTER: Thank you. So that second is not really an additive line. It's actually a subtraction line?

THE WITNESS: Yes.

SPECIAL MASTER: Thank you.

Q (By Mr. Draper:) Mr. Book, could you look with us at the figures that you have, Figure 1 and there's 2 through 7, and describe how they relate to what you've been describing.

A Yes, Figure 1 on page 39 is basically a restatement of Figure 2 up on the chart from the first report. This shows some more information related to the specific permits at issue in this report. So this would be the first time that I have presented a map which shows these various permits and their location. Along the Tongue River and tributaries of the Tongue River up in the Dayton/Ranchester area, as well as the permits along Prairie Dog Creek referenced as Pilch, Rose, Koltiska. So that the location of those is identified.

In addition, there are also several reservoirs shown on this map. Those are specific reservoirs where I made adjustments to the surface area for reservoir evaporation. The next set of figures I provided map detail several of the permits for comparisons to document the derivation of the acreage as irrigated. It starts out by delineating the permitted acreage,

and then the irrigated acreage is delineated on these air photos. There are a set of six photographs here which correspond to permits in Tables 2-A and 2-B.

Q And do they help understand the choices you've made with respect to the irrigated acreage that should be counted?

A Yes, these correspond to permits which we remain in disagreement over the acreage delineation with Mr. Fritz after review of the information.

Q And the type of information that you've included on these aerial photographs, consists of what?

A The delineation of land that's irrigated as well as the permit outline.

Q And those are discussed in the body of the text of your report?

A Yes, there's a narrative discussion that goes along with each one of these permits.

Q Those are the narrative descriptions that appear on pages 6 through 10 or 11 of your report?

A Yes, that's correct.

Q You mentioned in looking at the Figure

1, I believe I neglected to ask you about this, that you had looked at criticisms of Mr. Fritz regarding the evaporation rates from reservoirs?

A Yes.

Q What did that criticism consist of and how did you analyze and respond to it?

A WWC had concluded that a number of the reservoirs were located along stream bottoms with a high predevelopment, evapotranspiration rate, and that they should have been deleted from my evaporation calculations. In response to that, I reviewed the aerial photographs of all the various reservoirs that he had concerns about, and made a determination about whether the reservoir had in fact been constructed in an area where there was predevelopment evapotranspiration, what I refer to as riparian zones. ET supplied from ground water, this would have to be land that is more than -- is consuming more than just the precipitation, the background precipitation. It would have some access to ground water, and then the theory would be that the evaporation from such a reservoir would not be an increase over the natural predevelopment condition. So I went back and reviewed the

various photographs of where these reservoirs were located with respect to streams and channels and riparian zones, and for several of the reservoirs I have either reduced the acreage or removed them, effectively zeroed out the surface acreage. Those are displayed on Table 1 of this report on page 24.

For several of these reservoirs I concluded that the area predevelopment would have been a riparian zone that would apply to entries here, such as the Allen Reservoir, the Eisele-Rise Reservoir, the Polo Reservoir, and Silver Lake. There are several others, I reduced the acreage based on -- well, for two of them I reduced the acreage slightly based on an estimate about where the riparian zone would be in the reservoir. That applies to the Widener Reservoir and the Hanft Reservoir. The issue that related to the Decker Reservoir was that it was pointed out to us that reservoir was in part pre-1950 and in part post 1950. So there was a reduction made for evaporation loss here of 50 percent on Decker Reservoir.

The net effect was a reduction in the acreage from 215 acres to 179 acres, and a

resulting change in the evaporation loss.

Q And is that analysis described in the text of your report on page 5?

A Yes, it is.

Q Was there an issue raised by Mr. Fritz regarding Wagner Reservoir?

A Yes.

Q Is that described on page 4 of your report?

A Mr. Fritz had concluded that I had not deducted enough pre-1950 storage from the Wagner Reservoir quantity of water supply, and proposed reducing the amount of water supply that I had developed to account for that. After reviewing the record from the deposition, the description of the water rights associated with the Wagner Reservoir, and the fact that there is split ownership of some of the water rights in that reservoir, I concluded that the pre-1950 water right that was raised at issue here by Mr. Fritz, was a water right that was owned by the neighbor, and apparently used by the neighbor, and not available for use as described by Mr. Benzell. So I disagreed with that adjustment.

Q So you made no change in that regard?

A That's correct.
Q Were there other criticisms by Mr. Fritz that required a response?
A The last quantitative response I think I mentioned this earlier, relates to the issue about the use of reservoir water on Prairie Dog Creek -- on the permits on Prairie Dog Creek. The permits that I evaluated were original -- original source irrigation rights for Prairie Dog Creek lands served from Prairie Dog Creek water rights. And it was pointed out that the owners of those lands have access to storage water from Kearney Lake Reservoir, or Lake De Smet, and had in fact used that water, and Mr. Fritz had concluded there shouldn't be any depletion associated with the Prairie Dog Creek water rights post 1950 water rights in these years for these particular permits. I disagree with that conclusion on the basis that the reservoir water -- the use of the reservoir water is not documented as to the time, or specifically who was using that reservoir water, and it is unlikely that such water was delivered to the basin early in the season. The reservoir water most likely would have started running when the

normal reservoir season began with Kearney Lake Reservoir. And these specific permits at issue here would be using some other source of water besides reservoir water, at least for some significant part of the season.

My conclusion overall is that I don't have enough information regarding the use of native water or some enlargement of a pre-1950 water right for these, or reservoir water, to make a reduction to these estimates for these permits.

Q So you made no change in that regard?

A That's correct.

Q I believe you state your general conclusions with respect to Mr. Fritz's criticisms on page 11 and 12 of your rebuttal report. Briefly, what were your overall conclusions?

A On page 11 and 12, I discuss the information that I obtained primarily from the hydrographic survey, but other information available through discovery as it related specifically to regulation in the basin for the four years at issue, 2001, 2002, 2004, and 2006. This is information that documents periods of

time, or points in time, when regulation was most likely to have started in these basins. Mr. Fritz had concluded that I had overstated the post 1950 depletions that would affect Montana water rights in these four years. And upon closer inspection of the information available per regulation, it's my conclusion that regulation in these types of dry years starts at various times in these two basins, but does not apply throughout the entire irrigation season. The irrigation season is essentially May through September. The information that I have tabulated on a year by year basis indicates that regulation in the Goose Creek Basin can start anywhere from the beginning of May, in the most extreme year, to as late as July in some of these four years.

My conclusion from that is in periods when there's not regulation -- active regulation occurring, there's not an impediment on these post 1950 water rights within these basins.

So it's a review of the information and a response, I would say, to my initial assumption about post 1950 use is not occurring in the Goose Creek and Little Goose Creek subbasin.

The quantitative results are summarized

on Table 3. Table 3 on page 27 is a mirror image of Table 12 in the original report. The top part of this Table, again, this is organized in the same order as before, the top part of this Table shows the effect of the post 1950 return flows from Kearney Lake Reservoir as proposed by Mr. Fritz and adjusted by me. So that's reflected in the last column.

The second category, the Wagner Five-Mile results have not changed. The reservoir evaporation was modified, as I described, to account for a revision to the acreage.

The section on the post 1950 acreage is totaled for the revisions, both before any adjustment for coal-bed methane. So you can see the acreages both total and then the reduced acreage if you remove the lands that had been mapped as irrigated with coal-bed methane water. So the bottom line total is expressed without coal-bed methane lands, or with those lands deducted.

The bottom line total on this Table is listed on the bottom line of the Table after the adjustments I described. The average over the

four years is 2030 acre-feet per year.

Q In this last part of the Table, in which you entitle, summary, covers the four years you analyzed, and you bring the numbers from the upper part of the Table into this part; is that right?

A Yes.

Q Could you just describe how you do that, where each one comes from?

A The post 1950 storage comes from the same column as in the previous report, and the Kearney Lake Reservoir return flows are netted out in the second-to-the-last line in this Table. So the post 1950 storage comes from the top part under net at state line. The Wagner Five-Mile, again, I'm using the average for the years '01 and '02, and then the original values for 2004 and 2006. The evaporation is an average value that gets pulled in for each year.

The post 1950 acreage reflects the total for each of the two years, without CBM -- without lands irrigated by CBM water, that's 327 acre-feet for 2004 and 473 acre-feet for 2006. Then I use the average for each of the other two years. The coal-bed methane effects are

unchanged from the original report.

And then those are totaled, and the Kearney Lake return flows are netted out.

Q And that gives you the net with Kearney Lake return flows accounted for?

A Yes.

Q So your total on this Table is 8,120 acre-feet of impacts for the four years?

A Yes, that's correct.

Q Does that summarize the response that you developed in answer to Mr. Fritz' responsive report in this case?

A Yes.

Q And you also responded to Mr. Hinckley's report; is that right?

A Yes.

Q What criticisms did Mr. Hinckley present in his responsive expert report?

A I would characterize those in three categories, which I have responded in part to each of those. I know others are responding as well.

The three issues that Mr. Hinckley raised that I am addressing specifically, the first one related to the actual irrigation of the

pre-1950 acreage in Montana, as it had been mapped in my first report, and as it compared with the mapping from the survey, the 1946 and '47 county surveys.

The second aspect related to the calculation I made of the direct flow demands, and specifically as that related to the timing of return flows that were used as a component in that calculation.

The third aspect related to the wintertime operation of Tongue River Reservoir and the effect that the bypasses in the wintertime had on the actual filling status that occurred for the reservoir in each of those four years. Those were the three primary issues.

Q Let's look at the first one of those, the issues relating to Montana's pre-1950 water rights. What did those consist of specifically and how did you respond?

A I did some more investigation of the status of the pre-1950 water rights in Montana; specifically, the direct flow water rights between the state line and the T&Y Canal. I did not do any further investigation of the T&Y Canal, but I did compile documentation of the

status and location of the lands that are pre-1950 under the current State of Montana adjudication proceedings. I compiled the maps for those pre-1950 water rights, and prepared a tabulation in this report. And then produced mapping which identified where the actual pre-1950 lands are that are irrigated presently.

There are two primary elements of this. The first is the tabulation that I produced on Table 4-A and 4-B. This is found at page 28.

Q What do you show on Table 4-A, page 28?

A Table 4-A is a compilation that I prepared of the pre-1950 water rights in Montana, as documented in their current database of water rights on the Tongue River. They have documented them in addition to the ownership information and various identifications. They have the priority dates listed as well as flow rates.

On the second page of this tabulation, this is laid out Table 4-A is the first page, Table 4-B is a companion page, which contains various additional information regarding the status of the documentation. It's primarily on the second page providing acreage information for these various water rights from different sources

that are contained in the water rights files. These are documented with a set of footnotes describing the columns.

My conclusion about the acreage is listed on the first page on Table 4-A, under the column heading, Maximum Acres. That's the current status of the water right. In addition to that is the maximum flow rate in column 9.

The other information that's contained on this Table is a map ID. There is a set of maps in Appendix A which documents the acreage irrigated for each of these based on the information from the maps in the file and located by this map ID.

The bottom line total in terms of acreage and flow rate is summarized on page 29. This is a total for these water rights, excluding the T&Y Canal, so it corresponds to the land upstream of the T&Y Canal. There are several other pre-1950 water rights that are located below the T&Y Canal on the Tongue River. Those are indicated in blue lines on this Table. But the total, the bottom line total that I have listed here, excluding the rights at and below the T&Y Canal, are 465 cfs, and a maximum acreage

of 11,576 acres.

I then overlaid these water rights claims over the irrigated area mapping that I had described in my original report. I believe that was Appendix A. What I have tabulated here is irrigated in 2009, that corresponds to the irrigated area mapping that I had prepared, and these figures are the irrigated area for these pre-1950 water rights. That number totals 8,295 acres for 2009. That would be in addition to the T&Y Canal.

Q And do you show these water rights in your appendices?

A Yes, I do. I prepared an Appendix D to this report.

MR. DRAPER: Your Honor, I might interrupt for a second. The clock has just passed 4:30. What's your pleasure?

SPECIAL MASTER: I would suggest that we at a minimum finish up the discussion with respect to the Montana pre-1950 water rights, and then the question is on the return flow analysis in the Tongue River Reservoir, if they are going to take the more than five or ten minutes, we should probably leave those for tomorrow morning.

MR. DRAPER: I think they will. Now, there's a couple of appendices, most of this bulk in the report is related to these pre-1950 rights, the documentation of those. We'll go through as much of that as you want us to this afternoon?

SPECIAL MASTER: Why don't we do that right now.

MR. DRAPER: Okay.

Q (By Mr. Draper:) Mr. Book, I believe you have these rights mapped and also documented in the appendices; is that right?

A Yes, that's correct. I would characterize Appendix D as the information out of the water rights files that provides the backup for the compilation that I prepared, which is the tabulation.

Q And Appendix D starts on page 125? I'm sorry, I think it's a little before that. 120.

A Yes, that's correct.

Q And what do you have compiled in Appendix D?

A I have compiled a series of maps which correspond to the headings in the Table that we

referred to as well as the basic documents related to the claim and the status of the water right.

Q Now, you have an index in the beginning of Appendix D. How many water rights are listed there?

A I didn't bring my copy of that Appendix with me.

Q Would you believe 77? Maybe I can --

SPECIAL MASTER: I'm loaning the witness my copy for a second so he can look.

THE WITNESS: Yes, that is correct.

Q (By Mr. Draper:) We are supplying the witness with a copy. Now, these 77 entries on pages 121 through 124, what do those represent?

A These correspond to the individual records that are tabulated in Table 4-A, and these are the pre-1950 water rights on the main stem of the Tongue River in Montana between the state line down to Miles City.

Q So there are 77 pre-1950 water rights on the Tongue River in Montana?

A Yes.

Q Those are direct flow water rights?

A Yes.

Q So they don't include the Tongue River Reservoir, right?
A No, that's correct.
Q And just for a brief feel for what you have in this appendix, the first entry on the list is the Nance Cattle Company. Documentation starts on page 125; is that right?
A Yes.
Q And what do you have here in terms of documentation?
A First, I have a series of maps. This is a map of the water resource survey as mapped by the state and the examined place of use.

The second map on page 127 is a map of the claims, claim place of use.

The third map is a map of an aerial photograph with the examined place of use.

The fourth map, page 129, is a copy of the water resource survey, mapping over this claim on an air photo.
Q And after the maps you have further documentation?
A Yes, I've included the information necessary to compile this information from the file for the various claims.

Q And is the next document the preliminary decree in the Tongue River adjudication?
A Yes.
Q Now, this is the Nance Cattle Company we are using as an example. What's its priority date as shown on page 130?
A July 6, 1886.
Q And from compiling this, do you know whether this is the earliest right on the river?
A It is.
Q Is that the way you've organized these in terms of priority dates, starting with the earliest and proceeding later in time?
A We've got this tabulation broken out into three different categories. The first one is based on decree; the second category is based on the file; and the third category is based on use. These are all different bases for the water rights.
Q And so using Mr. Nance as the example here, does the decree include a flow rate?
A Yes.
Q What is that in Mr. Nance's case?
A 10.48 cfs.

Q Is the acreage also specified?
A The maximum acreage ultimately is 375 acres here.
Q The maximum acres shown on page 130 is 426, if I'm reading that correctly.
A Yeah, that's been modified.
SPECIAL MASTER: So just to be clear on that, then maybe we probably should stop because I want to make sure people get out of the courthouse before they actually lock the doors downstairs. And I figure you probably need to have a little bit of packing that you'll need to do.
But just so I'm clear last point, just ask one or two follow-up questions and then you are certainly welcome, Mr. Draper, to continue on this particular point tomorrow.
But the abstract of the water right claim is the abstract of the claim that was submitted by the holder of the claimed water right permit; is that correct?
THE WITNESS: Yes.
SPECIAL MASTER: So that was a claim for 426 acres?
THE WITNESS: Yes, that's correct.

SPECIAL MASTER: And then following that you actually have the Master's report in the proceeding itself, and that's where you saw the figure 375?

THE WITNESS: Yes, that's correct. That's on page 135.

SPECIAL MASTER: Just one other quick question. In this, are all of the various materials in this appendix, are they from the water rights proceeding with respect to the Tongue River?

THE WITNESS: Yes.

SPECIAL MASTER: Okay. Thank you. So if you have one more question you can ask it, Mr. Draper, but otherwise you can continue first thing in the morning.

MR. DRAPER: Let's continue in the morning.

SPECIAL MASTER: Okay. Thank you very much. Just quickly, do we have, then, the list of other witnesses proposed for the next two days?

MR. KASTE: Yes. We received one.

SPECIAL MASTER: Okay. I'm assuming the direct examination will conclude very rapidly

in the morning.

MR. DRAPER: That's a good assumption.

SPECIAL MASTER: Okay.

MR. KASTE: I imagine he'll be on the stand at noon. He's likely to take the whole afternoon, Mr. Dalby.

MR. DRAPER: We can look into that.

SPECIAL MASTER: Okay.

MR. KASTE: I don't have any major heartburn about the exhibits that were identified.

SPECIAL MASTER: Great. So what I would simply suggest is that if there is significant chance that in fact we'll be able to finish up with these four witnesses tomorrow, that we do have a fifth witness available. The one thing I don't want to do is to end up losing an hour at the end of the day because we have finished with all the witnesses without having somebody available. So I'm not going to suggest that we have to finish everybody on this list tomorrow, but if there's a significant chance of that, I would ask that we have somebody on standby.

MR. DRAPER: We'll do our best.

SPECIAL MASTER: Thank you very much. We stand in recess.

(Recess.)

REPORTER'S CERTIFICATE

I, Richard L. Mattson, Certified Court Reporter, certify that the witness was first duly sworn by the Notary Public to testify the truth, the whole truth, and nothing but the truth; that this deposition was reported by me in machine shorthand and thereafter reduced to typewriting via computer-aided transcription; and that it is a true and correct record of the testimony given by said witness.

I further certify that I am not attorney for, nor employed by, nor related to any of the parties or attorneys to this action, nor financially interested in the action.

IN WITNESS WHEREOF, I have set my hand and seal at Billings, Montana, this day of 2011.

_____
Richard L. Mattson
Certified Court Reporter
Notary Public for the
State of Montana
Residing at Billings

(Seal)
My Commission expires:
June 15, 2015