STATE OF MICHIGAN

STATE OFFICE OF ADMINISTRATIVE HEARINGS AND RULES

In the matter of:	File Nos.:	GW1810162 and MP 01 2007
The Petitions of the Keweenaw Bay Indian Community, Huron Mountain Club, National Wildlife Federation, and Yellow Dog Watershed Environmental Preserve, Inc., on permits issued to Kennecott Eagle Minerals Company. _____/	Part:	31, Groundwater Discharge 632, Nonferrous Metallic Mineral Mining
	Agency:	Department of Environmental Quality
	Case Type:	Water Bureau and Office of Geological Survey

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

HEARING - VOLUME NO. VIII

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE

Constitution Hall, 525 West Allegan, Lansing, Michigan

Wednesday, May 7, 2008, 8:30 a.m.

APPEARANCES:

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EXHIBIT INDEX

NOTE: Page numbers may change on final transcript. Full exhibit list for today will be included in the final transcript.

Lansing, Michigan

Wednesday, May 7, 2008 - 8:40 a.m.

MR. DYKEMA: Your Honor, we have one unfinished piece of housekeeping from Dr. Flaspohler.

JUDGE PATTERSON: Okay.

MR. DYKEMA: I offered yesterday the demonstrative exhibits that we used with Dr. Flaspohler. Because I didn't use all the slides, I took a few out, and I wanted to give counsel some time to look at them before they responded to my tender.

JUDGE PATTERSON: Right.

MR. DYKEMA: The demonstratives have been marked as Petitioners 143. And I ask that they be admitted for purely demonstrative purposes.

MR. PREDKO: You said purely demonstrative?

MR. DYKEMA: That's correct. Solely to illuminate the transcript.

MR. PREDKO: With that stipulation, your Honor, I don't believe that Intervenor has an objection. I just would restate that the objection, to be clear for the record, that I made yesterday with respect to there's a letter in here from another expert and we would object to that coming in as substantive evidence. But again to the extent it's all demonstrative, used to illuminate testimony, no objection.

JUDGE PATTERSON: Okay.

MR. REICHEL: That's the Respondent's position as well. In other words, no objection to demonstrative purposes.

MR. DYKEMA: Thank you, your Honor.

(Petitioner's 632-145 received)

MS. HALLEY: Petitioners call Jerry Lee Curtis.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the truth?

MR. CURTIS: Yes, I do.

JERRY LEE CURTIS

having been called by the Petitioners and sworn:

DIRECT EXAMINATION

BY MS. HALLEY:

Q Would you state your name for the record spelling your last name?

A Jerry Lee Curtis, C-u-r-t-i-s.

Q Thank you.

JUDGE PATTERSON: Is Jerry with a J or a G?

THE WITNESS: J.

JUDGE PATTERSON: J. Okay. Thank you.

Q Mr. Curtis, what is your educational background?

A Associate's degree in social work, counseling, certified addictions counselor, certified drug and alcohol counselor.

Q What is your occupation?

A I'm the administrator for Keweenaw Bay Indian Community substance abuse programs.
Q And where do you live?
A Baraga, Michigan.
Q Are you a member of the Keweenaw Bay Indian Community?
A Yes, I am, enrollment number 180.
Q How long have you been a member?
A Lifetime.
Q Do you hold an office for KBIC?
A Yes, I do. I'm a present council member, second year my first term.
Q Council meaning the tribal council?
A Tribal council, Keweenaw Bay Tribal Government.
Q And what do you do in your role as a member of the tribal council?
A First and foremost look out for the welfare and the general well-being of the community.
Q Do you consider yourself part of the Anishinaabe Nation?
A Yes, I do.
Q Could you describe to the Court what the word "Anishinaabe" means to you?
A To me, that's the first people, the original, the Anishinaabe. Anishinaabe is the plural, the original.
Q And what lifestyle does it mean to be -- what lifestyle decisions do you make based on being Anishinaabe?

A Try to lead a -- set a good example for the young, for the youth, walk -- we call it the Red Road, some of us, walking the straight and narrow.

Q What does that mean?

A For me, it was -- I'm a recovering alcoholic. I've been in recovery for 15 years plus. And, to me, that's probably one of the biggest contributions I can make is being sober and being a good example for the youth of our community and following some of our traditions, if not all of them.

Q Which traditions do you follow?

A I sing and drum. It's a group -- our drum is call the Four Thunders. We work with the youth and we teach the youth. Sweat lodges, we participate in, different pipe ceremonies, healing ceremonies.

Q What's the purpose of those ceremonies?

A It depends on which one you want.

Q Could you just walk us through each one and briefly tell us what --

A Sweat lodge -- sometimes it can be a healing lodge. You go in to purify yourself like getting a new beginning, probably equated to maybe a baptismal is the Western concept of it. Pipe ceremony, that could be -- that's praying. It would depend on -- it could be a naming ceremony, it could be a funeral, a walking on ceremony, traveling ceremony. There's an abundance of different things that we do with the

tobacco.

Q So it sounds like your life is marked by these ceremonies?

A I would say indirectly as -- prior to my coming into recovery, I knew enough to stay away from that thing. It's quite disrespectful when you're using and under the influence. And once I started my road in recovery, that's when I kind of really focused on my tradition and my culture.

Q Mr. Curtis, have you ever been to the Yellow Dog Plains?

A Yes, I have.

Q Could you describe the Yellow Dog Plains for us?

A Well, it's a hunting and gathering place that I've been going to since I was a child. Mainly hunting for me, fishing up in that area from the Big Huron all the way through the Triple A Road out to West Branch. Blueberries -- I know my family picks blueberries there. It's a pristine place, a lot of nature. My brothers and sisters are the animals.

Q If we were standing on the plains right now, what do you think we would hear?

A An abundance of animals, nature, birds, waterfalls.

Q Do you see a lot of traffic when you're out on the Yellow Dog Plains?

A Not really. Once in awhile I'll run in to another four-wheel drive or something, maybe a logging truck; not a

whole lot of traffic.

MS. HALLEY: DEQ Exhibit 31.

Q Have you been to a place called Eagle Rock?

A Yes, I have.

Q Could you locate Eagle Rock for us on this map? This is from DEQ Exhibit 31. It's figure 4.2 -- or 4-2. Excuse me.

A Right there (indicating).

Q That's Eagle Rock right there?

A Yes, it is.

Q Okay. What is that orange line through it?

A I believe that's the proposed tunneling, I think.

MS. HALLEY: Could you put up number 11 -- slide 11?

Q This is Petitioner's Exhibit 11, slide 11, which is already admitted. What is this a picture of, Mr. Curtis?

A Eagle Rock.

Q And you've been to Eagle Rock?

A Yes, I have.

Q Okay. Is Eagle Rock important to the Anishinaabe people?

A I believe it is.

Q Why is that?

A Sacred grounds. By way of sacred grounds, I would say our ancestors going back probably to time immemorial.

Q Doing what there?

A Praying, having different ceremonies there.

Q Could you describe what you know about the history of Eagle Rock?

A As far as I know, it's -- the connection that I have personally is the cultural. It's been passed on through the generations. It's just the overall sacredness. To me it's like a -- part of Grandmother -- Grandmother Earth.

Q How often do you go there?

A A couple times a year, three times a year for specific reasons. If I go hunting, then I'll make it a point to stop there and go lay my tobacco down and sit there awhile and do some praying.

Q What do you mean by "lay your tobacco down"?

A That's the way our prayers are carried up to the creator.

Q And when you're there at Eagle Rock praying, what is it like?

A Oh, a connectiveness. I can't explain it. I'm trying to think of an example. Just hitting that area probably, just coming in that -- I think coming around that second big corner, if you're traveling back to Skanee area, the Big Eric's Bridge, it's kind of like -- it gives me goose bumps, so to speak. It's like there's a connectiveness there that's always been there. It's kind of like when I drove through the Dakotas and they said to me, "You're going to feel something when you hit the Badlands." And that's probably similar to what I felt.

Q What do you think that "something" is?
A The spirits, my ancestors.
Q Is it noisy at Eagle Rock when you've been there in the past?
A No.
Q Do you see animals?
A I've seen deer, I've seen a couple wolves, coyotes, martins, pine martins.
Q Do you see unique plants?
A I see -- there's plants, but I can't identify some of them. But there is vegetation there.
Q Okay. And when you go to Eagle Rock to pray, do you see other people?
A What do you mean?
Q I mean, do you usually see other visitors, other human visitors at Eagle Rock?
A The last two times I've seen -- I think -- I don't know if it was part of Kennecott or somebody was doing a survey or doing something up there on the rock when we walked upon. And then another time there was -- our TPHO officer was up there.
Q Your what?
A TPO officer.
Q Okay. Can you state for the record what "TPHO" means?
A It's Tribal Preservation Historical Officer.

Q Okay. Thank you. Before that, the last two visits, did you normally see people there?
A Not really, not when I've -- I've seen a passerby maybe -- I think twice there was two cars that went by. But I haven't --
Q Is solitude part of the reason you go to Eagle Rock?
A Without seeking that, yes. Because it's -- usually when I've been there, that's what it is. You know, it's very quiet around there.
Q You described some of the ceremonies that you do in your daily life before. Could you describe any ceremonies that you do at Eagle Rock?
A I've smoked the pipe up there.
Q And what is the significance of smoking the pipe?
A It would be an honor in letting our asema go up to our -- our prayers are being carried through that pipe through the asema up to the creator.
Q What is asema?
A Tobacco. Excuse me.
Q Thank you. Okay. And what other ceremonies might you do at Eagle Rock or have you done?
A I haven't done any. But I've heard of a sweat lodge being put up there and a couple of neighboring tribal members have done a sweat up there.
Q But you go there and pray?

A Right. That's my mainstay for that is praying.
Q Okay. There's been some talk about leaving the top of Eagle Rock undisturbed but carrying out the mining activities in it and around it. If that were the case, would you still go to Eagle Rock to pray?
A Not if it was illegal, if it's fenced off, so to speak. And that's my understanding that's what it's going to be is inaccessible. And to me that's going against what I believe in.
MS. HALLEY: Could you put the map back up?
Q This is figure 4.2 again that we looked at a few moments ago. Do you see that gray outline sort of around the perimeter there? Could you outline that for us, please?
A Uh-huh (affirmative).
Q It's a little hard to see but -- yeah, that looks like it.
A Uh-huh (affirmative).
Q Okay. Does it look to you like Eagle Rock is inside or outside that fence line?
A It's inside of it. It's right there.
MS. HALLEY: Could you pull the page 5? This is Petitioner's Exhibit 118, page 5.
Q Mr. Curtis, could you read provision number 10? This is the permit as it was issued to the company. This is page 5 of the special conditions. Would you read number 10, please?
A "The permittee shall construct and maintain an 8-foot high

chain link fence surrounding the surface facilities as detailed in Figure 4-2 of the permit application."

MS. HALLEY: Okay. Could you go back to the Figure 4-2?

Q So this is Figure 4-2 that was just referenced in the permit. And you outlined the fence for us. Is it your understanding that Eagle Rock would indeed be fenced off?

A Yeah, that's what I believe.

Q And you testified that you would not go to Eagle Rock if it were illegal to do so?

A Right.

Q So does that mean that you would be precluded from using this as you described it, sacred site?

A Yes, it will.

Q Let's assume for a moment that you could legally access Eagle Rock and that the mining were going on. Okay. You're aware that the orange line, as you described it, signifies a tunnel through Eagle Rock; is that correct?

MS. LINDSEY: Objection. Foundation. Tunnel through Eagle Rock? I'm going to object to the foundation of this witness testifying as to that.

Q Mr. Curtis, what is your understanding of the orange line on this map?

A It's desecrating -- to me it's desecrating the sacred ground, drilling right through it. Whether it's top, bottom

middle, it's still desecration.
Q Would it affect your ability to use Eagle Rock as a sacred site?
A It wouldn't affect me. It would affect my ancestors, the spiritual connection.
Q How so?
A It would be like -- with all due respect, I'm trying to give you an example -- going to another -- like a burial grounds of a cemetery, maybe digging holes or boring through a public cemetery. You don't see that too often. I haven't seen that ever. And that's what I would liken that to, total disrespect and desecration of sacred grounds.
Q Sacred grounds that your ancestors used?
A Right.
Q Could you just go someplace else and pray?
A I could. But why should I?
Q Could you have the same experience someplace else that you have at Eagle Rock?
A Not really. I don't think I'd have that same connectiveness.
Q Why not?
A Because of the disturbance that they're going to my ancestors.
Q What I'm wondering is if you could go to another place to pray and have the same experience that you have had at Eagle

Rock in the past?

A I don't think so.

Q Why not?

A It would be like -- it would be like asking the Sioux, who are in the Black Hills, to put them over somewhere else and say, "Go have your ceremony. Go over there." And there's just not that connectiveness there.

MS. LINDSEY: Your Honor, I'm at this time going to renew our motion to exclude. As I understood their representation and the testimony of these witnesses, it was going to be to establish standing and to say that they have standing to bring this suit because they use that area. As all of this testimony is coming in now, I understand that it sounds to me like they're trying to say that this is a reason to deny the permit. And as we had raised in the motion to exclude that we filed two months ago, we said that whether this is used for spiritual purposes or cultural resources, this was not part of the decisional criteria for Part 632 or Part 31. And it now sounds to me like the testimony that they're attempting to elicit is that this is a reason for denying the permit. So if -- I can go into the reasons. But if you remember the motion --

JUDGE PATTERSON: I do remember the motion.

MS. LINDSEY: Okay.

JUDGE PATTERSON: Ms. Halley?

MS. HALLEY: Your Honor, the Rules and specifically Rules 425.202(2)(p) clearly indicates

JUDGE PATTERSON: Is that 202?

MS. HALLEY: Uh-huh (affirmative). 202(2)(p).

JUDGE PATTERSON: Okay. I got two sub what?

MS. HALLEY: (p).

JUDGE PATTERSON: (p).

MS. HALLEY: Which includes a list of things that the applicant was supposed to include in their environmental impact assessment analysis. And one of the things in (p) is places of worship.

JUDGE PATTERSON: I'm still looking for that. Sub (2)(p)?

MS. HALLEY: Yes. The numbering in that section is --

JUDGE PATTERSON: Yeah. It's confusing.

MS. HALLEY: It is. On my version, it's page 23. If we have the same version, that might help.

JUDGE PATTERSON: Okay. I've got it.

MS. HALLEY: Okay. So places of worship is one of the items listed in (p). And this testimony is imminently relevant to (p).

MS. LINDSEY: And, your Honor, this was the basis of the motion that we brought specifically addressing and setting for the legal arguments as to why Eagle Rock does

not fit within places of worship under the requirements of the EIA. We specifically raised this issue. And the reasons that we got was that we weren't going to put these witnesses on for anything other than standing.

MS. HALLEY: No. The issue that was briefed and discussed was the issue of EE. If you look further down that page, your Honor, you'll see cultural, historical or archeological resources.

JUDGE PATTERSON: Right.

MS. HALLEY: And even on that issue it was only Mr. Eggan that stipulated under Part 31 only to calling these witnesses only for standing. Mr. Haynes nor I have ever stipulated to anything like that.

MS. LINDSEY: Okay. Well, my understanding of the Part 632 response was -- this is what they said. "Kennecott's argument is beside the point. Petitioners intend to call witnesses from the Keweenaw Bay Indian Community not for the purposes of establishing that any portion of the mining area is listed on a register but rather to establish standing."

They did represent. And further, --

MS. HALLEY: Your Honor --

MS. LINDSEY: -- if I may, they said that none of the witnesses identified by Petitioners will seek to assert new claims. And I think that perhaps they were trying a

little too hard to be cute and distinguishing this without. But the point is we raised the issue that whether you want to do (p) or whatever you want to go under, that we raised the issue of not going beyond standing with these witnesses. And specifically the reason we raised it two months ago was because we did not understand this to be part of the 632 petition, part 31 petition, and we specifically raised it because, if we were going to have these issues two months ago as part of this case, we certainly needed to know that. We relied on the representation that there was nothing new being raised. And now they're going under a specific -- "Well, we didn't address your legal arguments at all, but we said they would be represented -- brought in only for standing." And now we've prepared our case and gone forward. And we're in the middle -- two weeks into trial we're hearing that, "No, actually we want to get into whether this is a place of worship," which was specifically argued and addressed in our motion.

MS. HALLEY: Your Honor, we are not asserting that any of these locations are listed on any register, which is what that motion addressed. We're not making that assertion at all. These witnesses are not testifying about any listing, nothing of the sort. They are testifying about their personal use of this site. And for the Defendants here to claim that this is somehow new information to them

is ridiculous. Our comments included a report about the significance of Eagle Rock. The DEQ has, in fact -- and the DNR have both held consultations with members and representatives and of KBIC on this very issue. In fact, I don't think Mr. Curtis himself testified at the hearings in Marquette. But certainly tribal members have testified over and over again about the religious significance of Eagle Rock and the plains to them. This is in no way new information.

MR. EGGAN: Absolutely not, your Honor. Can I can just interject. I may have contribution to the confusion here, because I did speak to Mr. Kohl shortly after their motion to exclude was filed. And I made it clear to him that I would be calling witnesses from the tribe that would be testifying on standing issues. But I made it absolutely clear to him at the time that there would be -- that the Part 632 folks would be calling some witnesses from the tribe to testify about what I called at the time the worship issue. And so Kennecott is not surprised by this issue. We have discussed it.

And furthermore, I think the record should be clear that we did what we said we were going to do. We called witnesses on the Part 31 side. And it should be no surprise to anybody that we had this other segment of witnesses that we talked about with Kennecott and who are

here now testifying. This is not a surprise issue. And nobody is trying to be cute with this at all. It's an important part of the 632 case.

MS. HALLEY: Your Honor, I might point out that the previous tribal witnesses also testified about the religious significance of Eagle Rock with no objection.

MR. REICHEL: Judge, I'd like to be heard on this. Because leaving aside any claim of surprise or lack thereof, I think, if this testimony is being proffered on the proposition that it's relevant to the Petitioners' challenger that the environmental impacts -- first of all, this Rules deals with the prescribed contents of the environmental impact statement. Counsel has suggested that this testimony is relevant to whether or not the environmental impact statement addressed this particular requirement in (2)(p) of the Rule. I submit that it is not, given the plain language of the Rule, relevant. If your Honor looks at the text of the Rule, which I'm quoting here, "Residential dwellings, places of business, places of worship, schools, hospitals, government buildings or other buildings used for human occupancy all or part of the year." Reading the text of this Rule as a whole, particularly the last clause, on its face it's clear -- what it contemplates is that that EIA was required to address the existence and the potential impact on buildings of the various kinds that

are used for human occupancy for all of part of the year. It is manifest and indeed one of the previous witnesses testified that Eagle Rock is not a building. The activities that have been described by the witness do not occur in a building. So as a purely legal matter, if the claimed relevance of this testimony is under (p), I don't think it applies to (p).

MS. LINDSEY: Thank you, Mr. Reichel. And we -- that was going to be my other thing. Wholly apart from whether this comes as a surprise is the legal argument which we did brief as well. This is something we briefed and they chose not to address the legal argument on when we briefed it. And I would just also like to say that, on the Part 632 witness list, I don't believe any of these witnesses are listed on Part 632. And as I understand --

MS. HALLEY: No. But we did reference the witnesses on the other lists by incorporation.

MR. EGGAN: And I placed a special phone call -- again, nobody is trying to be cute, Counsel. But I placed a call to one of the partners in your firm, Steven Kohl, and I informed him of the issue the day that we did it so that it would be absolutely clear.

MS. LINDSEY: I understand. And we rest of the legal argument that we made two months ago which is that this is not relevant and not part of the decisional criteria

and wasn't required to be in -- considered under the EIA part P -- excuse me -- Part 425.202(p) because it is not a place of worship. And we did not respond to that argument. And legally I don't think there is a response.

MS. HALLEY: Your Honor, that particular issue has not been briefed. It clearly has not. And nothing could be more relevant to whether the EIA is complete than these witnesses' testimony about whether or not this is a place of worship for them. They are going to be excluded from this site. That is the issue here, your Honor. And furthermore in anticipation of this building argument, over the weekend I looked up the definition of "place of worship" in the dictionary. It is not defined in the Rules. It's not defined in the statute. If you look up "place" in the dictionary, the first definition is simply "open space." There is nothing about a room, a building or anything of the sort.

MR. REICHEL: Your Honor, may I respond?

JUDGE PATTERSON: Go ahead. I'm sorry, Counsel. You were finished?

MS. HALLEY: And to assert that a place of worship has to be a building flies in the face of the very definition of religion in this case. These witnesses could and will testify, if they need to, that actually their primary place of worship is outdoors.

MR. REICHEL: Your Honor, if I may respond further?

JUDGE PATTERSON: Sure.

MR. REICHEL: My argument is not that a place of -- that people cannot and do not worship outdoors. That's not the point. I'm simply making the legal argument which is, for this testimony to be relevant, it has to relate to some decisional criteria under Part 632 or the Rules. And the only claimed relevance is under this (p). And I submit, if you read this Rule applying recognized principles of statutory construction, which apply to Rules, looking at the text as a whole, I submit that it is clear in the context of the entire Rule that what the Rule is addressing is, in fact, as a class are buildings used for human occupancy all or part of the year.

MS. HALLEY: Your Honor, the Rule also includes the term "places of business." Certainly Mr. Reichel wouldn't assert that the only place to do business is in a building.

MR. REICHEL: That's not my -- I'm sorry. That's not my contention. I'm not saying that the only place to do business is in a building or the only place to worship is in a building. I'm saying you read the text of Rule that lists things all of which in the context of the Rule are intended to be buildings.

MS. LINDSEY: And if I just may respond for a moment to the argument that this was not briefed. I can hand you our brief, your Honor. We specifically as part B addressed this issue and had pages of argument on this. And so to say it's not briefed, I mean, this was -- we specifically quoted that Rule for the places of worship and very much did address this issue in our brief.

MS. HALLEY: Your Honor, may I also suggest that this set of testimony is relevant to (x), land uses and land access, current and historic land use trends. These are all -- this is all relevant.

JUDGE PATTERSON: Okay. Here's what I'm going to do. I'm going to let the testimony stand. What we've gotten down to is a legal argument. Whether or not it's applicable to the criteria 632, that can be addressed later. But, I mean, Mr. Curtis is here. He's made the effort to come here.

MS. HALLEY: Indeed.

JUDGE PATTERSON: Complete his testimony. There is standing testimony regarding the religious use of Eagle Rock. I'll let that -- I'll let the testimony stand. We can argue later whether it's relevant to criteria 632.

MS. HALLEY: Thank you, your Honor.

MS. LINDSEY: Thank you, your Honor. Could you just note a continuing objection so I don't have to --

JUDGE PATTERSON: Sure; yeah.

MR. REICHEL: And the same objection on behalf of the Department.

JUDGE PATTERSON: All right.

Q Sorry for that interruption, Mr. Curtis. I believe that we were talking about the tunnel. And I believe that my next question was going to be whether the tunnel in some way affects -- would affect your ability or desire to use Eagle Rock as the sacred site that it has been used as?

A Yeah. As I explained when I tried to give you an example -- or the example of what that's like to me. It would be like me and tell my family, "Come on. Let's go down to the public cemetery here and let's dig some trenches through or around or under," however you want to call it, which is total disrespect and, you know -- and to me limiting my access to that is -- it goes our Native American Religious Freedom Act, too, of 1978. It specifically states in that Act that we shall not be limited to access to sacred sites. And that totally contradicts what that Act stands for -- the intent of that whole Act.

Q And the intent of that Act, as you understand it, is to provide you with what?

A Freedom; freedom of religion, freedom to express and practice where we feel it's any sacred ground.

Q What does the phrase "place of worship" mean to you?

A On a personal note, I don't like to use the word "worship" in our -- as a Native American. To me that's a Western concept. And I practice my culture. I may pray. I sing. I talk to the creator. In some other light, that might be worshipping. But on a personal note again, I don't consider that worship. To me it's -- that's just a part of being Anishinaabe. I stay away from the -- most of the Western concepts, because they tend to contradict with the Native -- what Anishinaabe believe in.

Q Given that the phrase "place of worship" is what we're talking about here, I wonder if you consider Eagle Rock a place of worship?

A Definitely.

Q Has anyone from Kennecott consulted with you about the significance of Eagle Rock?

A No, they haven't.

Q Has anyone from the DEQ consulted with you about the importance of Eagle Rock?

A Not directly. I was in on a couple of hearings with them but nothing direct like a one-on-one basis or anything like that.

MS. HALLEY: Thank you, Mr. Curtis. No further questions at this time.

MR. EGGAN: May I ask just a follow-up question? Mr. Curtis, I'm Eric Eggan, and we've met.

DIRECT EXAMINATION

BY MR. EGGAN:

Q You mentioned that you were in on a couple of -- and I think you called them "hearings" with the Department of Environmental Quality and then the DNR?

A Right.

Q Were you talking about the government-to-government consultations that occurred between the Keweenaw Bay Indian Community and the Department of Environmental Quality and the Department of Natural Resources?

A Yes, I was.

Q Okay. Those were face-to-face meetings. Now, what did you understand the purpose of those meetings to be?

A To express to them what Eagle Rock meant to us as well from a cultural standpoint.

Q Okay. And so these were discussions directly with the community as a government communicating with the Department of Natural Resources as a part of Michigan government?

A Right. One sovereign to another sovereign.

Q Very good. And there were two meetings?

A Yes, there were.

Q One was with the representatives of the Department of Natural Resources and the other meeting was with the Department of Environmental Quality?

A Yes, there was.

Q Do you remember when those meetings were?
A Oh, within the last year. I think one was in the fall.
Q One was in November of 2007?
A I believe so.
MR. REICHEL: Objection. Leading.
A It was the fall.
MR. EGGAN: Well, this is purely --
MR. REICHEL: Lack of foundation.
MR. EGGAN: Are you -- I can give you the dates of the meeting. I'm just trying to establish them with him. Your clients were there.
MR. REICHEL: I'm aware of that. And I also don't -- I'm going to interpose an objection as to relevance. I believe it's a matter of record that -- well, I don't understand how this consultation is relevant to the decisional criteria under Part 632 or 31.
MR. EGGAN: I think that makes sense. My concern was that the witness testified that he attended two hearings. And I didn't want there to be confusion that these were some sort of contested case proceedings. So I was just merely trying to clear that up. But as long as Mr. Reichel will stipulate that these were two meetings, government-to-government consultations between the tribe and the Department of Environmental Quality and the DNR, then I think that's all we need to do.

MR. REICHEL: Well, I can certainly state for the record it's my understanding that the meetings that Mr. Eggan is referring to were as a result of a memorandum of agreement between the State of Michigan and the Native American tribes or communities within the State of Michigan, which provides a consultation -- a process by which there can be consultation between tribes and the State of Michigan. It was my understanding that that was the context of these meetings that Mr. Eggan has alluded to.

MR. EGGAN: That is the context. As long as we have that stipulation, we're all set then. Very good.

JUDGE PATTERSON: Okay.

MS. LINDSEY: Good morning, Mr. Curtis. My name is Sarah Lindsey. I just have a few questions for you.

CROSS-EXAMINATION

BY MS. LINDSEY:

Q You talked a little bit about -- I believe you said you hunt in the Yellow Dog Plains area?

A Yes, I do.

Q What do you hunt?

A Deer.

Q Anything else?

A No. Just hunt and fish. My other members of my family do the gathering, berry picking.

Q And how often do you deer hunt?

A Only supposed to -- allowed two, but sometimes we go out for ceremonial purposes, community feasts. We'll be allowed to get another tag through the tribe. I don't know. Four or five times a year through there hunting -- specifically hunting.

Q And you were talking about the hunting in the entire Yellow Dog Plains; correct?

A From -- to include that and from what they call Big Eric's Bridge in Skanee, Michigan. It's the beginning of Triple A where you can enter it from the Baraga County side.

Q You often hunt in the area of the mine site -- proposed mine site?

A We go from -- like I said, from Big Eric's all the way, come out to Big Bay. Sometimes we'll turn around or just come back on the highway.

Q And you said you also fish?

A Yeah.

Q How often do you fish?

A Every spring when the ice goes out and lets us get into the rivers.

Q And again this is fishing in that entire area that you described?

A West Branch, Little Huron. I've never fished the Salmon Trout River, but I have friends that have.

Q Okay. And you have not fished the Salmon Trout River?

A No.
Q And you said that you personally don't do any gathering?
A Right. My family does.
Q All right. And I believe I hear you refer when you were giving an example of Eagle Rock and sort of analogized it to something like burial grounds. You're not saying that these are, in fact, burial grounds; correct?
A They could be.
Q But not to your knowledge?
A Not to my knowledge that they're not.
Q All right.
Q And you also said that you would continue to use Eagle Rock if you had access to it during the mining period -- if you had access, I think you said, that you were continue to use it?
A I may. It probably would be the same like I alluded to.
MS. LINDSEY: I have nothing further. Thank you.
MR. REICHEL: I have no questions.
MS. HALLEY: No further questions.
THE WITNESS: May I add one thing, your Honor? Could I say something?
JUDGE PATTERSON: Sure. Go ahead.
THE WITNESS: In regards to the sacred grounds like -- you keep referring to a list of -- I don't know what is that? Preservation list or -- what is that? May I ask

what that is?

MS. LINDSEY: On our motion?

THE WITNESS: List of sites or scared sites, is that? I didn't understand.

MS. LINDSEY: Yeah. We had talked about -- we had raised a motion to address, I believe, the issue -- the list is the things that are listed on --

MS. HALLEY: I believe he's asking about the list --

THE WITNESS: Yeah. I was just --

MS. HALLEY: -- listed spaces under the National Historic Preservation Act.

THE WITNESS: Okay. Just a little insight. A lot of the sacred grounds, sacred places that pertain to the Natives, the Anishinaabe -- a lot of places aren't listed. What don't believe in listing them for specific reason -- purposes. And part of that is due to this exploitation, if you will, whatever. And that's -- I just wanted to bring that to your attention. There's a lot of places that aren't listed that are sacred.

JUDGE PATTERSON: Okay. Thank you.

THE WITNESS: Okay.

MS. HALLEY: Petitioners call Doreen Blaker.

REPORTER: Do you solemnly swear or affirm the testimony you're about to give will be the truth?

MS. BLAKER: I do.

DOREEN BLAKER

having been called by the Petitioners and sworn:

DIRECT EXAMINATION

BY MS. HALLEY:

Q Could you state your name for the record spelling your last name?

A Doreen Blaker, B-l-a-k-e-r.

Q What is your educational background?

A I have a bachelor's degree in social science.

JUDGE PATTERSON: I'm sorry. What?

THE WITNESS: A bachelor's degree in social science.

JUDGE PATTERSON: Social science.

THE WITNESS: Uh-huh (affirmative).

Q What is your occupation, Ms. Blaker?

A I work at our tribal court system as an advocate. I sit with tribal people during criminal proceedings, juvenile proceedings, limited civil proceedings. I'm just an advocate, nothing else. No degree in law.

Q Where do you live?

A I live in Baraga, Michigan, on the reservation.

Q Are you a member of the Keweenaw Bay Indian Community?

A I am.

Q And how long have you been a member?

A My life.
Q Do you hold a particular office at KBIC?
A I sit on the tribal council. I'm currently in my second term.
Q What does the tribal council do for the tribe?
A We wear many hats. We do a lot of things. We do legislative. We do programs. We take care of our tribal members.
Q Do you take care of them in the way of tribal traditions?
A Yes, we do. We have re- -- we have our culture committee. We have a language program. We are bringing back a lot of things that had been taken from us over the years. I don't want to go into that. That has nothing to do with what we're doing here time now. So I'll just state it like that.
Q Is KBIC part of the Anishinaabe Nation?
A They are. It's -- actually the Anishinaabe Nation runs from North Dakota into Canada, encompasses the states also of Wisconsin, Minnesota, way to the eastern into Ontario, Canada. We are one of many bands of Anishinaabe.
Q What does it mean to you to be an Anishinaabe person?
A As an Anishinaabe ikwe, a woman of --
Q What does ikwe mean?
A -- the people or tribe, a woman, we are keepers of the water. It is our responsibility specifically to take care of our water. One of the most important things I feel is

we've been put here to make this place as soon as good as, if not better, for future generations so that they, too, may enjoy what we enjoy right now.

Q Do you practice Anishinaabe tradition -- traditional ways?

A Yes, I do. Are you specifically talking ceremonies? I practice ceremonies. When you say Anishinaabe, practice Anishinaabe beliefs, well, that's just something we do every day as a community, you know. We live it, you know. And specifically, yes, we do practice ceremonies. I do practice ceremonies.

Q Could you describe some of those ceremonies for us and help us understand the purpose of them?

A As I stated earlier, one of -- as a woman of -- a woman we have water ceremonies which we consider very, very sacred. I've participated in sweat lodges, fasting, visions, pipe ceremonies, sacred fire. It's quite a lengthy process to go into each ceremony and why we do them, so I'll just leave it at that.

Q Would you mind talking a little bit more about fasting?

A When we practice our traditional -- we're in a unique position. We live what we call "with both feet in two worlds." We live the modern world but we also have the way of our ancestors. And there comes a time sometimes in this busy, busy world that you have to stop and you have to, you know, acknowledge the gifts that the Creator gave you, you

know, what we have: the clothing, the food, you know, what -- our medicines, you know, what's been given to us. And there's certain areas with certain manitos or spirits that reside in those areas and we stop and we acknowledge and send megwich to them and to the Creator for what they've given us.

Q What does "megwich" mean?

A I'm sorry. Thank you; give thanks. And that's -- you know, there's many different fasts, but in particular when you said "fast" I was thinking of a one-day fast and that's when you just stop everything and just remember where everything came from. And we can't live without water. We can't live without, you know, clean air. We can't live without food. You know, it's -- sometimes you just have to stop and remember that; that we depend on this environment. You know, we are -- we're the pitiful ones; we're the ones who depend on this and we have to remember that and give thanks for what we have.

Q Do you gather; are you a gatherer in your tribe?

A Yes, I am. I don't hunt and fish. I have three sons that do that for me; there's no need for me to go and do that. They're good hunters and they're good fishermen and I'm very proud to say that. They bring in deer, fish and stuff like that. So no, I don't hunt and fish, but I do gather. I gather plants. I'm just starting gathering medicines; it's

a very -- it's a lifelong process of learning and I'm learning right now to -- basically I'm out there -- they're being identified; we're showing how to collect them, when to collect them. You only take as much as you need. Well, in the case of like berries, well, we get those every year. We all like berries, so yes, I do do that; different kinds, different areas.

Q Are you familiar with a place called Eagle Rock?

A Yes, I am.

MS. HALLEY: Would you put up that map, please?

Q Could you show us on this map where Eagle Rock is, in your understanding of it?

A It's right there (indicating).

Q Okay. What is your understanding of the orange line through it?

A I stated earlier it's a tunnel going over to that area.

MS. HALLEY: Could you put the other picture up, please?

Q Can you identify what this is a picture of?

A That's Eagle Rock.

Q Okay. Is Eagle Rock important to the Anishinaabe people?

A Yes, it is. Do you want me to go further, or just --

Q Please.

A There's certain areas where there's spiritual significance and areas where we and our ancestors, our people in the past

have fasted and went on vision quests. There's, like I said, many different times of year and number of days that you will go on things like that and they would look for places of significance and people would usually be brought there for those purposes of fasting or looking for a vision. And the area's well known to, you know, our people. I mean, you know who was Yellow Dog; he was an Ojibwa. You know, I told you the story just to shorten it up. You know, he was taking his son out for, you know, a vision and he had been ambushed and, you know, that's Yellow Dog, you know. I mean, the area is quite well known to our area -- or to our people; well known to other natives who had been there a long time ago also.

Q Roughly when would that event with Yellow Dog and his son have -- would have taken place?

A Well, he shot and killed two Sauk Indians, so they had rifles at the time, so that would have been at least a couple hundred years ago. I can't give you an exact date of when this event happened; I just know what I've been told.

Q So your understanding though is that your people have been using Eagle Rock and the vicinity of the Yellow Dog Plains for at least, as you said, a couple hundred years?

A Oh, more than that, but the story of Yellow Dog in particular probably goes anywhere from 2- to 300 years back. I don't have an exact date.

Q Okay. Do you go to the Yellow Dog Plains?
A Yes, I do.
Q And what do you do at the Plains?
A Depends; depends on what time of year it is. Sometimes you gather berries. Like I said, I gather medicines; it's very limited. What I do there that -- you know, I want people to understand I'm just -- on the path of that, that's a lifelong thing to do. And sometimes we just take rides through there. It's quiet and peaceful and you want to get away from the -- I don't want to call it "the rat race," but the business of everyday life. You know, sometimes you've just got to go somewhere where it's quiet.
Q And when you go there is it quiet or is it loud? What's it like when you're there? Can you just describe it to us?
A It's just quiet; it's peaceful. I don't know how else to say it. It's a quiet place to go.
Q Do you hear, you know, horns honking?
A No. No.
Q Do you see many people usually?
A No, you don't see lots of people going through. I mean, you're lucky if you run into one or two. You know, and like I said, we've fasted up there and you might see me --
Q Just a minute. You what?
A On Eagle Rock we've fasted and, you know, it's peaceful. I mean you're lucky to see maybe four or five vehicles.

Q Over the course of how long?
A Well, we get -- we start out with a sunrise ceremony and the fire is made and we pray and we go out -- I don't know. We're out there from like 6:00 to maybe 6:00, a good 12 hours.
Q And you -- how many cars did you see in 12 hours?
A I don't know, maybe four or five.
Q And that's --
A And that also includes four-wheelers; I said vehicles.
Q Ah, four-wheelers and cars. Thank you. Okay. And that's from Eagle Rock and --
A Yeah, we're up on the top there; we're all in different areas and --
Q And you're looking down at -- which roadway from up there are you seeing these vehicles?
A On the AAA; is that what you call it?
Q And is the AAA the primary transportation route on the Yellow Dog Plains?
A Yeah.
Q I believe it's really the only one, isn't it?
A Yes. I'm sorry. Yeah.
Q You testified that you have been to Eagle Rock?
A Yes, I have.
Q Okay. How often do you go to Eagle Rock?
A Three, four times a year. It's when I'm directed by our

elders. When we're told to go, you know, and do ceremonies, or our spiritual leaders, you know, we do that. And there's reasons for it.

Q Okay. Do you normally go there with other people or by yourself?

A I usually go with other people. I have a terrible sense of direction, so -- been lost a couple times out there.

Q And when you're there what do you do there? When you go to Eagle Rock what is it that you do there?

A As I had stated earlier, we've got various ceremonies that we may perform. We've done different ceremonies; like I said, a sunrise ceremony which includes a pipe ceremony, the lighting of a sacred fire and the acknowledgment of that. The fasting, the praying.

Q What do mean by "a sacred fire"?

A It's -- how do I want to say this? It's where we put our asema, our tobacco; we're offering our prayers before we go up there. And while we're up there we're also offering our prayers with tobacco ties. Tobacco ties are put into different colored pieces of cotton; they represent different directions or it might be your own personal colors. Those are offered while we're up there. It's just a lot of praying. When we're done we come down, we have a feast. We feed the fire, which is before we even eat any of the food that's been prepared. We acknowledge and thank those who

have given of themselves so that we may have that feast and that's offered into the fire. We then feast. We clean up our area; it's important to clean your area after you leave. And then we're done. And that's a daytime fast.

Q Okay. So you go there and spend the whole day from sunrise to sundown praying and carrying out these ceremonies?

A Yes.

Q For several times a year, you said, you may do that?

A Well, not several. I've gone -- you know, maybe others go a little more than me. I can't -- you know, I've seen -- you can tell when other people have been there and they do -- there's many ceremonies that are done. I forgot about moon ceremonies. I mean, it's just -- we could sit here all day. But in particular I would say I go three, four times.

Q Okay. Is there anything unique about Eagle Rock as far as you know?

A Yes, it is. Like I had said earlier, when our people and when we're put out there is areas that we're put into. There's "markings" -- I guess we want to say that -- specify an area, why it's sacred to our people and at the top is what we call or what I've been told is nanaboozho's footprint, which it's the indent in the rock. Nanaboozho was -- he gave many gifts to the Ojibwa people. He brought many things to help us survive and showed us the medicines, the foods. It's very hard to talk about him right now

because those kind of stories are told in the wintertime. When the Earth is sleeping we bring out the stories of nanaboozho. But on there is his footprint and it's consider a sacred area. It is a sacred area. There are certain spirits that watch over that area and they're up there. And I really don't feel comfortable talking about them. That's not my area to talk about.

Q Could you just go to a different place and carry out these ceremonies and have the same experience?

A The reason that we would go into that particular area is to acknowledge the gifts that come from there. There's medicines actually right in Eagle Rock that are collected. When you go into an area such as that not only is there the spiritual significance of nanaboozho coming through there, but there's also medicines that are gathered in that area. No. When I go there it's to acknowledge the gifts that are there and thank the Creator for what's coming out of that area. If I go down onto the reservation and I go to the -- into the bay area, to the lake, I'm offering up and thanking for the gifts that are coming out of that area.

Q So places to pray are not interchangeable necessarily?

A No.

Q Okay.

MS. HALLEY: Would you put up the picture, the map again?

Q Ms. Blaker, do you see the sort of gray outline around the facilities there?
A Yes.
Q And Mr. Curtis testified that that's a fence; that's your understanding of this picture?
A Is that there's going to be a fence, yes.
Q Right. I believe the permit specifically states eight-foot high chainlink fence surrounding the facilities as described in this figure?
A Yes; I heard him read that.
Q So by looking at this figure does it look to you as if Eagle Rock is inside the fence?
A Yes, it is.
Q So would you have access to Eagle Rock then?
A If I scaled the fence I could probably get in there. I don't know if our elders could scale the fence though. But usually a fence means to stay out and you have to respect that.
Q Indeed. How do you feel about being fenced out of your sacred site?
A Irritated. I think anybody would feel irritated and more than angry if all of a sudden you went somewhere and it's been fenced off and you're not allowed in anymore, whether it -- I would just feel angry and irritated.
Q Let's assume for just a moment that you could actually get

to Eagle Rock during the life of this proposed mine. Would you still want to go there and pray even if the surface facilities you see are in that green blob sort of behind -- well, in this picture to the north of Eagle Rock? Would you still want to use Eagle Rock in the same way that you and your people have been using it?

A That's a hard question to answer. Well, there's, you know, spirits in that area. I don't know quite how easy it would be to perform our ceremonies if there's a whole bunch of business going on in there. I understand there'll be quite a lot of traffic. Cripe, I wouldn't want to get ran over or something when I was there. I think it would be --

Q Well, what's your understanding of how the area would be different than it is now if the mine were going on there?

A There's going to be a lot of -- there's buildings and there's going to be a lot of -- there's going to be a tunnel, for one thing. It looks like, you know, it's coming out of Eagle Rock, so if we're standing on top of it and they're rumbling out from underneath it, you know, it's -- I don't really know anybody when they're worshiping if you had a big truck coming out from underneath the steps of your, you know, your church or your synagogue or something how you would feel about that. You know, it's kind of --

Q What does the phrase "place of worship" mean to you?

A It's an area where you go to talk to the Creator. There's

many places around the world. You know, a place of worship could be a church or a mosque, a synagogue, a holy city, a sacred spring. You know, they're all over the world. There's, you know, Eagle Rock, you know. There's many places many people have, you know, what they call places of worship. It's not necessarily a building. I don't ever recall that you have to be in a building to pray to the Creator in anybody's religion.

Q Do you consider Eagle Rock a place of worship?

A The "place of worship" does -- gets us when that terminology is used, but yes, I'll say we consider it a place to talk to the Creator, yes. There's spirits we acknowledge, there's medicines in that area on that rock, yes.

Q Has anybody from Kennecott ever consulted with you about the importance of Eagle Rock?

A No.

Q How about anybody from the DEQ?

A Me? No. I attended public hearings.

Q What was the testimony related to Eagle Rock at those public hearings?

A There was -- from tribal members? I mean, there was like --

Q Yes, from tribal members.

A -- lots of people at these hearings.

MS. LINDSEY: Objection to hearsay and probably the relevance at this point to what the testimony at public

hearings were.

MS. HALLEY: I'll withdraw the question.

JUDGE PATTERSON: All right.

MS. HALLEY: Thank you. No further questions at this time.

MS. LINDSEY: Good morning, Ms. Blaker.

THE WITNESS: Good morning.

CROSS-EXAMINATION

BY MS. LINDSEY:

Q Do you remember the first time that you went to Eagle Rock for any sort of fasting or other ceremony?

A Maybe about four years ago.

Q Do you remember the first time you heard of Eagle Rock referred to as either that or is it also referred to as Migi zii wa sin?

A It's been called that.

Q Do you remember the first time you heard it referred to as either of those things?

A Specifically as that?

Q Yes.

A The name or the place? Because the place we've known -- I've known for a long time. Our people are quite familiar with it, but the specific name "Eagle Rock"? A while ago.

Q Within probably the time when you have been there a few years ago?

A Eagle Rock?
Q Yes.
A Yeah. I've also known it as -- it's very hard for me say this. We've just begun doing our names in Ojibwa. Got a beautiful saying on traditional names and stuff and I don't know if I can this correctly, but mazhaamegosikaa zibii. I've also known it as that. That's the proper name for it. But names change; I mean, we've got names for all sorts of things. "Eagle Rock" I guess is probably four years ago; known it by other names for a long time.
Q And you told a story about -- I think it was how the Yellow Dog Plains got its name?
A I don't know if it specifically got its name. The reason I brought up Yellow Dog was because I'm trying to show you, you know, you people that we've been in and out of that area for a long time. The specifics -- you know, it could have been called "Yellow Dog" by us. No, I messed that up. I don't want to say we specifically called it Yellow Dog. The story is of Yellow Dog and he had been killed there. That's what I was trying to say. I don't want to go into the story but, you know, my point is he was putting his son out for a vision quest when he had been -- they had been attacked by a party of Sauk Indians.
Q That was the story about --
A It just kind of stuck as the Yellow Dog Plains. The place

where Yellow Dog was killed, you know. I could go into that story if you'd like.

Q No.

A Okay. You don't want to hear about it.

Q Thank you. You talked about the tunnel and your understanding of it going through Eagle Rock?

A Uh-huh (affirmative).

Q You do understand -- correct? -- that that tunnel is going underneath Eagle Rock?

A Right.

MS. LINDSEY: Okay. Thank you. I've nothing further.

THE WITNESS: Okay.

MR. REICHEL: I have no questions.

REDIRECT EXAMINATION

BY MS. HALLEY:

Q Does it make a difference to you at what level the tunnel goes through Eagle Rock, if it's at the very top, in the middle, in the very bottom, underneath the ground surface; does that make any difference to your relationship to Eagle Rock?

A Yes, it does.

Q How so?

A Well, the Earth is sacred from the top -- from up all the way down. The gifts are also inside the Earth also that we

get. Yes, it does make a difference; just leave it at that.

MR. EGGAN: I don't have anything.

MS. HALLEY: Thank you, Ms. Blaker. No further questions.

THE WITNESS: Thank you, your Honor.

(Witness excused)

MS. HALLEY: Can we take a short break?

(Off the record)

MS. HALLEY: Petitioners call Harland Downwind.

REPORTER: Would you raise your right hand? Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

MR. DOWNWIND: I do.

HARLAND DOWNWIND

having been called by the Petitioners and sworn:

DIRECT EXAMINATION

BY MS. HALLEY:

Q Could you state your name and spell your last name for the record?

A Harland Downwind, D-o-w-n-w-i-n-d.

Q Where do you live?

A I currently reside in Brainerd, Minnesota.

Q What is your occupation?

A Well, my occupation right now is I work for the Sault Ste. Marie Tribe of Chippewa Indians as a traditional

practitioner.
Q What does that mean?
A Well, put it simply the tribal medicine man, which they are typically. So in a framework of understanding here it would be that I work with the traditional plants of medicines and ceremonies for Anishinaabe people.
Q Okay. Are you certified as a clinical provider for the traditional medicine?
A Yes, I am, through the Michigan Intertribal Council of tribes here in Michigan; also by the Ontario Council of Chiefs and the Minnesota Midewin Society.
Q How many certified clinical providers are there in Michigan?
A I believe I'm the only one at this point.
Q Okay. Are you a member of the Anishinaabe Nation?
A Yes, I am.
Q Okay. And you just said that you live in Brainerd, Wisconsin?
A Minnesota.
Q I apologize -- Minnesota. Are you a member of a tribe in Minnesota?
A I am of the Anishinaabe Nation also, Minnesota branch, I guess. They anishinaabe Nation is spread from here to North Dakota, eastward to Toronto, north to Hudson Bay and over into parts of Manitoba. So the Anishinaabe Nation is quite -- covers a vast area.

Q Okay. And you're about to testify about the Yellow Dog Plains and Eagle Rock. If you're from Minnesota what takes you to the Yellow dog Plains and Eagle Rock?

A Well, one of the purposes that I have as defined by my elders as a spiritual leader is that I'm to bring back a lot of the traditions to our tribal people all over the Anishinaabe Nation. So I travel; I travel quite extensively throughout the month to different Anishinaabe Nations throughout the country. So my experience with Yellow Dog is -- and Eagle Rock specifically, is the spiritual adviser to the ceremonies that are conducted there.

Q Do you have a particular role in the Anishinaabe culture?

A As it stands it's identified for me by my elders and by the things that I do for our tribal people is what we call the nah-nan-wii-way wi-ni-nii. Again, that would be tribal healer or medicine man to put it in laymen's terms and equating as that.

Q Are you a member of the Midewiwin Society?

A Yes, I am. I'm mide priest.

Q What does that mean?

A That means that I've been initiated into our religious society. To equate, it's like the priesthood; different of course, but I guess that'll be the same thing, the Midewiwin Society.

Q And what is the purpose of the Midewiwin Society?

A The Midewiwin Society is -- I guess it's like an institute, a school if you want -- might say it, to where our elders teach religious duties to initiates.
Q And you're a member of this school?
A Yes, I am.
Q And is there a gradation of membership in the school; I mean, are you brand new or --
A There is levels. There's levels of initiates up to eighth degree. And I'm not brand new but I'm -- it could take a person well over ten years to finish first degree in ceremonial religious duties involved in that first degree.
Q So this is a serious and lifelong road for you?
A Yes, it is. It's a lifelong obligation, yes.
Q And how large of a geographical area does the Midewiwin Society serve?
A Well, I've worked in Anishinaabe health in Toronto, Ontario to the east. I've also been called on by the Mohawk people in New York to provide service out there. Down to Tama, Iowa which is by Ames Iowa down south to Sweet Grass, Saskatchewan in the west, Winnepeg, Manitoba; throughout Northern Ontario, which is Quinora, White Dog and those areas there also. So it's a huge area.
Q Could you describe in more specific ways what you do as a Midewiwin priest when you're traveling to other places?
A Well, like I said, primarily my duties include traditional

practices that are handed down from our elders, which is the ceremonial aspect, the prayer aspect, and also the medicines and the healing part of it.

Q Okay. Are you familiar with a place called Eagle Rock?

A yes, I am.

MS. HALLEY: Could you put the figure 4-2 up, please?

Q Could you show us where Eagle Rock is on this?

A Right there (indicating).

Q Okay. And what is your understanding of the orange line through --

A I believe that's the proposed mining tunnel.

MS. HALLEY: Could you put up the slide 11 of Exhibit 11?

Q Are you familiar with this place?

A Yes; that's Eagle Rock.

Q Okay. What is it like at Eagle Rock when you've been there?

A One of the things in the concepts or the beliefs of the Anishinaabe people, all Mother Earth is sacred. All of Mother Earth; not just Eagle Rock but all of the Earth, water, the rocks and everything on Mother Earth. But in particular we're given sites or places by God -- or "The Great Spirit" as we refer to it -- that are marked for us that we are to find and we're to use. And we look for these particular markings on rocks, on lake shores, mountains, you

know, there being one place of the four corners of the Earth. Also Dreamer's Rock in Canada, Manitoulin Island area. Those are very, very sacred. I guess those being like the Vatican to us; you know, a real, real powerful place of worship. And that -- Eagle Rock has a significant marking on it that I've only seen in two places in my travels and one is in -- among my Cree relatives in Saskatchewan. They have a mountain -- a sacred mountain also like -- that has the same markings as Eagle Rock. And this is the other place that I've seen that.

Q So in all of your traveling around the Midwest and Canada you've only seen one other place other than Eagle Rock that has this particular significant marking?

A That's correct.

Q Okay. What does that marking mean to you?

A That marking to me and what -- when I was introduced to Eagle Rock told me of tribal teachings and legends of -- you've heard mentioned by Mr. Curtis Winaboozho and by Ms. Blaker. Winaboozho we believe in our traditions and our religious society is the son of God, similar to Jesus. And that there's certain places in our creation story that he has marked for us to use for prayer and for ceremony.

Q And is it your understanding that Eagle Rock is one of those places?

A Yes, it is.

Q Could you describe the history of Eagle Rock, maybe not quite as far as back to Winaboozho, but your ancestors?

A In my travels, like I say, I go to many different places around the country and provide ceremonies to our Anishinaabe people. They have their sacred sites on their reservations. Like in Red Lake I can tell you about the place of the little people that we use for sacred offerings and nothing -- it's like little churches all over, I guess you might say, if you want to equate to something. In my reservation I could tell you exactly where our sacred places are. And as I said earlier, part of my non da go zeein or purpose in life is to provide ceremonies and medicines and healing ceremonies to our people as Midewiwin Society prescribes for me to do and also to bring back a lot of our sacred teachings that the elders carry.

Q I see. You've been to Eagle Rock yourself?

A Yes, I have.

Q And why did you go to Eagle Rock? What prompted you to go there?

A Well, we needed to do -- conduct some sacred ceremonies, some sacred fasting, spiritual offerings for the health and benefit and welfare of the people of the Keweenaw Bay Indian Tribe. So we -- I needed -- I asked the people there of a sacred place that we could use and that's how I was introduced to Eagle Rock.

Q And about when was that?
A That was in 2002.
Q So about six years ago?
A Yes.
Q And in that discussion of deciding where to go and -- well, where to go, was the mine a part of that discussion at all?
A I don't believe so; no.
Q Okay. So you weren't going there because of the proposed mine?
A No, we were going there to pray.
Q Pardon me?
A We were going there to pray.
Q Going there to pray? Okay. Is it your understanding that Anishinaabe people have been using Eagle Rock for a long period of time?
MS. LINDSEY: Objection; foundation.
MS. HALLEY: I'll lay a foundation.
JUDGE PATTERSON: Okay.
Q You have heard and learned from your elders about the history of Eagle Rock, have you not?
A From the Keweenaw Bay elders, yes.
Q Okay. And they for some reason indicated that Eagle Rock was a special place?
A Yes, they did.
Q Okay. What would lead them to that conclusion do you think,

based on your experience of Anishinaabe culture?
A From what I understand they prayed there before in the past.
Q Roughly how long into the past; do you have any idea?
A Well, some of the elders that I talked to were 80 years old there in the tribe, so, you know, who knows?
Q Does the significance -- this marking on Eagle Rock, does that lead you to any conclusion at all about how long your people have probably been using Eagle Rock as a sacred site?
A Well, according to the teachings, if -- and the Midewiwin, that anyone with understanding of Winaboozho -- like I said -- like I said, it's not our tradition to talk about that person -- they would have you utilize that --
Q Just for the record --
A -- as a place of worship.
Q Just for the record, Mr. Downwind, you were using the name "Winaboozho" and she used the term "Nanaboozho." Are those the same?
A Dialect; dialect.
Q Thank you. But you're referring to the same entity?
A Person, yes.
Q Okay. Thank you.
A It's western dialect; eastern dialect. Nanaboozho; Winaboozho.
Q Okay. Thank you for that clarification. What are the historic uses of Eagle Rock?

A Well, in my understanding it's a place for vision and fasting and that's what we do there. Vision quests being seeking a greater communion with The Great Spirit. Fasting is short-term one to four days of prayer and offering.

Q Does that mean staying at that one particular place for one to four days?

A yes.

Q Okay. One to four days 24 hours a day or what?

A Yes. It's 24 hours a day, whether it's one -- it's sunup to sundown, or sunup to sunup or four sunups, four sunrises. That's how we do it in terms of use.

Q Okay. Thank you. So since you started going to Eagle Rock how often do you go there?

A Well, specifically I would say twice a year up to two to four days, because -- and let me further elaborate on that. It's because that we have certain times that we fast and that's the spring and the fall when -- and then as a sacred site we use it all the time for like Mr. Curtis stated of making our tobacco offerings; which basically is just stopping to pray, to pray in those terms.

Q So this may sound like a silly question at this point, but is Eagle Rock important to you on a personal level?

A Yes, it is.

Q Why is that?

A Because of the -- like I said, the markings and the power,

the spiritual power of the region and the area.

Q Okay. And you've talked about fasting at Eagle Rock. What else do you do at Eagle Rock?

A Well, we've done a number of ceremonies over there. And I guess -- well, we've done tobacco ceremonies and we do ceremonies where we feed our ancestors, feed our -- the spirits of the region. We pay tribute and homage to the land right there. We believe that every space is occupied by a spirit; every part of the Earth is occupied by a spirit. So when we go there we pray with those spirits and -- but our greater communication is with The Great Spirit, our God.

Q So you just said that you believe that every part of the Earth is occupied by spirits?

A Yes, it is.

Q Okay. So is Eagle Rock any different than any other part of the Earth to you?

A Like I said earlier that there's certain places on the Earth that are marked, I guess, and like I said, like there be one -- being one, Eagle Rock being one, the mountain in Saskatchewan that I've been to and Dreamer's Rock in Canada. They're marked in a certain way by The Great Spirit and certain things that are there for us to recognize as Anishinaabe people. That's why we say it's a recognizable prayer site.

Q Do you collect plants?
A Yes, I do.
Q What do you do with those plants after you collect them?
A Well, that's a whole process in itself. Certain plants can only be picked at certain time of year. We pick plants there also.
Q "There" being at Eagle -- on Eagle Rock or in the vicinity of it?
A Around the area in the vicinity, yes. Certain things that we use for healing, herbal medicines; can equate it to that, I guess. And we pick those and we process them, dry them, use them for ceremonial healing.
Q Just to be clear, do you gather medicinal plants on Eagle Rock?
A Yes, I have.
Q Okay. And is there -- are there unique plants there that you have trouble finding at other locations?
A Well, there's some plants that we use for kidney and diabetics, which is -- we use a lot of those within our tribal nation right now, so yeah. Yes, there's just -- just there at Eagle Rock.
Q Oh, okay.
A There's also certain cancer plants there.
Q Certain --
A Plants we use for cancer.

Q Plants you use for cancer?
A Yes.
Q That are unique to Eagle Rock?
A Yes. They're within the jack pine tree.
Q Okay.
MS. HALLEY: Could you put the site map up again?
Q Okay. We've gone over this a couple of times at this point, but do you see the gray line around the surface facilities there?
A Yes, I do.
Q And what does that gray line indicate?
A I understand it's a proposed fence.
Q Is the rock inside or outside of the fence?
A It's inside the fence.
Q Inside the fence. How do you feel about that, Mr. downwind?
A Well, fences are made to keep people out. I believe that's what the fence is going to be used for.
Q How do you feel about being kept out and off of Eagle Rock?
A Well, I guess it's a tragedy. You know, it's another loss for our people, you know. That's the way I look at it.
Q Could you go to some other sacred site and have the same spiritual experience that you have at Eagle Rock?
A You know, we conduct many, many ceremonies a year, but each one is individual and within itself unique, so there would be no other place like Eagle Rock. When we do a ceremony

there it's the ceremony for that area.

Q I see. Okay. Let's assume for a moment that you could access Eagle Rock but that the mining were going on in the vicinity, as you see there adjacent to Eagle Rock; right across the road about a quarter of a mile away more facilities. Would you still go to Eagle Rock if that were the case?

A Well, provided you could get through the fence, I probably wouldn't go back there.

Q Why not?

A Because it would be desecrated.

Q And why is that? If the -- what if the top of Eagle Rock were left undisturbed and the top looks just like it looks today, then what?

A I believe -- you -- in understanding our culture and traditions that there are -- it goes down below.

Q What do you mean?

A It goes -- the spiritualness of the rock or the area goes straight to the core of the earth, according to our teachings.

Q So does it matter to you if the tunnel is at the very top or in the middle or underneath the ground surface of Eagle Rock? Does that -- what does -- does that have anything to do with the spiritual nature of Eagle Rock for you?

A Yes, it does. As I said, it would be desecrated. It would

not be the same.

Q Even though the tunnel is proposed to be beneath the ground surface?

A Yes. To put it in another analogy, it would be like Christians, you know, finding -- say they found dinosaur bones under their Calvary Hill and they wanted to dig that up. Well, that would be desecrating that site. It's the same thing.

Q I see. What does the phrase "place of worship" mean to you?

A A place where I can commune with the great spirits.

Q Do you consider Eagle Rock to be a place of worship?

A Oh, yeah; yes, I do.

Q Has anybody from Kennecott ever made any effort to talk to you about the importance of Eagle Rock?

A No.

Q Has anybody from the DEQ ever made any effort to talk to you about the importance of Eagle Rock?

A No.

MS. HALLEY: I don't have any more questions at this time.

MR. EGGAN: I have nothing.

MS. LINDSEY: Good morning, Mr. Downwind.

THE WITNESS: Good morning.

MS. LINDSEY: I have just a couple of questions.

CROSS-EXAMINATION

BY MS. LINDSEY:

Q You wrote a letter to Susan LaFernier, did you not, about Eagle Rock?

A Yes, I did.

Q And that was in 2006?

A Yes.

Q If I can just read from your letter, you said, "I was asked by the Keweenaw Bay Indian community to look at an area" --

MR. EGGAN: Counsel, is this an exhibit?

MS. LINDSEY: It is not, but I'm going to ask him to --

MR. EGGAN: Well, then please don't read it until it's been offered and established as an exhibit.

MS. LINDSEY: I don't believe it needs to be an exhibit to talk to him about his letter.

Q You wrote a letter; correct?

A Yes, I did.

Q Okay.

MS. LINDSEY: I can make it an exhibit. I was not going to make it an exhibit.

MR. EGGAN: It's up to you, Counsel, but I -- if it's not an exhibit, I'd just as soon you not read it.

JUDGE PATTERSON: Well, it's a letter that Mr. Downwind wrote, and I think --

MS. LINDSEY: Correct.

JUDGE PATTERSON: -- your just asking him to acknowledge the language of that, as I understand.

MS. LINDSEY: That's all I'm asking.

JUDGE PATTERSON: All right. I'll allow that.

MS. LINDSEY: Okay.

Q So in that letter you were talking to Ms. LaFernier -- correct? -- about being asked to look at an area called the Eagle Rock?

A Uh-huh; yes, I was.

Q And that was in 2006?

A Okay.

Q So was it Ms. LaFernier who asked you to look at Eagle Rock?

A Yes, it was. But we had already been using it since 2002.

MS. LINDSEY: I have nothing further. Thank you.

THE WITNESS: Thank you.

MR. REICHEL: I have no questions.

MS. HALLEY: I just have one clarifying question.

REDIRECT EXAMINATION

BY MS. HALLEY:

Q When you first started using Eagle Rock in 2002, did it have anything at all to do with the proposed mine?

A No. As I stated earlier, it was for prayer basically for the travel people; that we needed new ceremonial offerings for the travel people. That was the recommended place by the elders.

MS. HALLEY: Thank you. No further questions.

JUDGE PATTERSON: Thank you, sir.

MS. HALLEY: Thank you.

MR. HAYNES: Your Honor, before we call our next witness, I'm afraid we have to take that dreaded technology break.

JUDGE PATTERSON: Okay. All right. How long do you need?

MR. HAYNES: Five to ten minutes.

(Off the record)

MR. HAYNES: Petitioners call Robert Prucha to the stand.

REPORTER: Would you raise your right hand? Do you solemnly swear or affirm the testimony you're about to give will be the whole truth?

DR. PRUCHA: I do.

ROBERT H. PRUCHA, PH.D.

having been called by the Petitioner and sworn:

DIRECT EXAMINATION

BY MR. HAYNES:

Q Would you say your name for the record and spell your last name, please?

A Robert H. Prucha. It's P-r-u-c-h-a.

JUDGE PATTERSON: I'm sorry. Can you do that again?

THE WITNESS: It's P-r-u-c-h-a.

JUDGE PATTERSON: Okay. Thank you.

THE WITNESS: Uh-huh (affirmative).

Q Dr. Prucha, could you tell us briefly what your educational background is?

A I have a background in geology, hydrogeology and engineering -- water resources engineering.

Q And did you obtain a bachelor's degree?

A I did.

Q In what subject?

A Geology.

Q And where did you get your bachelor's degree from?

A At UC Berkeley.

Q For those of us out here in the Midwest --

A In California.

Q Thank you. And, Dr. Prucha, did you receive a master's degree from an educational institution?

A I did.

Q From where and in what?

A University of California at Berkeley, and that was in the mining hydrology --

Q And what was your --

A I'm sorry -- engineering hydrology.

Q And what was your master's thesis or the subject of the master's thesis?

A Geothermal reservoir engineering.
Q And did you obtain a Ph.D.?
A I did.
Q From where and when?
A University of Colorado at Boulder in 2002 in civil engineering water resources.
Q And what was your Ph.D. thesis?
A It was on looking at integrated hydrologic models and developing conceptual and numerical frameworks for large-basin systems and in semiarid areas.
Q Dr. Prucha, where do you live?
A In the Boulder, Colorado, area.
Q Do you have any professional registrations?
A I do. I'm a professional engineer in the State of Colorado and in California.
Q Could you give us briefly your work experience post master's degree?
A I worked at several companies, some large -- a large engineering firm, a smaller engineering firm for a number of years.
Q And generally what have your duties been in your work?
A Mainly to develop hydrologic models, water-flow systems.
Q And what is your present employment?
A I co-own a small business called Integrated Hydro Systems, and we are involved in developing to a large extent models

or reviewing models that have been developed for surface water systems, groundwater systems, the integrated coupling of those systems.

Q Have you published any papers dealing with hydrologic modeling?

A I have; integrated modeling to a large extent where you couple groundwater systems and surface water systems.

Q And are those papers listed in your resume?

A They are.

MR. HAYNES: For the record, Dr. Prucha's resume is Petitioner's Exhibit 120, and it has been admitted by stipulation.

Q Dr. Prucha, in your experience and education, have you become familiar with geologic terms?

A Yes.

Q And for instance, geologic terms such as "dikes"?

A Yes.

Q "Faults"?

A Yes.

Q A geologic term such as "unconsolidated material"?

A Yes.

Q By the way, is that a relatively recent phrase that's used to describe another -- is there another way to describe unconsolidated material? What did it used to be called?

A It's what I normally refer to as unconsolidated material or

deposits that are not consolidated. They're not in hard rock.

Q So unconsolidated material would be not bedrock?

A That's right.

Q In your field of hydrology and water resources engineering, are there other geologic terms that would be used that are relevant to your testimony today?

A You may hear terms like "quaternary deposits" or "alluvial deposits."

Q And what do you mean by "quaternary deposits"?

A Those are really Ice Age -- post Ice Age deposits, and I think they can be synonymous with the unconsolidated deposits or materials.

Q And what about alluvial deposits?

A Alluvial deposits are deposits that were deposited in a moving-water system.

Q So how would you distinguish from a geologic standpoint quaternary deposits from alluvial deposits?

A "Quaternary deposits" just refers to an age or a date, and they're pretty much the same material.

Q I see. Now, do you have experience reviewing hydrogeology reports of other consultands?

A I do.

Q Do you have experience writing such reports?

A Yes.

Q And has that been true throughout your career?
A Yes.
Q Do you have experience reviewing characterizations of bedrock aquifers?
A Yes.
Q And has that been true throughout your professional career?
A I would say not exclusively. I probably spent more time looking at unconsolidated deposits. But in almost every system I've looked at, bedrock becomes an important factor in looking at the whole hydrology of the system.
Q I see. And do you have experience preparing reports dealing with characterizing groundwater flow?
A Yes.
Q And would those reports characterizing groundwater flow deal with groundwater flow in the unconsolidated materials as well as bedrock?
A Yes.
Q Do you have experience designing conceptual groundwater flow models?
A Yes.
Q And for Judge Patterson's benefit and perhaps for ours too, can you give a brief description of what you mean by "conceptual groundwater flow model"?
A It's a term that's used to describe where you think water comes into a system; the basic structure of the system; the

aquifers where water flows through; the aquatards where water doesn't flow through so easily; where water exits the system. So it's really a pretty comprehensive description of where you think the water's going throughout the system and what the stresses are or influences -- factors that influence its movement through the system.

Q And, Dr. Prucha, these models are predictive systems, are they not?

A That's right.

Q Do you have experience calibrating groundwater flow models?

A Yes.

Q And what do you mean by "calibrating groundwater flow models"?

A It's the process where you develop a conceptual understanding of the system, and you construct a mathematical model of the flow going through the system. And the process of calibration is your efforts to try and reproduce what you see in the field, either flows or groundwater levels, within a specified degree of tolerance.

Q When you say "a specified degree of tolerance," what do you mean by that?

A Well, that's where you say -- when you develop a model and you try and reproduce a water level at a given point within the system or flow, the model's only a representation of the true system. There are simplifications. But effectively,

that means that you will have some difference between what you simulate and what you observe. And the calibration attempts to reduce or minimize that difference between your observed and estimated or simulated level at that point.

Q Dr. Prucha, in your experience, do you have experience validating groundwater flow models?

A I do.

Q And what do you mean by "validating groundwater flow models"?

A We typically use it in a context of having developed a calibrated flow model, and typically you use it in the context of -- when you calibrate a model, you have another set of system observations, a distinct set. And you try to reproduce that set so it's -- the first model that you calibrate is one set of conditions. The second would be another set of conditions. Maybe the rainfall changes. And you go through the same process of calibration, where you compare the simulated or estimated model-derived value with what you observe. And again, if you can show that your model correctly, you know -- or reproduces the system flow within this tolerance in both conditions, it provides considerably more credibility in the model that you've developed; that it reproduces the system.

Q I see. In your work, Dr. Prucha, do you have experience using models to predict groundwater flows?

A Yes.
Q Is that the purpose of such models or a purpose?
A It's a purpose, yes.
Q And in your work, Dr. Prucha, do you have experience performing uncertainty analyses?
A Yes.
Q And what, for our benefit, is an uncertainty analysis?
A After you develop this series of models that you believe represents the system within this tolerance that you've specified, because the model is a -- it's a simplification of the actual system, you acknowledge that there will be some error in that calibration. And the uncertainty analysis is an attempt to add effectively a plus or minus at the end of a predicted value. So I estimate the flow out at this river of "X" amount, and you would add a plus or minus saying, "I believe that it's uncertain within a certain range." So there are a series of steps that you usually go through in conducting an uncertainty analysis, and it's really a required step these days to qualify your response. Because in modeling it's possible to develop a model that's not very-well calibrated, and you can generate a significant amount of uncertainty that could be greater than your objective.
Q For purposes of your testimony today, Dr. Prucha, did you review various groundwater models prepared by Kennecott and

its consultants?

A I did.

Q Dr. Prucha, we've had put on the screen a figure from Kennecott Exhibit 7.

MR. HAYNES: This is the -- for the record, the environmental impact assessment Appendix B-3.

JUDGE PATTERSON: B?

MR. HAYNES: B; "B" as in "boy," 3, figure 8.1.

Q Dr. Prucha, have you reviewed this figure?

A Yes.

Q And is this figure related to the hydrology of the -- excuse me -- the groundwater modeling that was performed for the proposed Eagle Mine?

A Yes.

Q Dr. Prucha, can you tell us what the various -- what your understanding is of the various figures that are shown on this figure 8.1?

A Okay. My understanding is that this is a map that describes the locations of where they conducted a bedrock well test, where they pumped the groundwater from the bedrock. And in this upper left corner here shows a line going down here with a black zone, and it says, "This is well 084." It's a pumping test interval. They pumped the water from this (indicating) zone in the lower bedrock, and they observed the response in surrounding wells that are labeled at

various locations here.

Q And just for the record, what are the labels of the other wells?

A To the left or west of the pump zone is well 84. And by the way, this is a well that has an -- it was drilled at an angle. So it started at the ground surface here and went to the east. To the west of that pump zone is well 074, and it actually starts at the surface to the south and goes up to the north. They have a shallow well, 023, to the far left -- upper left corner; have another well here, 107, that's between 84 and, say, 23, and another well, 077, that starts to the north and drops down into the lower bedrock to the south. And they have a well to the far right called YDO2-20. The text below each just indicates the amount of the drawdown at the -- during the test reported when they pumped this particular well.

Q When they pumped well 84?

A Right; when they pumped well 84.

Q And just for the record, for instance, what was the drawdown based upon this figure for well 074?

A I believe that says "83 feet" or "meters" -- "83 meters."

Q Okay. Can you explain for us what you mean by "drawdown"?

A When you pump a well -- and by the way, this particular well was pumped from a particular zone that was packed off over a small zones where there was a fracture noted that produced

flow through it. But drawdown effectively is, when you pump this well, the water surrounding it with time starts to drop from its original elevation, and that propagates out from the pump zone with time. So at the location where the pump was actually sitting in this well, the drawdown is the greatest. The water level drops the most. And for this well it was nearly 200 meters that they dropped that; couple of football field lengths. It's a pretty significant drop.

And out at wells at a distance here, they dropped -- this dropped 83 meters. So it's saying, in effect, that the pumping at this lower -- from this lower zone here (indicating) is influencing the water level at this well 074.

Q Is the purpose of the pump test, then, to try to determine how the water behaves underground when there is water drawn out from underground?

A Yes.

Q Dr. Prucha, I've now put up on the screen from Petitioner's Exhibit 63, this is slide 14. Dr. Prucha, is this a figure that you prepared?

A I did.

Q And what was your purpose in preparing this figure?

A My intent was to take the figure that had been provided in the report and simply try to locate it over the orebody and with reference to the Salmon Trout River to tunneling in the

area and to noted faults.

Q All right. For this figure, we see a blue line that starts on the bottom sort of center and then trends up and to the left, and I see a label that says "Salmon Trout River." Is that your representation for your analysis here of where the Salmon Trout River is?

A That's right. This comes from the DEQ website for -- this is just another geographical information shape file, so it's a file that had this map, and I simply brought it into this program.

Q So you transposed an electronic map onto this figure?

A That's right.

Q Okay. And then the -- there seems to be an -- I guess it's orange-colored or magenta-colored figure to the north of the Salmon Trout River. What does that represent?

A This (indicating) line?

Q Right; yes.

A The red boundary is the approximate location of the orebody --

Q And where did you get --

A -- as I took off --

Q I'm sorry. Where did you get the orebody figure from?

A I traced that from a map that I'd gotten from a report and brought that in. That wasn't provided.

Q And then we have a purple line that seems to go in various

directions. What's that represent?

A This is an approximate line that represents the tunnel. And again I got that off of a map. The intent wasn't to draw it super accurately but to get the approximate location and reference it to the pump test wells.

Q I see. And horizontally going through about the center of the figure, we see a light-blue sort of dashed line. What does that represent?

A This is a line that represents a dike that a geologist in the late 70's identified.

Q And by "a dike" -- what do you mean by "a dike"?

A It's an obtrusive body of material that's different than the surrounding country rock. that is extending up vertically relative to that country rock and --

Q And you've identified, it appears, on this figure that dike as the Klasner dike?

A That's right, --

Q Is that your --

A -- as he defined it.

Q I'm sorry?

A As he defined it.

Q All right. Now, we also have a sort of a yellow line that's on the right-hand side of the figure that trends sort of northwest to southeast. What is that?

A This is actually the left side of a zone that the same

author, Klasner, in the late 70's defined as a fault zone. And again, this was taken from his report by georeferencing his material and lining it up with information that we had at the local site here.

Q And we also see a red arrow in the upper right portion of the figure that you seem to have labeled "Klasner Fault Zone." What is that?

A Right. This orange line represents the westernmost boundary of the fault zone. And so if you proceeded maybe 500 meters to the east, it would represent the other side of this zone that he had mapped as a fault zone.

Q Now, you may have already testified to this, but what was your purpose in preparing this slide?

A The primary purpose was, when I read through these reports initially, I had a lot of trouble trying to determine where these wells were located with respect to the orebody. One of my primary interests was to determine whether they had characterized hydraulic -- through hydraulic testing the entire area where they plan to mine, tunnel; whether they had crossed mapped faults through the area.

Q Now, in your experience, Dr. Prucha, is it important for modelers to take account of things like dikes and faults?

A Absolutely. They can be controlling features for the hydrology, especially in bedrock systems.

Q When you say "controlling features," what do you mean?

A Controlling the groundwater flow through those systems in the bedrock. The bedrock has been -- the matrix material, not the material that's faulted, appears to be relatively low permeability or has a low ability to transmit water through it.

Q Let me see if I can -- if I understand what you mean. Are you saying that bedrock normally doesn't allow water to flow through it very fast?

A Not very readily, not compared to the unconsolidated depends that would --

Q Above the bedrock?

A Which are maybe sands. It much more readily allows water to flow through it; a greater volume.

Q And so, then, are you contrasting the dikes and faults with the bedrock, then, in terms of the flow capacity?

A That's right. They're associated with the bedrock and, when you think of the bedrock system -- when I read through the report, I think the conclusion is that there's not much flow through the bedrock system. And yet these large faults are -- can be significant conductors of water through the system -- through the bedrock system, and they can translate water from the bedrock system into the over- -- the unconsolidated material.

Q And explain that process for us; that is, how these faults and dikes would transmit water more readily than the

bedrock. Why is that?

A Because their effectively open --

MR. LEWIS: Just a minute; just a minute. Just an objection as to form, your Honor. The witness has testified that they can be, and this question is now posed as if they are. So I have an objection to the form and the foundation.

MR. HAYNES: Well, I'll rephrase it.

JUDGE PATTERSON: All right.

Q Dr. Prucha, how would you describe the process by which faults and dikes can transmit water more readily than bedrock?

A There are continuous features that -- in the case of Klasner mappings, these are on the order of kilometers -- several kilometers or miles, and they're open. They have a certain width, and the -- they allow water to flow through readily along those lineaments.

Q Describe a lineament for us.

A It's a straight -- I mean, generally these features tend to be more linear than not linear.

Q Than curved or at right angles?

A That's right; that's right.

Q Dr. Prucha, I've had put up on the screen again from Kennecott Exhibit 7 the environmental impact assessment Appendix B-4, figure 9.5. And is this a figure, Dr. Prucha, that you've reviewed?

A Yes.
Q And what was your purpose in looking at this figure?
A This is a predicted drawdown at the end of mining for what's been referred to in the report as an upper bound case, where they --
Q And explain for us what you understand an upper bound case to mean as a -- from a modeling standpoint.
A Well, in modeling you try to define the range that could possibly result from your interpretation of -- conceptualization of the system flow. When I reviewed a lot of the available information, it suggests that there are faults that run through the area that are extensive, and I was looking to see in this result here (indicating) whether the model that had been developed produces a drawdown -- simulated drawdown in the bedrock that is reasonable.
Q And, Dr. Prucha, when you reviewed this exhibit, did you try to calculate the area that is shown by this figure in terms of the drawdown post mining?
A The area impacted?
Q Yes.
A I did not actually calculate the area for this particular drawdown.
Q Do you have an estimate?
A It's at least a mile in diameter.
Q So from the center of the figure out to the outermost

concentric circle here, we have a mile in diameter?

A A mile in diameter, right, at least.

Q Now, is that modeling dimension something that you would expect to see from the models that you saw in the reports that you reviewed?

A I was surprised that it wasn't more -- that it was so concentric or circular. It didn't seem to indicate just by design that the faults had a pronounced effect going north, south and east, west like they imposed on this particular model.

Q And for modeling an area that has a mile in diameter, would you expect to see six wells used or more than six wells or less than six wells?

MR. LEWIS: Objection; foundation.

MR. HAYNES: Your Honor, I think I've laid a foundation that the witness can testify about how models are constructed.

JUDGE PATTERSON: I agree. I'll overrule the objection.

A I would expect over this area that you would have not only more wells but not all located in one location.

Q And what do you mean by that?

A Well, relative to the size of the drawdown area here (indicating), all of the wells in the bedrock are located in the very smallest central drawdown area that you can't even

really see at this scale. It's almost a dot at this scale. So in effect, they haven't characterized the bedrock system over this entire area; just this small area largely within the orebody.

Q Just so the record is clear, Dr. Prucha, you're saying that, for purposes of this predicted drawdown figure, figure 8.5 -- excuse me -- 9.5, the wells are located within the center circle, and there are no wells located. for purposes of this drawdown prediction, in any of the other concentric circles noted on this figure?

A Not that I noted in the reports.

Q Dr. Prucha, I've put up on the screen from Kennecott Exhibit 7 the environmental impact assessment Appendix B, as in "boy," 1, figure 4. And is this a figure that you have reviewed?

A Yes.

Q And what does this figure show you in terms of the geology of the area around the proposed mean?

A Well, first of all, the proposed mine is located in this area, and it --

Q You're pointing with a laser to the center?

A In the central part of the figure. And the Salmon Trout extends just below that and off to the west going to the north. And what I saw from this figure was a number of faults -- fault lines that go from southeast to northwest,

pretty much paralleling each other. And in some cases they're offsetting dikes that are effectively for the most part running east/west. Another thing that struck me about this figure was the length of these.

Q Of these what?

A Of these dikes and the faults; that the lengths of these are -- and here's the scale here. This is 1 kilometer, this scale down in the lower left. And these -- there are one, two, three, four dikes shown on here that are running east/west, and these are several kilometers -- several miles long. And I believe that other information I've looked at it's actually these extend on for even longer than that.

Q And why is that significant for purposes of groundwater modeling? Let me rephrase the question. Is that significant for purposes of groundwater modeling?

A It is.

Q And in what way?

A Well, I believe that these dikes can be low-permeability material compared to the surrounding country rock. In terms of the implications for modeling and so forth, these weren't considered in the model, and they would certainly have an impact on any estimate or prediction put forth by those models from the drawdown in this particular area.

Q Dr. Prucha, if you had been asked to prepare a groundwater model for this mining application, would you have put these

dikes and faults into the groundwater model?
A Absolutely.
Q Would that have been best practices?
A Yes.
Q I'm sorry, Dr. Prucha. The faults and dikes, are those areas of low permeability or high permeability?
A Well, the dikes are generally considered to be areas of low permeability except for the information that I've reviewed from Marcia Bjornerud and Stan Vitton that indicates that there are brecciated zones around either side, the contact of these with the surrounding country rock.
Q And excuse me. What do you mean by "brecciated zones"? And could you spell that for the record so the court reporter --
A B-r-e-c-c-i-a-t-e-d.
Q And what are brecciated zones?
A My understanding is that they're the zone between the intrusive that was hot, and it cooled and created fractures in the country rock that was colder, and it created the fractured rock that's permeable, and that permeability allows water to freely move through that zone. So you can imagine that these might be impermeable to flow in a north-south direction. The dikes that are located east/west may be impermeable or prevent significant flow going from north to south. But along them on these brecciated zones at a large scale like this, you can imagine them preferentially

routing water along them. Then add that into conjunction with the noted faults through the area -- and I note that some of these actually align with rivers, which I think is another important point that was sort of overlooked.

Q And how is it important to note that faults are generally aligned with rivers?

A Well, in a lot of systems I've looked at, this is generally the case, where over the time the rivers tend to align themselves with these large structural features, because water moves through these faults preferentially, and they establish a connection with the surface water because they tend to drain water out through the rivers.

MR. HAYNES: I apologize, your Honor. We have to wait for the electrons to move right.

Q Now, Dr. Prucha, for purposes of your testimony, did you prepare the figure that we have up on the board, which is slide 13 of Petitioner's Exhibit 63?

A Yes.

Q And what were your source materials in preparing this slide?

A Again, the information that is shown on the map. I have a topography shown with the various colors underlying the whole box here (indicating).

Q And what do the colors represent generally?

A Elevations generally are higher in red zones and lower in darker colors off to the north.

Q And what else have you shown on this figure?
A I've also shown the Salmon Trout River. It's roughly in the center of the diagram and goes up towards the north.
Q And does the diagram show the orebody?
A It does; a little red zone here (indicating) just above the Salmon Trout River, and then it shows Eagle Rock off to the right of that in the center area.
Q And what do the green lines represent -- the green horizontal lines?
A The green lines are the dikes that we saw in the former exhibit.
Q And what about the -- I think those are red sort of northwest-southeast-trending lines.
A These are the faults, the darker, almost brownish color heading off to the northwest.
Q And we also have a series of lighter blue lines that look like they tend mostly east and west. What are those?
A These were dikes as mapped by Klasner in 1979.
Q I see. And on this figure we have at the top -- it appears to be a reference to Rossell and Coombes 2005. What is that?
A They were the authors of the geology report that I reviewed.
Q And what was your purpose in preparing this slide?
A Well, I'd also note that Klasner also mapped the orange lines here as well, and these were faults in the area. And

one of my primary interests was to see how two different groups were mapping the faults and dikes in the area.

Q Did you find the mapping between the two authors consistent generally or inconsistent generally?

A More consistent than inconsistent, but I did find differences.

Q Now, Dr. Prucha, have you reviewed Marcia Bjornerud's report that was submitted as part of the comments for the application in October of 2007?

MR. HAYNES: And for the record, that is Petitioner's Exhibit 3, Appendix A already admitted.

A Yes.

Q Dr. Prucha? "Yes"?

A Yes.

Q And what portion of that report, if any, was significant to you for your analysis here?

A Probably the most significant part was the brecciated zone along the dikes and the fact that these could be very significant water conductors or routes that groundwater can preferentially flow through.

Q Now, Dr. Prucha, we've had put on the screen from Kennecott Exhibit 11 the environmental impact assessment -- excuse me -- Appendix B, as in "boy," 8, figure 21. And what was your -- you've looked at this exhibit, did you not?

A Yes.

Q And what was your purpose in looking at this figure 21, which is the conceptual hydrologic -- excuse me -- hydrogeologic cross-section B to B prime?

A The point of this was to see whether the authors of the report had considered whether the intrusive that was mapped at the orebody was actually located underneath the Salmon Trout River and --

Q And what does this figure show you in that regard?

A This shows me that they are considering that at this -- in this particular conceptual diagram; that the actual dike that's shown with sort of the left part of the diagram that's sort of a vertical structure, and it's elevated with respect to the surrounding country rock has intruded and sits below and is in contact with the Salmon Trout River and likely the wetland area.

Q Dr. Prucha, you've been talking about country rock. I don't see on this figure the phrase "country rock." Is there a designation of rock or soil types on this figure that would translate to country rock?

A It would be what they're referring to as the bedrock metasedimentary rock, and it's -- the writing doesn't show it well on this plot, but it underlies the unconsolidated material, and it appears on the left and the right of this (indicating) near-vertical dike or what they would refer to as igneous intrusive.

Q Does the phrase "metasedimentary" have a particular meaning in geology, just for the record?
A It's of sedimentary origin, and it has been consolidated into a rock as opposed to unconsolidated.
Q I see. And is there a significance about this figure for modeling purposes?
A A big significance.
Q And what is that?
A Well, in terms of producing a model, you'd want to be able to show that the bedrock system is intruding to the ground surface. And although this (indicating) figure doesn't come out in the area that's black here, it actually shows stratification of different layers in the unconsolidated material. But probably the most important thing about this drawing is the fact that, if -- I mean, there are brecciated zones in the contact of this intrusive. This would offer a direct conduit between lower bedrock areas where they're going to be dewatering the mine and surface water, in addition to the shallow aquifer system shown in black on this picture.
Q Now, I notice on this figure that there are some appear to be designations along the top -- along the surface. What are those designations?
A Well, in the original diagram, they refer to "boreholes" or -- that are, you know, actually wells that have been

drilled through the dark area here, which is really the unconsolidated material. So there are wells at each one of these points.

MR. HAYNES: Your Honor, I apologize for the opaqueness of the exhibit, but I think that Mr. Eggan will be able to clear this up later with a color version. So I apologize.

MR. EGGAN: We can do that if you wish, if it would help to have the color version.

MR. HAYNES: It would help, yes.

MR. EGGAN: Okay. Do you want it now?

MR. HAYNES: Yes.

MR. EGGAN: MDEQ 010814. Okay. It's a different one. Let me give you a different one. I think it's MDEQ 0110820.

THE WITNESS: That's it.

MR. EGGAN: That's it in color.

Q All right. Dr. Prucha, Mr. Eggan has graciously put up on the screen the same figure 21 in color. And with that help, can you explain for us what the different colors are in the legend for the different kinds of rock?

A Sure. The brown and the blue really are what are defined as sands, and the only difference there is that the blue is where groundwater has saturated the pores and exists there above that. It's referred to as a vadose zone, so it's

still sand, but there's not groundwater actually in that zone.

Q And just for the record, "vadose" is spelled how?

A V-a-d-o-s-e.

Q Thank you.

A The purple zone is referred to here as a fine sand silt and clay, and the red is considered a lean clay.

Q And what is a lean clay?

A Effectively a clay that has low permeability with respect to sand. So hydrologically it's going to provide less flow through it than sand.

Q I see. And the metasedimentary bedrock is in what color?

A Is gray, and it's shown below all of the unconsolidated soils in different colors.

Q All right. And then back to my question previously about the designations that appear to be on the surface here. What are those?

A These are simply well names, and associated with each well is a borehole that was drilled to install the well, and they record the geology as they go down.

Q And the representation here on this figure as you understand it shows the boreholes relating to the depth of the boreholes; is that a fair statement?

A I'm not sure --

Q Well, let me rephrase it. That was rather awkward. For

these well designations does the figure show the depth of the well approximately?

A Relative to the ground surface shown here at the top it does, yes.

Q Dr. Prucha, for groundwater modeling is it important for purposes of groundwater modeling to test the groundwater flow system?

A To perform hydraulic tests on the system, it's imperative to develop that understanding before jumping into modeling.

Q And how do you test the groundwater flow system?

A Well, typically you will go out, and one of the most important bits of information is to measure the groundwater surface. So this line right here (indicating) that defines the blue-brown contact is a critical surface. That really is probably the most important bit of information about the groundwater system that you need to understand. And when you go to test the system -- and by testing, the whole purpose of that is to define the hydraulic properties of each of the wells, the material that's screened across each of the wells.

Q And just for Judge Patterson's benefit, what do you mean by "screening across the wells"? What does that mean?

A Well, each one of these wells it will have at the bottom -- as though you stuck a straw into the ground, it has a zone where it's perforated and allows water from the surrounding

aquifer to come into the well. And the rate at which it comes in gives you a lot of information about the hydraulic properties of that aquifer material.

Q And does the testing of the groundwater flow system depend on the number of wells used?

A Yes.

Q And does it depend on the spacing, the geographic spacing of those wells?

A Yes.

Q And does the spacing and number of wells relate to the appropriate coverage for the groundwater model?

A Yes. It's important to have the correct spacing.

Q That is, the coverage of the area that's modeled?

A Did they include the correct spacing for the modeled area?

Q Well, that was going to be my next question. Was for this model, Dr. Prucha, in your view, the appropriate spacing used for the wells?

A I don't believe so, no; no.

Q Why not?

A They're located in -- if I were asked to go down and perform the test of the shallow aquifer system here, I would locate them primarily in the areas where I anticipate the greatest mine dewatering impacts to occur. And I don't see that that was done here.

Q Dr. Prucha, we've gone back to slide 13. In relation to the

question of the appropriate spacing of groundwater wells and considering the geologic structures that you've already testified to, for purposes of testing a groundwater model for the area around the proposed mine, where would you have expected wells to have been placed?

A All along the area from East Eagle over the tunnel entrance on the north side of the orebody through the orebody over that entire area plus any area that you would expect to be impacted around that. And given that this is largely underneath the Salmon Trout River, I would have expected wells on both sides and located -- you know, a number of wells in that area.

Q And in view of the geologic properties shown on this slide 13, Dr. Prucha, what would you expect in terms, not only in number but also the placement of the wells?

A Well, with reference to this plot here, I would have expected wells to be placed along noted -- near noted dikes, the brecciated zones above those, to see if there is contact and how much flow would occur there. I would expect them to have been placed near mapped faults -- fault zone areas.

Q And in your review of the groundwater models prepared by Kennecott and its consultants did you observe any such well located along those geologic structures?

A These are the features that I would expect to be major water conductive features 'cause they were mapped, and they're

very long. They run for miles. And I didn't observe that.

Q And would you consider that best practices for groundwater modeling?

A No.

Q Dr. Prucha, we've had put back up on the screen slide 14 from Petitioner's Exhibit 63. For the six wells that were placed and noted on your slide here, slide number 14, would you expect a groundwater model to be able to model the flow in the area shown on this slide as covered by these six wells?

A No.

Q Why not?

A Well, I don't believe that putting six wells in this area right here (indicating) covers even the area that they plan to dewater, let alone the area where faults have been mapped in the area or possible connection of this brecciated zone along the intrusive, the light blue line here in the center of the page just above the Salmon Trout River.

Q What do you understand from your reading of the reports, Dr. Prucha, to be the area that is planned to be dewatered?

MR. LEWIS: Objection to the form of the question, your Honor.

MR. HAYNES: I'm not sure what the objection is.

MR. LEWIS: I'm not clear if there's -- I don't know what "plan to dewater" means. I've got no recollection

of anybody talking about a plan to dewater. It may simply be that if I could get a little more explanation of what we're talking about, it would be fine.

MR. HAYNES: I'll do that, your Honor.

JUDGE PATTERSON: Okay.

Q Dr. Prucha, you mentioned the phrase "plan to dewater." What do you understand by that?

A The scheme to actually dewater the tunnels so that they can actually carry on the mining.

Q So did the documents you reviewed talk in any sense about dewatering the tunnels as the tunnel is built?

A Well, not specifically about every tunnel, but they do have a dewatering plan.

Q I see. And so back to my question, Dr. Prucha, what would you expect these six wells to be able to show in terms of -- in terms of the area that's going to be dewatered for this mine?

A Well, I think at most you can say something about only the area that they extend. And they don't extend up into the access tunnel to the north all the way over to East Eagle Rock.

Q And would you have expected that modeling to -- or that characterization to occur for this proposal?

A Absolutely.

Q That would have been best -- or would that have been best

practices?
A Yes.
Q And based upon the six wells that you have observed in the modeling proposed by Kennecott, would you expect those six wells to be able to be the basis for a model for the one mile in diameter area that you described before?
A No.
Q Why not?
A It's too small of an area. And also the design of this test presumes that they have, in fact, intercepted a larger water conductive zone like the brecciated zone or, say, the fault zone over here (indicating) that Klasner had defined in orange.
Q When you say "the design of the test," what do you mean?
A The placement of the wells, the depth that they're pumping from, the fractures that they pump from and as it relates to the location of those, and they don't seem to acknowledge that these large-scale mapped water conductive features exist or potentially impact their test.
Q Now, Dr. Prucha, we've had put on the screen, from Kennecott Exhibit 7 the Environmental Impact Assessment Appendix B-4, page 16. Dr. Prucha, this is section 7.1 and 7.3 of Appendix B-4. And what is the significance of the discussion in this section for the purposes of groundwater modeling?

A Well, as far as I can tell, the pump test on well 084 was pumped from a zone about 257 to 260 meters down. And this is the basis for that. And I wasn't very clear why that zone was chosen as the only zone to really pump test and then calibrate an entire bedrock model to.

Q I see. So is it your understanding that only one zone of this well that extends for almost 300 meters was tested here?

A In this particular case, yes, for this pump test that we referred to on that former diagram.

Q And were there other pump tests performed as part of the modeling besides this one?

A Not to my knowledge, that went into actually calibrating their bedrock model.

Q And in your view, based upon your experience, is the well 084 representative of the orebody?

A I would say of the orebody, it's through the orebody, so I would question whether it's fully representative of the entire orebody. It's one well.

Q Would you have expected for best practices to have seen more wells through the orebody and more pump tests through those wells?

A I would have expected to see more outside in the tunnel area, any area they plan to dewater.

Q And did you see those?

A No.
Q Now, Dr. Prucha, we've had put up on the screen, Kennecott Exhibit 7, Environmental Impact Assessment, Appendix B-1, Figure 18, which is labeled "Surface Monitoring Locations." Have you reviewed this figure?
A Yes.
Q And what, for purposes of your testimony, is the significance, if any, of this figure?
A Well, where they are collecting surface water flow measurements, for example, on the Salmon Trout River here located sort of in the left center part of the screen, it heads off. And each one of these (indicating) triangles is a surface water gage.
Q And is the placement of the surface water gages, from your view, Dr. Prucha, appropriate for the model that was performed here?
A Well, there were several models produced, but for the models that actually included the river flow, it is important because they used this information to help calibrate it to observed flow.
Q Dr. Prucha, I've had put on the screen the first page from Petitioner's Exhibit 61, which is entitled "Technical Report Number 3 of the Michigan Department of Conservation Geological Survey Division," entitled "Groundwater Investigations of the Marquette Iron Mining District,

Michigan," dated 1954. Have you reviewed this?
A Yes.
Q And what was your purpose in reviewing this document?
A I was interested in seeing whether nearby mines have had similar water inflows or dissimilar inflows predicted, whether they have associated surface water impacts.
Q And would a prudent modeler take into account the experience of nearby mines for purposes of modeling the groundwater flow in a proposed mine in the location of the proposed Eagle Mine?
A Yes. If it's a similar environment, yes.
Q Now, Dr. Prucha, we've put up on the screen page 20 from proposed Petitioner's Exhibit 61 and the text of this, which is pretty faint right now. But what's significant to you about the text of this report for purposes of modeling the groundwater flow at the proposed Eagle Mine?
A What I found here that it is a similar environment to the Yellow Dog Plains in that it has similar material, outwash sands, till material and this -- the thicknesses are 100, 200 feet thick. It overlies a bedrock. The bedrock is fractured, has dikes running through it. And so from that perspective, I think on this particular page, that was the point.
Q I see.
MR. HAYNES: Move the admission of Petitioner's

Exhibit 61.

MR. LEWIS: No, objection, your Honor.

JUDGE PATTERSON: All right. No objection, it will be entered.

MR. REICHEL: No objection.

JUDGE PATTERSON: I'm sorry.

MR. LEWIS: Mr. Reichel's back today.

(Petitioner's Exhibit 632-61 received)

Q Now, why would a prudent modeler take into account the experience of nearby mines?

A My perspective it's to assess the range of inflows that are possible in an environment similar to the Yellow Dog Plains, the long history of mining where they're mining in the bedrock system. And I wanted to compare what had been predicted by models in the Yellow Dog Plains to what is reported in this report.

Q So would the range of inflows be related to what sometimes is known as "the worst case scenario"?

A Yes.

Q And is that also sometimes known as the upper bound?

A In this report, yes -- or these reports that I've reviewed from Kennecott.

Q And does that relate to your previous characterization of modeling in terms of the range of uncertainty?

A Yes.

Q That is, we have a lower bound and an upper bound for the range of uncertainty for any model?
A Yes.
Q And did you observe in your review of the Kennecott reports any analysis or discussion of the experience at nearby mines in terms of the inflow into those mines?
A In terms of the flow rates?
Q Yes.
A Yes.
Q And what did you find in those reports?
A I found several mines have reported inflows of up to several thousand gpm, so significantly higher than what I was seeing reported from the modeling and estimates done by Kennecott.
MR. LEWIS: I'll just place an objection, your Honor, to the last question and answer. Number one, the way I heard the question it was, had he read such information in Kennecott reports? So I took it that the question -- or the answer would be in that reference. However, it sounds like there's some testimony being offered about some mine inflows at other mines other than this mine. And to the extent that's the testimony, I would just remind the court of my continuing objection, I think, at this point about such use of evidence from other mines without sufficient foundation of similarity and would move to strike the last answer on that basis.

MR. HAYNES: Your Honor, I have two responses: One, I don't understand why Counsel needs to put the continuing objection on the record. You've already ruled that nearby mines are relevant, and so that's now done. And so the continuing objection is just slowing us down. Second, I'm going to ask the witness again the same questions because I didn't -- I mean, I thought the answer was a little off track, so I want to get back to that question.

JUDGE PATTERSON: That was unresponsive, so okay.

Q Dr. Prucha, I asked earlier whether you observed in the Kennecott reports in the models you reviewed any discussion of experience at nearby mines in terms of groundwater inflow to those mines?

A No.

Q Now, Dr. Prucha, I've had put up on the screen the first page and an enlarged portion of that of Petitioner's Exhibit 60 which is entitled "Technical Report Number 2, Groundwater Problems of the Iron River District, Michigan," prepared by the Michigan Department of Conservation Geological Survey Division, June 1948. Did you review this document for purposes of your testimony today?

A I did.

Q And is this a document that a prudent modeler would consider in the conduct of his or her work?

A Yes.
Q And what was your purpose in reviewing this report?
A To assess mine inflows that were measured at mines in this area and to assess surface water impacts.
Q And how is the experience of nearby mines, if at all, relevant to assessing surface water impacts at this proposed mine?
A Well, it demonstrates that mines in the area can impact nearby surface water. And I point out that both this exhibit and the previous one, none of the mines that I looked at were sitting right underneath a river like the Salmon Trout River.
Q And why is that significant?
A Well, because I would expect more impact from the proposed mine at Eagle compared to the mines that I've seen here.
MR. HAYNES: Move to admit Petitioner's Exhibit 60.
MR. LEWIS: No objection.
MR. REICHEL: I have no objection to the fact that this is a report. I do have a concern that the subject of this document which is the Iron River District, is not a foundation sufficiently established that the geologic conditions observed in the Iron River District as defined in this publication are transferrable to or equivalent to those at the Eagle Mine site.

MR. HAYNES: I'll clear that up, your Honor.

Q Dr. Prucha, for purposes of modeling -- modeling surface water impacts from a proposed groundwater dewatering, is it important to understand the impacts at other kinds of mines in the general vicinity?

A Yes, because I think fundamentally, even though there are differences in the exact configuration and type of bedrock material, components are pretty similar. You have unconsolidated material, overlying bedrock. The bedrock's fractured. They're pulling water from the bedrock, and surface streams are interacting with the unconsolidated material and the bedrock in both of these areas.

Q And so for purposes of modeling the effect of dewatering underground for a mine and its effect on surface waters, you would expect that a modeler would review experience at mines nearby?

A Yes.

MR. HAYNES: Okay. Again move the admission of Petitioner's Exhibit 60.

MR. REICHEL: Again I would note that it's still established that, quote, "this is a mine nearby." I think if -- when and if we get into this, if you look at the body of the document, the area is located some considerable distance away in the western Upper Peninsula.

Q Dr. Prucha, would that make a difference for you, that the

mines discussed in Petitioner's proposed Exhibit 60 in the Iron River District are located some distance away?

A Not really, no.

MR. HAYNES: Your Honor, I think we've laid a sufficient foundation for purposes of modeling to admit this exhibit.

JUDGE PATTERSON: What was the number of the exhibit again?

MR. HAYNES: 60.

JUDGE PATTERSON: I'll admit it over objection.

(Petitioner's Exhibit 632-60 received)

JUDGE PATTERSON: Would this be a good time to break for lunch?

MR. HAYNES: Sure.

(Off the record)

Q Dr. Prucha, good afternoon. I would like to return for a moment to Petitioner's Exhibit 61. And I'm looking at -- it's identified for the record as HMC006188 which appears to be page 3? Okay. Page 3. And, Dr. Prucha, on the left-hand column of this exhibit is there some texture that is of particular significance to you in terms of using nearby mines for comparison for modeling purposes?

A Yes.

Q And could you point that out so that we can enlarge it, please?

A This paragraph here (indicating) in the upper left.
Q And, if you could, read the portion that you find significant and tell us why.
A This part here (indicating) that says, "Induced recharge from the Carp River at the Morris Mine exceeds 400 gpm."
Q And what is the Morris Mine, if you understand it, and where is it located?
A It's a mine in the Marquette Mining District. It's about 15 miles or so from the Eagle Mine.
Q And what does the phrase "induced recharge" mean to you in the context of your testimony today?
A Effectively here it means that because of dewatering it, the Morris Mine, the study here has measured 400 gpm lost in the Carp River that runs by it. But I point out here that this mine is about 1,000 feet away from the river.
Q You mean the Morris Mine is about 1,000 feet away from the Carp River?
A That's right, as opposed to the proposed Eagle Mine being pretty much underneath the Salmon Trout River, and the drawdown cone or extent of that drawdown from the Morris Mine later in this report also indicates that it extends about 10,000 feet downstream of the Carp River so about two miles in terms of the zone that it's impacting along that river, so --
Q And why would that be important from a modeler's

perspective?
A Because, a) it establishes that there is a connection between the pumping in the Morris Mine and the nearby river, a drop in the flow of the river.
Q Now, Dr. Prucha, I've had put on the screen on the first page of what has been marked Petitioner's proposed Exhibit 64 what appears to be a paper entitled, "Underground Hard-Rock Mining Subsidence and Hydrologic Environmental Impacts." Do you see that?
A Yes.
Q Have you reviewed this paper for your testimony today?
A I did.
Q And what is the significance, if any, of this paper for purposes of modeling proposed groundwater inflows into proposed mines?
A Well, a couple of things: One would be that this is sort of at a national level. So the first two papers that we went over are within, say, 15 miles. And the next one was maybe at 50 miles distance. This one is nationwide, and it specifically points out as one of the study sites the Athens Mine which is in this Marquette Iron Mining District area.
Q And how is that significant for you from a modeling standpoint?
A Well, I wanted to see what the impacts were in terms of the amount of mine inflow at the mine -- at the Athens Mine.

And also it points out that the subsidence issue is something that doesn't just occur in Marquette Iron Mining District or in the Iron River District.

Q All right. And we've pulled up now what's been marked HMC006327 from this report which is page 10 of the report. And is this where the discussion of the Athens Mine occurs?

A I'm not sure.

Q And what would be the significance from a modeling standpoint of the fact that the Athens Mine is now mentioned in a nationwide report dealing with subsidence?

A Oh, it's considered --

MR. LEWIS: I just want to note my objection for the record, your Honor.

JUDGE PATTERSON: Okay.

A I think it's significant because it's pointed out of one of many national mines that's had this problem associated with it.

Q And the problem is a subsidence issue; is that correct?

A Right, and they acknowledge here that it's not just a mine inflow problem, but it also is -- and they acknowledge that subsidence affects both groundwater and surface water, the mines that they go over in this report.

MR. HAYNES: Move admission of Petitioner's Exhibit 64.

MR. LEWIS: The objection I've stated from time to

time, your Honor, as to the lack of necessary foundation under our Michigan Supreme Court law on the subject, lack of any necessary foundation of similarity to the only mine that's at issue in this case and therefore lack of relevance.

MR. REICHEL: I'll join in that objection.

JUDGE PATTERSON: I think I previously ruled that -- consistent with previous rulings, I will admit Exhibit -- I'm sorry. I missed the number again --

MR. HAYNES: 64.

JUDGE PATTERSON: -- 64.

(Petitioner's Exhibit 632-64 received)

Q Mr. Parker, we're back to slide 14. And I'd like you to, if you can, talk about where the bedrock wells were monitored in direction from the pump to L084.

A Well, I think what struck me about this pump task that was performed is that the monitoring wells are largely oriented east to west in relation to this pumped well instead of trying to monitor possible fractures, faults that might extend, say, for example along the north-west trending mapped faults through the area. So in other words, I would have put wells up in this (indicating) area to the north and south and an area around the area that they're going to need to dewater, for one, but not just sort of along an east-west trend.

Q And would that have been best -- would that be best practices for modeling for this kind of a situation?
A Yes.
Q Now, Dr. Prucha, I've had put on the screen what is Kennecott proposed Exhibit 214, 2-1-4, which -- have you reviewed this proposed exhibit?
A I did.
Q And what do you understand this exhibit to show?
A The presence of faults or fracture lines that are oriented both north -- you know, roughly trending along this (indicating) line north to south and also faults through the area that appear to be oriented almost at 90 degrees to that, that trend up.
Q And just so the record is clear, we have -- we're showing the first page of this exhibit, and there seem to be two figures. Can you identify the various features that we've talked about this far, the orebody and so on, on these figures?
A My understanding is these are just horizontal slices through at different mine elevations and that the orebody I believe is shown here in red. And the faults --
Q The green vertical lines represent what, Dr. Prucha?
A My understanding would be that those are boreholes.
Q Oh, I see. And again I apologize if I've asked you this question, that this exhibit shows faults or dikes; is that

right?
A Faults.
Q And would you have expected those faults to have been included in any model that predicts -- tries to predict groundwater inflow into the mine?
A I would think that you'd need to include those. They're water conductive, and I don't see any reason why they weren't considered as not water conductive.
Q And did you see the -- did you see that these faults were included in the mine -- in the model that you reviewed?
A I didn't see it in the model or their analysis. And I think another significant point about this is that if you keep going down an elevation, I see similar fault features at various elevations. So it's not just something that occurs in the lower bedrock unit as they've defined it.
Q And then the next page of this exhibit we see a couple of figures. What do those show to you?
A Well, this figure on the top shows the drillhole trace map with above holes on level 275 of the mine. The lower one was sort of more interest because superimposed upon the fracture traces or faults are the pump test wells that they had performed in the bedrock.
Q Why is that significant?
A Well, for one, this was the first time I'd seen any reference to the faults there oriented here east-west. And

these do appear to be significant because I see them in multiple layers going through the different mine levels. And to me, if I were developing a pump test to assess the flow through the faults which are going to control the amount of water flowing through the entire bedrock, which again is going to dictate how much mine inflow occurs, you want to design a test to acknowledge the existence of these, have wells that cross those and demonstrate clearly that they're connected or not connected.

Ultimately when I look at the pump test results, it looked like when they pumped the lower bedrock in 084, that I saw more of a east-west drawdown response. It seems to support the notion that there may be connected fractures, faults through this zone to the orebody. I don't see any information that suggests that these couldn't continue on and be further connected to the regional water conductive faults. That would be a critical element in the bedrock model that was used to predict mine inflows. So omitting that and assuming that you only had a very short connected fault is kind of presumptive in the sense that they calibrated the model and say, "This is really the only feature in here."

Q And do models normally, in your experience, assume that kind of a condition when you have multiple faults and multiple dikes in a bedrock system?

A No.
Q All right. Dr. Prucha, we've put on the screen Kennecott proposed Exhibit 7, the Environmental Impact Assessment Appendix D-2, Figure 2-1. And what does this figure represent?
A Well, it shows a profile, a plan view of the boreholes in the top relative to each other. And there are horizontal lines showing the projection of where those wells extend to. The bottom plot simply shows the vertical projection of those boreholes in cross-section, and you can see the one well that's at an angle. This is their well 84.
Q And well 84 is the well that was pumped; correct?
A That's right. And the significance of this is that if you have identified near vertical faults through the area -- it could be water conductive -- the chances of hitting one of those near vertical water conductive faults is not that high with a vertical -- near vertical well.
Q And as a modeler, what would you have done in order to model the effect, if any, of the geologic structures that we've talked about?
A Well, before modeling I would have tried to assess how -- you know, I would have located boreholes and wells in areas where I suspected faults, large water conductive faults or the dike that might be permeable. And if you did put verticals boreholes, that those would have to be pretty much

right on those or going at an angle intercepting those and then testing those zones. But you can see from this picture that the majority of these are vertical and very localized compared to the entire orebody of the entire mined area which they'll be dewatering.

Q Now, Dr. Prucha, I've had put on the screen Kennecott proposed Exhibit 7, the Environmental Impact Assessment Appendix B-2, Figure 3-1, and what does this figure represent to you?

A Well, this is in color originally, and this had different geologic units on the left in this column and a legend describing what the geologic material is over here (indicating) on the right -- upper right corner. And then you see a series of columns of lines and dots and at the top different information like a caliper or resistivity, conductivity, flow rate, test information that they collect as they test the borehole through its vertical extent. And the point that struck me here was that when you look at these logs and the conductivity or the reverse of that, the resistivity information, which the conductivity can be translated into a TDS or, you know, effectively tells you how much salt you might have in the fluid at a depth.

Q Excuse me. Let me interrupt you for a second. What does TDS mean?

A Total dissolved solids. It's also an indication of -- it's

been indicated that the water at depth has a higher TDS than the shallow pressure water, the surface water, and that this boundary between the two defines an upper bedrock zone and a lower bedrock zone.

Q You're saying that's what was interpreted here?

A Not from this information, but from this log, this information doesn't appear to have been used to help refine that definition of where the bedrock might be, upper or lower.

Q And where would you -- how would you have used that information if you were to design a model for this system?

A Well, you take all of these logs and align them vertically so that they're at the same elevation. The comparison of the curves that you see on this conductivity plot -- and when it jumps out here, you get a higher value or higher value of TDS. And this (indicating) is depth below ground surface up here. Going down, that will tell you where you get jumps in the formation of TDS.

Q And is that information relevant for purposes of modeling?

A Yes, because an important factor in the bedrock modeling that was conducted is this definition of where an upper bedrock zone and a lower bedrock zone occur and that contact between the two. The upper bedrock zone is assigned a much higher hydraulic conductivity. Water flows through it much easier than the lower. And this -- if that zone had been

put down lower, which some of these logs indicate, I believe that you would end up producing a higher mine inflow rate just on that basis alone.

Q All right. We're looking at Figure 3-2.

A This is well 54. And the conductivity log shows a very constant value for -- I can't make out what the depth is, but it's maybe 125 meters below ground. The depth that was selected without consideration of its uncertainty, was 90 meters, --

Q The depth for what?

A -- total vertical depth. For the break between the upper bedrock and the lower bedrock.

Q And can you tell from these figures or from the other materials you've read why that depth was selected?

A Well, from what I can see, it was based on a measurement in well 85 where they measured the TDS and said it looked like it had this value. And then they interpolated back up to near the ground surface, and they estimated 90 meters total vertical depth as the break.

Q All right. I think now we're at figure 3-6, and this looks like well 84, Dr. Prucha?

A That's right.

Q And explain for us what you just testified to.

A Well, the conductivity in this well shows a very low value to below 200 meters. The previous well 83, the previous

plot for well 83 showed a similar depth. There's another well -- and by the way, 83 and 84 were sort of closer to the western part of the orebody. And as you go to the east you see higher and higher elevations for the conductivity. So it seems like spatially there's a trend. But this suggests to me that 90 meters, you know, they're claiming as an upper bedrock up here (indicating), and really it could very well be down 200-plus meters. And then this pulse actually goes back to a low value, suggesting maybe there's fresher water at depth below this. This also -- this depth down here (indicating) of close to about 260 meters also seems to suggest that this peak is where you have the -- this is where they read the high TDS which happens to correlate reasonably well with this conductivity jump here.

Q And the peak in the TDS would suggest what?

A Well, that you've hit a fracture zone right here (indicating) that may not -- that may have a higher TDS in it.

Q And what's the significance of that for modeling purposes?

A Well, again, the most important point is the definition of this upper and lower bedrock zone. The upper bedrock was modeled as being more permeable than the lower bedrock. And the depth that gets assigned to this upper and lower bedrock is important because in the lower bedrock, they assign faults and put those in there, and in the upper bedrock they

don't. The upper bedrock, if you increase the permeability and drop that depth and they're still mining in this upper bedrock, it will produce more water as a mine inflow rate if the depth is deeper.

Q Dr. Prucha, we've put up on the screen from Kennecott proposed Exhibit 7, the Environmental Impact Assessment Appendix B, as boy, 2, page 12. And there's some discussion in here of field work. What is significant here for you?

A I believe this is where they indicate that the -- the fact that you find high TDS at depth is indicating that it's not well connected -- the zone is not well connected to the surface water or shallow aquifer zone.

Q And what's the significance of that for purposes of modeling?

A Again the upper and lower bedrock contact is an important factor to have considered in the modeling. There was no effort made in the modeling to consider the uncertainty of that depth and its implication on the estimated mine inflows or the dewatering extent, magnitude.

Q Dr. Prucha, for purposes of modeling and for modeling bedrock flow systems, is it important to consider groundwater flow direction?

A Yes.

Q And is it important to consider groundwater flow velocity?

A Yes.

Q And is it important to consider hydraulic gradients?
A Yes.
Q What is a hydraulic gradient?
A It is the change in the groundwater potential from a high point to a low point over a certain distance. So a higher gradient has a steeper slope. It's like walking on the ground surface. And a flat gradient is walking on very flat ground like in this room. A steep gradient is walking in the mountains, and you would go from high points to low points. It's what drives the water from high areas to low areas in an aqua group.
Q And for purposes of modeling bedrock flow systems for -- in a groundwater system, is it important to consider three dimensional flow paths?
A Yes.
Q And why is that?
A Well, because water doesn't just flow horizontally. It flows in a three-dimensional path. It can flow from the lower bedrock to the upper bedrock or vice versa in addition to moving laterally. So it's important to define the three-dimensional flow path that water takes.
Q Dr. Prucha, I have put up on the screen from Kennecott Exhibit 7 the Environmental Assessment Appendix B-3, page 41 which appears to have a table dealing with tunnels within a weathered zone. Do you see that?

A Yes.
Q And what's the significance of this table for purposes of modeling?
A Well, these were inflow estimates for idealized tunnel within the weathered zone. Oh, I think it's the paragraph here under 8-2.
Q All right. And read the portion of the paragraph that's significant for you.
A The conceptual model for the bedrock groundwater system below 90 meters true vertical depth is comprised of two components on weathered bedrock that is controlled primarily by matrix properties for the bulk of the rock mass and water conductive fractures with moderate hydraulic high activity with relatively sparse distribution."
Q And what does that mean for those of us who are not hydrologists?
A Well, effectively they're saying below this upper bedrock zone in the bedrock that they've defined, they're saying that they see that faults exist in there but apparently don't extend up into the upper bedrock.
Q And from the reports that you've reviewed and the slides that you've put up previously and that you've testified to previously, does that conclusion make sense?
A It doesn't.
Q Why not?

A Well, to have a permeable fault stop right at a boundary that you've defined very loosely doesn't make sense. But the fact is that if you have faults that are extensive and the fact that we saw this Exhibit 214 suggests that these faults do extend up through the upper bedrock. And the real importance of this is that when you go to predict mine inflow, by limiting faults to only the lower bedrock, you prevented a pathway for the water going into the mine dewatering system from impacting units above it. And I feel that's not very realistic to assume that the faults end right there at this presumed boundary. There doesn't seem to be any evidence that I see to the contrary.

MR. REICHEL: Excuse me. Counsel, I apologize for the interruption. Could you please state for the record what page --

MR. HAYNES: Yes.

MR. REICHEL: -- and which appendix of the Environmental Impact Assessment we have up there?

MR. HAYNES: It's Appendix B-3, --

MR. REICHEL: B3.

MR. HAYNES: -- page 41.

MR. REICHEL: I'm sorry. I don't mean to be argumentative, but I have a hard copy of that document and it doesn't seem to correspond. There may be something --

MR. HAYNES: Your Honor, let's take a short break

and try to clear this up.

JUDGE PATTERSON: Okay.

MR. HAYNES: I want to make sure we're all on the same page here literally.

(Off the record)

JUDGE PATTERSON: We all set?

MR. HAYNES: Yes. Your Honor, I stand corrected. The reference there is Appendix B-2, not B-3.

JUDGE PATTERSON: Okay.

MR. HAYNES: Thank you, Mr. Reichel.

Q Now, Dr. Prucha, following that correction, I've put up on the screen from Kennecott Exhibit 2, the mining permit application Appendix C-1, page 12, which has a discussion about Eagle deposit geology. Do you see that?

A Yes.

Q And what of that discussion is relevant for purposes of your testimony today?

A I think what I noticed on this was actually the paragraph above that where it talks about joint patterns that often align with stream patterns suggesting that they have concerted control over the drainage development. I know when I read through reports like Exhibit 60 and 61, Marquette iron range, they pretty much stated the same thing; that they saw that faults joint patterns tend to align with the streams in the area. It suggests to me that

there's strong correlation with faulting which would occur in the bedrock and the streams flowing over.

Q And did you see evidence in the models that you reviewed of those factors being taken into account?

A No.

Q On the screen is from Kennecott Exhibit 7, the Environmental Impact Assessment, Appendix B-1, figure 23. What does this figure purport to show, Dr. Prucha?

A It says that it's plotting the A zone groundwater elevation contours.

Q And what does that mean?

A This is the groundwater surface from what is referred to as the A zone in the reports, the upper most permeable outwash sand aquifer.

Q And for purposes of the model, do you consider the number of wells here to be appropriate?

A No.

Q Why not?

A Well, the main mine impacts, the mine dewatering impacts would occur around the tunnel and mining area and orebody. And when you zoom into this area, that's where I would have concentrated the number of wells to gain a full three-dimensional understanding of the flow through all of the unconsolidated material, not just the A zone. There's another significant aquifer zone in the unconsolidated

materials in the Yellow Dogs Plain D zone which underlies -- is below the A zone, but it's separated over a good part of the plains by a lower permeability sequence as B and C zone. But the key point here is again the distribution and number of wells around the key area of interest, which is the area that will be dewatered.

Q And how many wells are there just for the record?

A In the area around the mine?

Q Yes.

A I see three alluvial -- it's hard to tell right here. But the problem is that the system in this area for the unconsolidated material is very complex. And usually you design the distribution and locations of the wells to correspond with the complexity of an area.

Q And do you see that happen -- did that happen here in the model that you reviewed?

A No. There are complexities of units that are disappearing, that are pinching out in this area. You have actually bedrock that's exposed at the ground surface. There are maps that I've reviewed that seem to indicate a really large area is just void or absent with the unconsolidated material, and that seems to be --

Q Let me back up. When you say the "unconsolidated materials is absent," what does that mean in terms of the relationship of bedrock to the surface?

A There's no more unconsolidated material overlying the bedrock. The bedrock, if you're walking around out there, you would walk over the bedrock at the surface.

Q I see. On the screen now is figure 24 from the same Appendix, Appendix B-1. And what does this figure show, Dr. Prucha?

A This shows the D zone "Groundwater Elevation Contours," the title up in the upper right. This is the groundwater elevation map, and really you can't see on the black-and-white plot. But they have contour lines that show the actual surface of the water -- this aquifer system. And I guess some of the problems associated with a number of wells on this plot are, again, around the mine key area where you expect the most mine dewatering impacts to occur, they're saying that the de-aquifer is actually missing in these areas that are cross-hatched. And yet when you show an outline like this with no question marks, it is extending across the Salmon Trout River, and I see no wells or boreholes to show that this area -- over most of that area is actually controlled by points where you can actually drill a borehole out here -- I don't -- this is a complete guess right here. The D zone could be there, and I think --

Q You're saying that the cross-hatched area is a guess?

A Yes. Well, with -- outside of the areas where they are

showing actual boreholes. They have four points in this area. And this is important because in terms of their modeling to estimate the impacts of mine dewatering from the bedrock system, you dewater that zone below this unconsolidated unit where permeable aquifers disappear or occur are really important in terms of how that drawdown from the lower bedrock will impact the drawdown in the unconsolidated units or aquifers, the A and the D zone.

Q Dr. Prucha, on the screen now is from Kennecott Exhibit 7, Environmental Assessment, Appendix B-1, figure 13. What does this show?

A In the report there are colored contours line. You can't really see them here. But the point is that they have a number of boreholes they've put throughout the orebody area and the treatment area, processing area. And they've estimated the thickness of the unconsolidated material or the quaternary deposit. And where you don't see points which represent boreholes, they have a lot of contours, no question marks. This is a complete guess in these areas. And yet this guess was never considered in terms of how it impacts the estimates of mine inflow, how the mine inflow dewatering would impact the overlying unconsolidated material.

Q Are you saying, Dr. Prucha, that the contour lines that extend out from the various well locations cannot be

interpolated?

A It's fine to interpolate an area. And by "interpolation," I mean that between wells you know what the thickness is. Maybe it's 60 feet at one point and 50 feet at another. Between the two points, you logically assume they're somewhere in-between; 55 feet. But in areas outside of where you have good borehole controls, you are forced to do what they call extrapolate, which means you're using data points locally here to try and guess what is going on out here to the south where you don't have control points.

Q And is extrapolation an appropriate method to use in modeling groundwater flow systems?

A It can be used, but there has to go along with it an understanding that you're introducing a lot of uncertainty into the conceptual understanding of where water is flowing. How thick is the aquifer? Is it 10 feet? 100 feet? In areas where you don't have the boreholes, you can't say anything about that or you can but you need to say it's plus or minus a certain amount of distance and that --

Q And do you see such qualification in any the documents that you reviewed?

A I did not.

Q What we have on the screen now is figure 12 from Appendix B-5 of the Environmental Impact Assessment, Kennecott Exhibit 8. What does this figure show, Dr. Prucha?

A This is a similar plot. The title is "Quaternary Deposit Isopack." It's just the thickness of the unconsolidated material. And this does show the contours pretty well in here, and you see that they're defined by these dark lines. And the pattern from this scale, I see contours almost two bulls eyes right around the orebody and then East Eagle Rock which are elevated with respect to -- the bedrock surface in those locations is elevated with respect to the surrounding countryside with I think we showed a cross-section before that demonstrated that.

Q And how is that significant for purposes of modeling?

A Well, this has a strong control in terms of the thickness of the unconsolidated materials overlying the bedrock where the groundwater flows through those. Where it's thin, you don't have as much water possibly flowing in the unconsolidated or it gets -- the directions and flow rates get dictated by the bedrock surface.

Q And did you see these contours taken into account in the modeling?

A They did, but it's the uncertainty in the area where they didn't have boreholes that I think they didn't consider.

Q Now, Dr. Prucha, we've put on the screen Kennecott Exhibit 7, Environmental Impact Assessment, Appendix B-1, figure 15. And what does this show?

A Well, this plot shows the D zone groundwater elevation

contours, and they don't show up that well on the black and white. But they're -- the point I was going to make about this is that the contouring of both the A and the D groundwater elevations in my opinion are very poor around major features such as the Salmon Trout River.

Q Dr. Prucha, let me interrupt you for a moment. I misspoke. This is Appendix B-1, figure 24, but go ahead.

A Okay. I think this is a really important part of the characterization process where you collected water levels and you've posted them and you're estimating where the flow directions are going to go. And because of the lack of data in a lot of areas like, for instances, no wells south and west of the Salmon Trout River, you really can't say too much about what's happening in this aqua zone in that entire area. It's a very large area, and yet this is an area that would be impacted the mine dewatering. Not accounting for the flow directions around the Salmon Trout River, this would have been a primary interest for me if I was going out there and trying to assess how the river interacted with the unconsolidated aquifers, how the bedrock interacts with the Salmon Trout River, and yet there's very little in terms of the number of wells and boreholes to tell you much in this area that would be impacted by mine dewatering even with their own modeling scenarios.

MR. HAYNES: Your Honor -- sorry -- we're going to

have another exhibit switch here. This will take a moment.

JUDGE PATTERSON: Okay.

Q While we're switching for the color version, Dr. Prucha and I apologize. What we put up is Appendix B-1 to the Environmental Impact Assessment, figure 15, Kennecott Exhibit 7. What's significant about this figure, Dr. Prucha?

A Well, the significance is in the area that's black here, but --

Q Once again.

A I think I can still speak to that though. I think what's important is this intrusive associated with the orebody. It's visible even in the local area there at the surface. The letters above the surface, QAO-OO8, is a well here and to the left of that intrusive, QAL-004. This is the only information they have in terms of the geology of these aquifer units near the proposed mine facility and yet --

Q Would you expect more for modeling purposes?

A Yes; absolutely. And given the likelihood that you have Brecciated zones that are acting as permeable conduits, these aren't shown. They're not considered. Any faults through the area aren't considered on this conceptual hydrogeologic cross-section. I think another important thing is in other cross-sections I've seen it seems to be sort of confused where the actual country rock or

surrounding metasedimentary rock surface contact with the unconsolidated material here shown in the black versus white color, actually shows it smoothly going up to the intrusive indicating that the intrusive was -- elevated the whole area as it was intruded up the bedrock surface. And here it shown going directly in, and then you show unconsolidated materials. And with the color, you'll see them going directly into the side of the intrusive. And I don't understand geologically how that can occur. But fundamentally this is the conceptual model that so many books and standards indicate is absolutely necessary for producing a good sound defensible model. And I see this as a confusing diagram. It doesn't really iron out the details before jumping into a model.

Q All right. Well, thanks to Mr. Eggan, again, we've put up what appears to be the same figure and this is, for the record, MDEQ 011171, and if you could then illustrate your testimony, Dr. Prucha, with the colored stratigraphy shown on this figure?

A Just pointing out the red lean clay here on the left and right side of the intrusive. And again, my point about layers coming horizontally straight into the intrusive and the bedrock surface going straight in as opposed to being carried up. No intrusive brecciated zone associated with the dike. That's important because a lot of water from deep

down where the mining's going to occur, the tunneling could easily interact with this -- not only the surface but the stream we showed at the former cross-section that -- where the intrusive was right under the stream. This one has it over off to the side. But here are other things. This green area here (indicating) is a clay glacial till.

Q What is a clayee glacial till?

A It is derived from glacial movement; it's really a mixture of fine grained material. It's generally considered to be a low permeability material, probably similar in hydraulic properties to the red clay, the red lean clays down here. But what's important about this is that it occurs in an area where there are no boreholes, so I'm not sure what information is used to define that that exists here. At the borehole locations this information comes from the logs that are collected in the field and used to define the aquafers. The A Zone is this upper blue and the B Zone is this lower zone.

MR. REICHEL: Excuse me, Counsel.

MR. HAYNES: Yes?

MR. REICHEL: Sorry to interrupt the flow of your exam, but just so the record is clear the slide that you have before this was Figure 15 from Appendix B-1. I was able to verify that.

MR. HAYNES: Yes.

MR. REICHEL: This one, although similar, appears to be from a different document. The previous one had a cross-section B to B Prime; this is --

MR. HAYNES: C to C Prime.

MR. REICHEL: I just want the record to be clear as to what document is being displayed; that's all.

MR. HAYNES: I appreciate that. So noted. All right. Let's go to the next page.

Q Dr. Prucha, I've had put up from the Environmental Impact Assessment Appendix B-8, Figure 23, which is Kennecott Exhibit 11. What's the significance of this figure for purposes of delineation of the stratigraphy?

A Well, the bedrock surface in this case you can clearly see being elevated and it's clearly associated with the intrusive on both sides. This controls the development of the unconsolidated deposits, but there's very little information around the actual intrusive. And this seems important, because this is where a lot of the mining will go on and the dewatering. And you can see that they have projected a well or borehole here, QAL025 which is from some distance, but there's not much control here. But I think the most important point about this is in contrast to the last cross-section conceptual hydrogeologic cross-section we looked at. The last one had the bedrock going straight into the dike; this one has it elevated. So I'm left wondering

which is it and what information do you use to define this. To me, if I model this system, this is really critical information in terms of translating the dewatering in the mine -- the effects of the dewatering in the lower bedrock up to the surface.

Q And did you see any indication in the models that you reviewed of this -- these differences noted in the model?

A I did not.

Q All right. And just for the record, following up on Mr. Reichel's suggestion; this Figure 23 shows a cross-section D to D Prime, for the record?

A Right.

Q Okay. Dr. Prucha, we've had put on the screen from Kennecott Exhibit 8 the Environmental Impact Assessment, Appendix B-5, Table 2. What is the significance of this table for purposes of your testimony today? Well, let me lay some foundation, Dr. Prucha. Is it important for purposes of modeling to consider the hydraulic conductivity on consolidated materials?

A Yes.

Q And how does one normally go about doing that?

A There are a variety of tests that you apply in the field to collect hydraulic conductivity or the hydraulic properties of an aquifer system; there's some that you can do in a lab. And there are different levels of quality in terms of the

uncertainty associated with the tests. The highest level -- and it's even acknowledged in the reports I reviewed -- are pump tests where you pump one well and you observe the drawdown response from that pumped well and surrounding wells. And that's the best kind of test to perform because it tests a much larger area of the aquifer.

Q And what other kinds of tests can be performed to determine hydraulic conductivity?

A There are a variety of other sorts of tests, like -- I noticed in their report they have done a number of slug tests. This is where you introduce a small volume of water into the well or you -- and watch the response from that well; you don't monitor the response of surrounding wells. So effectively that test only is giving you information about that local well, around that local area. And my experience is -- and there are pretty well documented literature that you end up with a bias towards the low end of hydraulic properties or hydraulic conductivity even up in the order of magnitude plus where slug tests give you lower than -- lower hydraulic properties than what you would get from actually conducting a multiple-well pump test. Other tests are doing -- collecting the soil from the actual borehole and sending it to a lab and estimating the grain sizes and you can estimate, but only roughly, what the hydraulic properties would be. In other words, if you get a

value for a sand and you estimate it through this method the uncertainty could be orders of magnitude, which is -- an order of magnitude is about a factor of ten, so it could be ten to maybe a thousand times in error.

Q And what kind of tests did you see performed in the reports that you read dealing with a hydraulic conductivity?

A The majority by far were slug tests, seep tests, lab tests which produce values but the uncertainty is the greatest in those. And I saw one pump test in the unconsolidated material for multiple wells and that was really to test the interaction between the A aquifer zone and the D aquifer zone.

Q And would you have expected -- would you have expected to have seen in a model of this complexity that you've been describing more than one pump test?

A Absolutely. For the complexity that I see based on my review of the geologic logs, their plots, I would have expected more pump tests to test a broader area in the unconsolidated material; not only that, but between the unconsolidated and the bedrock. And I had a -- well, --

Q And in terms of the tests that you observed, did you note the length of the screens of the various tests that were performed?

A I did.

Q And what was -- what's your observation about those screens?

A Well, it seemed like a lot of the wells were screened much -- over a much shorter interval -- for example, five feet -- when the actual aquifer zone, like the A or the D zone, were on the order of 20, 30 feet thick and to me that just simply -- by doing that it introduces more uncertainty because the analysis is more complex and you induce flows that aren't as simple for the analytic method, the method that you would use to assess the hydraulic properties for.

Q Now, we've had put on the screen, Dr. Prucha, from Kennecott Exhibit 8, the Environmental Impact Assessment, Appendix B-5, Figure 9. And although it's in black and white and, therefore, not quite as readable as before, what's the significance of this figure for purposes of your modeling -- or for purposes of modeling?

A Well, I think the point to this plot here was that the mine, I believe, is at -- the orebody is up here (indicating) and the location of the one multiple-well test where they pumped -- where they were looking at the interaction of the pump test between A and the D zone to establish what level of communication hydraulically they have -- they performed a test well south of the actual orebody and it's confusing to me why you would go and establish the hydraulic communication in an area so far away from the area that would be most impacted by mine dewatering. And another thing is that when you look at the trend of the thickness of

the lower permeability units between the A and the D aquifer zone in the unconsolidated material it actually thins towards the mine and it's actually absent near that over some distance or area that hasn't been well defined. But the point is, if I were doing the test I would have put it up by the orebody to test the influents there because that's the area I'd want to know -- it has the greatest potential for having dewatering from the lower bedrock impacting the overlying unconsolidated material, and I wouldn't have put it in an area that had a thicker zone between this A and D aquifer of lower permeability units.

Q Now, Dr. Prucha, we're back to Kennecott Exhibit 7, the Environmental Impact Assessment, Appendix B-1, Figure 23. And the -- I apologize, but the figure doesn't show contours very well, but on this figure are contours represented?

A I don't think I saw contours represented well on any of the maps that I reviewed based on the wells and -- posted and the obvious hydraulically significant features, such as the Salmon Trout River.

Q And when you say "hydraulically significant," are those features significant for modeling and are -- let me back up. Would it be important to -- for modeling purposes to have contours inputs -- contour inputs into the models?

A Well, for this kind of information you don't -- you enter in as an input the groundwater elevation as an initial

condition, but really the importance of this data is in -- sort of two-fold. One is that you contour it up first, which means you take this information and you estimate where the groundwater flows based on contouring and the contouring, if you have enough wells in the right location, gives you a very good indication of how much interaction -- for example, you have between the Salmon Trout River and, say, the A Zone of the unconsolidated deposits, let alone the D aquifer zone, I don't even know from the available data whether the intervening B and C Zone, the low permeability unit between the A and D Zone is missing along a significant portion of the Salmon Trout River. I don't think it's been characterized well.

But this is the point where groundwater information you have to establish an understanding before you jump in the modeling of where you think the water is going and base it off of good sound data. A key area should have been an area right around the mine dewatering area. So initial modeling could say, "Here's the mine impact area." It looks like it's at least a mile in diameter over the extent of the Salmon Trout River. Why don't we have more wells in this complex unconsolidated system right there to establish clearly just based on data, not even modeling what the interaction is between the A and the D Zone and the unconsolidated and the bedrock zone?

Q I notice on this figure, Figure 23, that there are some arrows -- some sort of curved arrows pointing -- you know, northerly direction. What do those arrows represent, to your understanding?

A These are estimated flow directions of the groundwater in this A Zone groundwater elevation.

Q And from the materials that you've reviewed do those estimated flow directions appear to be accurate?

A No.

Q Why not?

A Again, a variety of reasons. Just even up in the northern area I think there's confusion about whether the A and D Zone even -- which zone occurs, whether the B and C Zone pinch out; whether they know whether water is actually flowing towards some of the seep locations. There's a variety of things when you zoom in and look at the contours. It looks around the Salmon Trout, the whole upper stream area, in a large number of these contours it looks like the contours are written right over the Salmon Trout River as though it has no influence on the groundwater. So then later I look at some of the modeling and it looks like the contours are very sharply pronounced right around the river indicating that some of the models reviewed it looks like they are simulating kind of something what you would expect where that's acting as a discharge point for the local

groundwater.

Q And would you find such contouring to be consistent or inconsistent with the topography in the area?

A I would find it inconsistent.

Q And is that important from a modeling perspective?

A Yes.

Q Now, Dr. Prucha, we've put up from Kennecott Exhibit 7, the Environmental Impact Assessment, Appendix B-1, Figure 30, which is denominated the contours of the wetland study area. Do you see that?

A Yes.

Q What is significant about this figure for purposes of groundwater modeling?

A Well, again, this is another attempt to contour and demonstrate that the flow directions of groundwater run to this natural condition or factor it, and I have problems again with where they've placed wells and what wells or data they're using to help constrain the contours. And you don't see those here, but there's a pretty big gap in the data everywhere on the other side of the Salmon Trout River.

Q Now, you're pointing your laser pointer to the west and south of the Salmon Trout?

A That's right. Immediately across from the orebody and upstream to the west. In addition, the contours don't seem to take into account what is commonly done to help constrain

groundwater contours in the area as the stage elevation or average stage of the river flow through the system. And that seems like a key to help constraining whether groundwater is going into the river or going out at any point. Although I believe most of this stretch is a gaining reach on the stream; meaning, the groundwater is flowing into the stream.

Q So can you tell, Dr. Prucha, from your analysis of the documents whether the -- whether groundwater flow direction can be verified in these documents?

A No.

Q And is that -- would that be important for modeling?

A Yes.

Q And why is that?

A Well, I think at this level if you can't understand the contours you're introducing a lot of uncertainty in any modeling exercise and say that the modeling is just destined to not produce very reliable results because you don't understand the basic system, and that is the fundamental step in hydrologic studies that are conducted as the standard.

Q Dr. Prucha, for purposes of modeling a groundwater flow system, is it important to establish the hydraulic communication between the bedrock and the unconsolidated material?

A Yes.
Q And why is that?
A Well, you're going to be pumping water out of the bedrock and that will create a drawdown in the bedrock and that drawdown will induce an increased amount of flow from the overlying unconsolidated material; the greater the drawdown on the bedrock the greater the drawdown on the overburden. So I think that's critical to understand where that occurs, the extent over which it occurs and the magnitude of that.
Q And for some of the documents that -- or for the documents that you reviewed, Dr. Prucha, did you note any documents that showed that there was an absence of unconsolidated material over bedrock in portions of the study site?
A Yes, in critical areas right around the orebody. And there were several maps that I looked at that seemed to have just one control point, but one map showed it extending for quite a distance under the Salmon Trout River.
Q And did the groundwater flow models that you reviewed consider these -- this feature?
A No, and it's important because if there are faults through the area and brecciated zones that are conductive, the fact that you have bedrock right at the surface -- and in one cross-section we saw before that had intrusives right underneath the Salmon Trout River -- this is a direct connection with the mine dewatering and --

Q Go ahead. I'm sorry.
A -- flow rates significantly higher than estimated.
Q Now, for purposes of modeling is it important to characterize the surface water flow system?
A Yes.
Q And why is that?
A Well, because that is where the drawdown from the mine dewatering will eventually propagate, and without characterizing the current system and its interaction with the underlying unconsolidated aquifers and bedrock, it's -- you wouldn't be able to assess the relative impact when you went in to predictive modeling. So you need to understand that interaction now.
Q Now, Dr. Prucha, I'm putting back up for purposes of this portion of your testimony Kennecott Exhibit 7, Environmental Impact Assessment, Appendix B-1, Figure 30, which deals with the wetland study area. And in terms of the spatial distribution of the wells in the wetland area, what does this figure tell you?
A Again, I don't think it's adequate to characterize the stream-aquifer connection, so this is a pretty standard terminology in hydrology these days and it just means that if you have a stream that's connected hydraulically with the underlying aquifer you need to characterize how much flow goes in and out of the river and interacts with the

groundwater. And they have some wetland wells that they show on the north side of the Salmon Trout River here but they're shallow. And I think if you were doing a study to assess this interaction over the length that would be impacted by mine dewatering, you would put wells shallow and deep; nested well pairs right below the river and assess the interaction.

Q What is a nested well pair?

A A nested well pair would be wells that are screened at different depths. Wetland wells they have here are nested, but they only go down nine feet, nine and a half feet, and the A aquifer zone is deeper than that. And I think to fully establish this connection you'd just not want to do it at two or three locations here but along a length that would over -- where the mine dewatering would be impacting it.

Q Dr. Prucha, on the screen is from Kennecott Exhibit 11, the Environmental Impact Assessment, Appendix B-6, Figure 6, which is "Denominated Wetland Hydrological Classification." And what's significant about this figure for you, Dr. Prucha?

A Well, they had three different zones of the wetlands defined on this map; one that was precipitation driven that was largely over where the mine is but apparently only there and not anywhere down to the south, and then they had a groundwater-driven zone that was running adjacent to the

stream but not directly underneath it, and then a third wetland zone that they called a "stream-driven wetland." And I guess I was surprised to not see a detailed conceptual picture, a cross-section through the orebody, through both sides of the stream that clearly showed the dynamics and the soil horizons, what's really controlling these zones and showing arrows of where -- where does water really come in and sustain these. Is it groundwater? Where does the groundwater-driven system versus precip really end? Is this -- are these boundaries seasonal? Do they vary spatially? This is one plot in time perhaps.

Q And, Dr. Prucha, we've had in earlier testimony and exhibits in this case some pictures of beaver dams along the Salmon Trout River. Would beaver dams be significant for purposes of groundwater modeling?

A Yes.

Q Why is that?

A Well, because they artificially dam the water up behind them and increase the elevation of the stage of the water and this could certainly mask potential fault discharge along different lengths of the stream.

Q In your review of the documents -- the modeling documents, did you see any discussion of the beaver dams?

A I did.

Q And was it sufficient for purposes of modeling in your view?

A It's really just a statement saying that it looked like they were significant, but nothing seemed to be considered; it wasn't considered in the modeling and didn't seem to be considered in their conceptualization of the flow around the critical orebody dewatering area.

Q Dr. Prucha, on the screen now is slide 31 from Petitioner's Exhibit 63. Is this a slide that you prepared?

A Yes.

Q And what does it represent?

A Well, it represents a plot that showed post-closure groundwater monitoring locations and I put flow arrows in green where I think it would probably occur and I put the orange boxes where I would put appropriate monitoring locations downstream of the temporary rock storage area closer to the actual stream.

Q And does this slide also indicate the placement of -- or the proposed placement of monitoring wells for -- by Kennecott's proposal?

A Yes.

Q And where would those be?

A They're shown with the circles with a cross through them.

Q And why did you place the orange boxes as opposed to -- where you did as opposed to where the monitoring wells are proposed by Kennecott?

A To me those would be more likely to intersect any water

flowing through that had impaired water quality than where their proposed locations are.

Q Can you tell, Dr. Prucha, based upon your experience whether the proposed monitoring well locations proposed by Kennecott would be able to determine the potential for measurable impact on surface water?

A Would you rephrase that?

Q Sure. Can you tell from the proposed locations here proposed by Kennecott for monitoring wells whether those monitoring wells would be able to measure impact on surface waters from the groundwater inflow to the mine?

A From their monitoring wells?

Q Yes.

A No.

Q And from their monitoring wells would you be able to determine in your view the measurable impact on groundwater from the groundwater inflow to the mine?

A Yes. The ones that I located were within their groundwater-driven wetland, whereas the precipitation -- it seems like the ones where they proposed were more in the wetland-driven precipitation area, which conceptually doesn't seem like it's being driven by the groundwater in that area. So if there are groundwater impacts from lower mining propagating up you might be more likely to see them as groundwater-driven wetland area.

MR. HAYNES: Your Honor, I'm going to move into a slightly different area. Perhaps we could take a break.

JUDGE PATTERSON: Okay.

(Off the record)

Q Now, Dr. Prucha, we put up on the screen Kennecott Exhibit 11, the Environmental Impact Assessment, Appendix B-6, Table 2 which talks about water elevation measurements. Do you see this?

A Yes.

Q And the discrete water elevation measurements. What, Dr. Prucha, about this table is significant for purposes of modeling?

A There might have been the second page on this table. Is there a second page on that? That's it.

Q All right. We'll try this one. What is significant about this page? This is Table 2, second page.

A Well, this is where they've shown in the report a number the wetland wells that they put in, piezometers, and they're at different depths; one four and a half and nine and a half feet below ground surface. And there are a number of F's over on the right-hand column refer to "water thawed prior to measurement" and I've never seen this before, but it makes me question the validity of those actual water elevations, the fact that they had to thaw the sample out. The change in density; the fact that the material around

that immediately thawed zone would still be probably frozen. I'm just not sure how to interpret that, but it seems like it dramatically influences their estimation of the vertical gradients that would occur over pretty -- a pretty small vertical elevation. So --

Q And I note that the columns on this table show that measurements were taken in November and December. Is that significant for purposes of modeling?

A Well, probably it would have been nice to show what happens during the summer months to know -- I mean, this really is kind of a wintertime effort. The gradients -- if you're trying to produce a model it would be nice to understand whether the wells in these different wetland zones are behaving dramatically different than the one plot that says here are the three different zones.

Q When you say "it would be nice to know," would you consider it best practices to take seasonal measurements in wetlands?

A Yes.

Q Dr. Prucha, on the screen now is Kennecott Exhibit 7, the Environmental Impact Assessment, Appendix B-1, Figure 32, and what -- this says, "Wetland Hydrologic Classification." I think we've had this one before, but what does this show for purposes of modeling for any relationship between the stream and the wetland?

A I think I made the point on the last exhibit when you

brought it up.
Q It is important from a modeling perspective to show groundwater discharges into streams?
A Yes.
Q And what is -- how is that important?
A In trying to determine the impact of the mine inflow modeling -- or, you know, the impact from the mine dewatering that was done in the bedrock model you need to consider the groundwater discharge and estimate it through measurements before connecting the modeling so that you have something to compare against.
Q Dr. Prucha, is it important for purposes of modeling to have an appropriate conceptualization of the flow in the system?
A Yes.
Q And why is that important?
A If you don't conceptualize the system well in the model that you produce based on that conceptualization will be only as good as the conceptual model. So if that's flawed, then your numerical model will start off flawed.
Q Dr. Prucha, I've had put on the screen from Kennecott Exhibit 7, the Environmental Impact Assessment, Appendix B-1, Figure 6 which is the "Generalized Geologic Cross-section." For purposes of a conceptualization of the flow in the system, how is this exhibit important, if at all?
A Well, they produced a model that covers this area over the

Yellow Dog Plains that's noted on the upper left, and this is a south to north cross-section. And I think the color version of this would show the intrusive dike coming up in here (indicating) in this -- through the sediments. But I'm not sure how realistic this is to show just one conceptual picture slice like this when you have a groundwater that's flat here and then it suddenly drops off and mysteriously disappears. I'm not quite sure I understand the mechanism by how this all occurs. Does it have all of the important features? I think one important feature they do show here is that at the edge of the Yellow Dog Plains that the topography does actually increase somewhat and I don't think I saw any adequate explanation for why that might occur.

Q Now, Dr. Prucha, we've had put on the screen Kennecott Exhibit 8, Environmental Impact Assessment, Appendix B-5, Figure 34 which is another "Conceptual Hydrogeologic Cross-section." What's the significance of this figure, if any, for purposes of modeling?

A Well, I think here's another example of a conceptual hydrogeologic cross-section for the system and I don't see the intrusive dike here or the four others that look like they traversed across this zone from the one exhibit that we showed that was produced by their geologist. And they show groundwater seeping out the site over here. I'm not sure what the mechanism is for seepage over here (indicating)

well above a bedrock surface. But this also seems inconsistent with the previous cross-section that I just saw.

Q And how is it inconsistent?

A Well, just in -- for example, what I mentioned before, the intrusive not being shown, faults not really being shown in here.

MR. HAYNES: Courtesy of Mr. Eggan we're now going to look at a color version of this.

Q This is, again, Figure 34, "Conceptual Hydrogeologic Cross-section" from Appendix B-5 and in this color version what does the blue represent, Dr. Prucha?

A That represents the area where the groundwater is -- that aquifer is saturated. If you drilled down you would hit groundwater at that point, at this contact, this upper contact. This doesn't show the detail of the unconsolidated material, the different aquifer zones that were defined; and yet that seems pretty important not only around the mine area but also at the discharge gallery TWIS, the Treated Water Infiltration System.

Q Dr. Prucha, are you familiar with guidelines for conceptualization in modeling?

A Yes.

Q And are the figures that we've shown here, Figure 6 from Appendix B-1 and Figure 34 from Appendix B-5, consistent

with those guidelines for conceptualization?
A I would say no.
Q Why not?
A Well, again, when you produce a model you should produce a model that is as defined as well as you can and if you do identify alternative models or hypotheses that's sort of your obligation to show why those alternatives aren't valid and that the one you decide to use in predictions is more valid than others. But there's a process that you go through to eliminate those and I don't think that was followed here or considered.
Q For purposes of modeling the inflow to this proposed mine, how important is it to conceptualize the groundwater flow system?
A I think it's critical.
Q And for purposes of the model how does the flow system then feed into the model?
A Could you rephrase that?
Q Sure. The flow system that is described by Exhibit -- or Figure 6 and Figure 34, these two exhibits; how is that flow system then translated into the model for purposes of deriving some sort of a prediction of the inflow into the mine?
A Well, this conceptualization is used to guide the definition of the structure of the numerical model that you develop,

how you see the interaction between the different aquifer zones within. For example, the unconsolidated material; how you see the interaction between the unconsolidated material and the underlying bedrock and, for that matter, what code you use -- what computer or mathematical code you use to actually simulate the flow in the system. And it also is important in terms of how you define things like boundary conditions or conditions that control how the water gets into the system and then how it gets out of the system.

Q Dr. Prucha, I've had put up on the screen the first page of Petitioner's Exhibit 62, which is a "Groundwater Modeling Guidance" from the Michigan Department of Environmental Quality, draft 1.0 from, I believe, 1990- --

A 2002.

Q 2002. I'm sorry. Have you reviewed this document, Dr. Prucha?

A Yes.

Q Have you in your career and your experience reviewed other various modeling guidance documents from other states?

A Yes.

Q In your view are such modeling guidance documents helpful for purposes of preparing models?

A Yes.

Q In your view are the guidelines that are in proposed Petitioner's Exhibit 62 appropriate for modeling at the

Eagle Mine site?
A Yes.
Q Do the guidelines discuss worst-case modeling?
A Yes.
Q Is that appropriate?
A Yes.
Q Is worst-case modeling what some might feel to be equivalent to conservative modeling?
A Yes.
Q Are the two phrases synonymous or equivalent?
A Yes, but I think sometimes you can get the word "conservative" confused; you need to define is it conservative one way or another. And by "worst case," the way I interpret that is what is the worst case in terms of how mine dewatering will impact, say, for example, the aquifer, the A Zone aquifer, the shallow aquifer? The worst case would be what's -- what do you think the largest drawdown would be? What's the magnitude of that? What's the worst-case dimension that would be impacted or area that would be impacted?
Q And is worst-case modeling standard engineering practice?
A Yes.
Q Would such worst-case or conservative modeling use site-specific data?
A I'm sorry?

Q Would such worst-case modeling use site-specific data?
A Yes.
Q And for a proposed underground mine what kind of worst-case -- excuse me -- what kind of site-specific data would you expect such worst-case modeling to use?
MR. LEWIS: Objection; foundation, your Honor.
MR. HAYNES: Your Honor, I'm not quite sure how to respond to that objection. I think I've laid a foundation for this witness to discuss modeling -- worst-case modeling, underground mines, so I'm not quite sure how what I have to do further.
MR. LEWIS: My objection goes to the lack of any information about any experience that Dr. Prucha has had with modeling the amount of water that might be expected to flow into an underground mine, and the question was specifically phrased in those terms.
JUDGE PATTERSON: I'm trying to recall if he testified to any experience in that.
MR. HAYNES: Well, all right.
Q Let's be more general, Dr. Prucha. You have experienced modeling groundwater inflows into underground structures; correct?
A Yes.
Q All right. And that would include underground mines?
A Well, open pit mines, not necessarily underground mines

exactly like this, but --

Q Okay. But for purposes of groundwater modeling does the structure make a difference if it's a mine, an open-pit mine, an underground mine or some other underground structure for purposes of groundwater modeling of inflows?

A No.

Q Okay. So what kind of site-specific data would you expect for modeling water flow to a proposed underground mine?

A Would you repeat that?

Q Sure. What kind of site-specific data would you expect in a model for purposes of modeling underground flow into an underground mine?

A I would expect adequate numbers and locations of wells throughout the bedrock and the unconsolidated material, a zone that would be impacted by the mine dewatering.

Q And would site-specific data assist in limiting the range of uncertainty in any models?

A Yes.

Q Would site-specific data assist in limiting the range of uncertainty for baseline conditions of a model?

A Yes.

Q Do the guidelines, Proposed Exhibit 62, call for an understanding of the importance of transport processes at a site?

A Yes.

Q What are transport processes?
A Well, the movement of water and in this case contaminants in the water.
Q Are transport processes related to site characterization?
A Yes.
Q And how so?
A Well, if you don't characterize how that transport of a particular component in the water is moving, then it would be difficult to model it accurately.
Q If you were to model the groundwater inflow into a proposed underground mine in Michigan, would you consider the groundwater modeling guidance prepared by the DEQ as part of your task?
A Yes.
MR. HAYNES: Move the admission of Exhibit 62.
MR. LEWIS: No objection.
MR. REICHEL: No objection.
JUDGE PATTERSON: No objection. It'll be entered.
(Petitioner's Exhibit 632-62 received)
Q Dr. Prucha, in your view, has there been proper site characterization of the flow into this system?
A No.
Q And why not, or how not?
A Lack of data in the right spots; lack of proper hydraulic testing; lack of interpretation of -- poor understanding --

characterizations -- very poor characterization of an interpretation of groundwater flow directions in the various units.

Q Dr. Prucha, when we started with you today, you spoke of the term "calibration of models." What does calibration involve?

A It involves trying to reproduce the sorry -- the observed system behavior. That would include groundwater levels in wells that vary over time; the discharge of flow at rivers; discharge from the groundwater system is evapotransporation.

Q Can calibration include calibrating steady-state conditions?

A It can.

Q And can calibration of a model include calibrating transient conditions?

A Yes.

Q And would you explain those two, please?

A Well, a steady-state calibration is what was done for the models that I've reviewed here, and my opinion, it's the basic level of modeling. And you can develop those kinds of models, but it's pretty well-known in the industry that -- the practice that steady-state models often are associated with large uncertainties and are associated with a problem we call non-unique. In other words, the models that get developed, you don't really have enough constraint on the model to define hydraulic properties accurately within the

model to reproduce the system. And this is why the next step of calibration is to go into transient calibration, where you're trying to match the fluctuation, say, of groundwater levels in time or discharge to a river.

And then the next step after that is -- and it's stated in these -- this modeling guidance here by the DEQ, is to go and verify that your calibration is correct. And you can't do a verification on a steady-state model because, by definition, the steady-state model only simulates a constant groundwater elevation. Nothing is -- groundwater moves through the system, but it's at a constant rate, and it -- this non-unique problem, a good analogy to that is that you have a bathtub and you're filling it with water at some rate of inflow, and you have a pipe that you don't know the size at the base of the bathtub coming out.

And you can pour in a huge amount of water, and your objective is to simply match the water level in the bathtub. But if you make the pipe at the exit larger or smaller, you can maintain this. It doesn't -- you're not calibrating the system. There are -- recharge can be adjusted very high, and the pipe diameter can be adjusted very high, and you can still get the same water level in the bathtub. It's the same concept in the groundwater flow model.

Q I see. In this case, based upon your review of the

documents, was transient modeling done?
A It was not.
Q If you were to model this system, Dr. Prucha, would you have performed transient modeling?
A Well, they performed a transient model simulation, but they did not do a transient calibration of the model for the unconsolidated material. In the bedrock model that they used for FEFLOW or developed with FEFLOW --
Q Wait. Let me stop you.
A Yeah.
Q "FEFLOW," a new term. What is it?
A It's a computer code that's used to simulate flow through a groundwater system.
Q And is FEFLOW a model that is normally used by groundwater modelers?
A It is.
Q I'm sorry. I interrupted you. Go on.
A In the FEFLOW model, they actually -- that they prepared, they calibrate -- they say in their report that they calibrate to the pump tests that they performed on this well 084 that we talked about earlier.
Q Now, Dr. Prucha, for purposes of predicting outputs from a model, just outputs be produced as a single outcome or as a range of outcomes?
A As a range of outcomes.

Q And why is that?
A Well, because your models by design are uncertain. And the examples I give there are the contour maps we looked at earlier of, say, for example, the thickness of the unconsolidated material outside of the areas where they actually have borehole data to constrain that estimate.
Q Dr. Prucha, is there something called code selection in model design?
A Yes.
Q And what is that?
A Well, that's the process of selecting an appropriate mathematical code. And I distinguish code from model in that a code is actually the computer code or software that was produced to develop a model. The model is of the actual site. You develop a model of the actual physical site. But there is a process where you go through selecting an appropriate code that can simulation, for example, fracture flow. Not all codes can simulate the flow of fractures -- flow-through fractures in a system. This is in fact why we have read report -- the reports here on modeling that indicated they used FEFLOW to model discrete fractures, where they used the more-common code, MODFLOW, that was developed by the USGS to simulate the unconsolidated material. But they actually end up simulating the bedrock later in later versions of the model.

Q And is it appropriate, in your view, to mix the two kinds of models, FEFLOW and MODFLOW?
A No.
Q Why not?
A Well, for the reasons that they pointed out in their document. FEFLOW has the capability of simulating discrete water-conducting fractures, and MODFLOW really doesn't have that capability. And so they -- that's -- that was one of their main justifications for using FEFLOW, to simulate the flow in the bedrock system, which was then used to estimate the amount of mine inflow.
Q Dr. Prucha, are you familiar with the American Society for Testing and Materials, --
A I am.
Q -- so-called ASTM?
A Uh-huh (affirmative).
Q "Yes"?
A Yes.
Q What is ASTM? What does it do generally?
A It's a standard. It's actually a series of quite a large number of different standards that have been put forth by a group of professionals in the industry. And the guidelines aren't absolute, but they are used in the industry to help guide the development of models that are more defensible and credible.
Q And, Dr. Prucha, are there ASTM standards for selecting

appropriate codes for modeling?
A Yes.
Q And have you observed any adherence to those standards in the models that you reviewed for your testimony today for selecting codes?
A They have statements as to why they chose their codes, but it was certainly not rigorous, in my --
Q And is such rigor required for modeling?
A In this system I believe that it should have been.
Q You testified just previously about the two models that -- the FEFLOW and MODflow models are the methods; correct?
A Yes.
Q In your review of the documents, is there a reason that you can determine why two models were used here instead of one?
A I'm still unclear as to why they used two models.
Q And in your view, Dr. Prucha, from modeling this system, would it have been preferable to use a single model?
A Yes.
Q Why?
A Well, the problem with using two different models, one for the overburden or this unconsolidated material and the bedrock, is that separating those two out leads to problems translating the drawdown that you see and that develops in the bedrock to the overlying unconsolidated material. And you're forced to choose boundary conditions that aren't really appropriate and don't

really simulate what's really going on in terms of the interaction between the unconsolidated material and the bedrock.

Q When you're forced to choose those conditions, is that appropriate for modeling?

A I think there are better alternatives.

Q And what would those be?

A Using one single code like FEFLOW to model both the bedrock and unconsolidated material.

Q Now, Dr. Prucha, we're going to back to figure 8.1 of Appendix B-3. You spoke early on in your testimony about model calibration. Do you recall that?

A Yes.

Q And was the bedrock model in this -- in the model that you reviewed your calibrated?

A It was calibrated to the pump test performed at well 84 here.

Q I'm sorry. Let me back up for a second. What do you mean by "calibration of a model"?

A Depends on the type of model you're trying to calibrate. The model that's used here covers 87 square kilometers, which is a large area. And you needed a model that size, because the prediction of mine inflow is unknown at the beginning of the simulations, but it's clear, even from the initial simulations they do, that the area is 1 to 2 miles in size in terms of the drawdown zone. The model that they're claiming to calibrate is calibrated. It's calibrated to a pump test, and it's arguable

that you could calibrate to a pump test where wells are spaced couple-hundred meters apart and extrapolate what you find there over 87-square kilometers, and that doesn't consider the 4 mapped miles-long dikes that they had that brecciated zones around them; doesn't consider the faults that they'd mapped; the large miles-long west-northwest-southeast-trending faults that seemed to align with water drainage features.

Q Dr. Prucha, just for the record, the 87 square kilometers, for those of us who think in terms of miles, what's that area in terms of square miles?

A It's about 33 square miles roughly.

Q You spoke of the faults -- the east-west dikes and the north-south faults, Dr. Prucha. How is the orientation of those faults important, if at all, for purposes of calibrating a model?

A Well, the orientation that you put into your model -- impose on your model ought to be consistent with what you're mapping. And what was imposed in the models that I reviewed were a set of north, south, east, west regularly spaced fault. But primary issue I had with that is that they were only included in the lower bedrock, and they did not extend to the upper bedrock, which, just by design, doesn't allow any transfer of -- or much transfer of the drawdown impact that you see in the lower mine and dewatering into the overlying unconsolidated material.

Q In your view from a modeler's standpoint, is it realistic to exclude faults in that way?

A No.
Q And is there such a thing in modeling called bias?
A Yes.
Q And how would you define bias in modeling?
A Where -- when you model you can choose to adjust parameters up or down to look at worst-case or not-such-a-worst-case scenario, and bias would be selecting things that maybe are biased towards your opinion or what you want the outcome to be.
Q And would characterizing the faults here as ending in the lower bedrock reflect any sort of a bias?
A I believe so, yes.
Q In what way?
A Well, again, if they had considered what I believe is more realistic, the faults to extend all the way into the overburden, this would have allowed direct connection between the dewatering that's occurring in the orebody and tunnel area to translate up into the overlying unconsolidated material and would have impacted a larger area and larger impacts on the Salmon Trout River.
Q Dr. Prucha, in your review of the documents, did you note whether or not a FEFLOW model was used for 2004 model?
A Yes.
Q And in your view, was that FEFLOW model appropriate to use?
A Well, this model was the -- what was referred to as a preliminary model -- preliminary numerical model, and that is the model where

faults or fracture zones were simulated in the model but only in the lower bedrock zone. And effectively, this is like putting a small permeable slit in a block of concrete and, if the slit is entirely contained in the bedrock or the concrete block and it's not allowed to connect to other permeable water bodies, there's not really any effect of that fracture or fault.

Q In this 2005 FEFLOW model, what was the groundwater used in that model? Was it constant, or was it variable?

A In the 2005 model?

Q Yes.

A The groundwater elevation was constant.

Q Is that appropriate?

A No.

Q Why?

A It doesn't reflect reality.

Q That is, groundwater is -- groundwater levels are variable; correct?

A That's right. And in this case they didn't produce a map of the water level in the bedrock, but you would assume that it was probably close to what is in the overlying unconsolidated material, and that certainly -- the number of maps that we've seen here for the A and D zone show the gradients approximately.

Q And what is the effect on this -- or what would be the effect on this 2005 FEFLOW model of using variable groundwater levels rather than steady-state groundwater levels?

A More realistic inflows.
Q So in your view, is this -- are the results from the 2005 FEFLOW model realistic?
A No.
Q What did those results predict for purposes of inflow into the mine?
A For -- that model was referred to as the upper bound, and that was 215 gallons per minute. Actually, their initial one, I think, was 180 gallons after three years; sorry.
Q And so, Dr. Prucha, in your view, the upper bound limit for the 2005 FEFLOW model is not realistic at 215 gallons per minute?
A No.
Q Based upon the data that you've reviewed, do you have a view as to what would be a realistic upper bound?
A I believe it's much high.
MR. LEWIS: Objection; objection; foundation, your Honor. There's no foundation for this witness having done anything which I assume would be necessary to present some alternative calculation. I've heard nothing about the steps taken by this witness. I've heard nothing about all these modeling details, calibration of his model, none of that. I don't believe there's any foundation for an opinion by this witness as to some alternative modeling results.
MR. HAYNES: I'll rephrase.
Q Dr. Prucha, have you had a chance to go through the data

presented by Kennecott in its 2004 FEFLOW model to determine if those data are sufficient for determining an upper bound?

A Yes.

Q And what would those steps be?

A I've looked at the four FEFLOW model exhibits which were FEFLOW model input files, and this preliminary numerical model was used to simulate several scenarios.

Q And did you in fact simulate several scenarios?

A Yes.

Q And did you then calibrate that model?

A No.

Q Were you able to -- do you think that -- based upon the data that you had available, that you would be able to calibrate the model?

A No.

Q In your simulation -- Dr. Prucha, was your simulation similar to that carried out by Kennecott?

A I used their model and their data as introduced in their -- you know, in the file that I started with.

Q And based upon their data, were you able to arrive at a figure for an upper bound inflow into the mine?

MR. LEWIS: Same objection, your Honor; same basis. The witness has just testified in effect that he has no basis to offer an alternative opinion. He would have no basis to offer anything that's been calibrated and -- nor anything that would apparently be realistic since that's the way he's characterized

all the modeling has gone before.

MR. HAYNES: I think I've laid enough of a foundation, your Honor, for the witness to testify.

JUDGE PATTERSON: I thought he testified he couldn't make a calculation from the data that he reviewed.

MR. HAYNES: Well, he said he didn't calibrate, but he did testify that he used Kennecott's data in his model, and that's what we're basing this on.

MR. LEWIS: Well, there's nothing about what he did with that data; how he computed the data; what calculations he did. And he's already testified it's not calibrated. He's already testified that calibration is a necessary function to derive any kind of result with any relevance to the Court, I believe, your Honor.

JUDGE PATTERSON: I'll him to go ahead and answer it if he can.

Q Dr. Prucha?

A That range, based on simulations I conducted, ranged from about 280 to over 3,000 g.p.m.

Q And the 280 to 3,000 g.p.m. is your range of uncertainty for this model based upon Kennecott's data?

A Effectively, yes.

Q Now, Dr. Prucha, in your review of the models prepared by Kennecott, did you also review a 2006 FEFLOW model?

A Yes.

Q And what is your understanding of the purpose of preparing the second model by Kennecott?
A The second model apparently was calibrated to this pump test at 084.
Q And is that the only change between the 2005 and 2006 model?
A They made a change to the boundary condition at the surface contact between the bedrock and the unconsolidated material.
Q And what was that change?
A A boundary condition, which changed it from a constant head boundary condition, where they'd specified a constant head to what they call a general head boundary condition, where they're specifying a head or a water level and a conductance term or a term that's used to define the flow between -- the resistance effectively between the unconsolidated material and the bedrock.
Q And how would that change affect the model results between the 2005 and 2006 FEFLOW models?
A The 2005 FEFLOW model -- and I'm not sure if I'm correct on this -- estimated 180 g.p.m. after three years. The 2006 FEFLOW model estimated an upper bound mine inflow of 215 g.p.m. or gallons per minute. And actually, you know, I'm going to make one more clarification. The model that I -- the other model that was produced that I reviewed was a model that they adjusted the fault lengths in the north-south direction and got rid of faults in the east-west direction. And I think I may have to correct that that was what was calibrated to this model, where they based

their reevaluation of this pump test data and used that as the basis for calibrating -- stating that the model was calibrated.

Q And in your view, was that appropriate?

A No. Because for this kind of model, it's not calibrated to the actual flow in the bedrock system. So for example, they developed another model that they claim is calibrated to the unconsolidated material, and they try to reproduce the observed groundwater flow directions and water levels, but in the bedrock they don't try to do that at all, because they didn't have any other bedrock wells other than these in this test.

Q Now, Dr. Prucha, did you review as part of your assignment here a 2005 baseline model for the unconsolidated quaternary deposit?

A Yes.

Q And how was the unconsolidated material model calibrated?

A That was calibrated at a steady-state level, and they used groundwater levels and base flow estimated from the stream gauges that are along the various stretches of streams.

Q And was the steady-state calibration one that was appropriate, as far as you know, for purposes of preparing such a model?

A I would say that it's calibrated at a very high level.

Q All right. Dr. Prucha, I put up on the screen Kennecott Exhibit 8, the environmental impact assessment, Appendix B-5, page 6, which has text dealing with boundary conditions. What portion of this text was significant for you?

A I'm not sure that's the exhibit. Yeah, that's --

Q All right. We'll pass that exhibit. Dr. Prucha, you may have testified abuse before, but what are boundary conditions in a model?

A Things like rivers, evapotransporation where water is being pulled out by plants or soil evaporation, wells recharge, which is derived mainly in this case through precipitation or rainfall, snowfall.

Q And for the model that was produced for the bedrock flow -- excuse me -- the mine inflow in this case, what boundary conditions -- what would boundary conditions be for such a model?

A For the bedrock model, did you say?

Q Yes.

A Well, you would have boundaries laterally. What was used in the model were no-flow boundaries but --

Q Excuse me. Low-flow boundaries?

A No-flow boundaries, --

Q No-flow. Okay.

A -- where water is assumed not to flow in laterally. It all comes in from above.

Q And for purposes -- I'm going to -- I'm sorry. I got a little ahead of myself. I'm going to move back to the quaternary deposit model. What was used as a boundary condition for the quaternary model deposit -- the quaternary deposit model?

A They had recharge in at the upper boundary. They had the rivers, like the Salmon Trout and the Yellow Dog were exchanging flows

with the shallow groundwater.

Q And how is bedrock system characterized in this quaternary deposit model in terms of boundary conditions?

A In the 2006 quaternary deposit model? Is that the one you're referring to?

Q Yes.

A Yeah. That was -- took the estimated flows from the FEFLOW model, which is a separate model that simplified the boundary condition, which represents the contact between the unconsolidated material and the bedrock, and they took that estimated flux or flow at every -- at a few points in their model domain around the mine area and the tunnel area, and they imposed that as a flux on their unconsolidated model at those locations. And they calibrated -- they ran a transient model, where they used every year a new flux from that bedrock model that was calculated. And that seemed strange to me. I think the problem with that unconsolidated model was that it wasn't re-calibrated after a number of modifications were made, based on my review of the report.

Q Dr. Prucha, is recharge an important parameter for modeling groundwater systems?

A Yes.

Q And why is that?

A Well, typically, in models like this, there's a significant control on the groundwater and your ability to calibrate a model

and on the -- it's one of the more sensitive parameters in the model.

Q Do ASTM standards apply to recharge in models?

A I don't know the specific ASTM standard for recharge, but I think it is acknowledged that parameters like recharge and hydraulic conductivity can be adjusted in steady-state models, and you can end up with non-unique solutions. In other words, you can adjust either of those parameters and end up calibrating the model to observe levels and discharge, and you really don't get a unique set of parameters, which you're after to go predict. The idea -- objective is to determine hydraulic conductivity parameters throughout the model so that you can calculate accurate velocities. But if it's uncertain in terms of what those values are, then this is this problem you get with steady-state calibrated models.

Q I put up on the screen Kennecott Exhibit 8, Appendix B-5, figure 3, which is the bedrock geology of the Eagle Project area. Does this exhibit illustrate how recharge was handled in the Kennecott models?

A No.

Q Dr. Prucha, how, in your estimation, was recharge handled in the Kennecott model?

A I don't think there was sufficient basis for defining the number of zones and the values of recharge that were imposed on the model. And this again is a very important parameter in a model

such as the unconsolidated deposit model.

Q Dr. Prucha, what is sensitivity analysis in modeling?

A It's a process where you adjust parameters or adjust model input and assess the sensitivity of the output. And there are really two types of sensitivity analyses that can be performed. One is kind of associated with the calibration process. And there's another process that I think is more important that I think was not done here, and it's the sensitivity that you would do -- a sensitivity analysis that you would do on predictive simulations.

Q And would you explain that for us, please?

A It's more important to do a sensitivity analysis on predictive simulation so that you can assess the uncertainty of your predictions based on range of uncertainty in your input parameters. This is described in an ASTM standard pretty well.

Q And how did Kennecott's models handle the sensitivity analysis?

A My understanding is that they're more oriented at the calibration process, and I'm not sure that they really used that information beyond performing that and identifying that things that -- you typically find when you simulate flows in, say, an unconsolidated aquifer, you'll typically find that parameters like recharge and hydraulic conductivity are the most important parameters governing your solution or your estimates of where the water table is and where it's discharging and how much.

Q And did you find those -- that kind of discussion in the Kennecott models?

A No.

Q If you were modeling this groundwater flow regime, Dr. Prucha, would you have used such parameters in your sensitivity analysis?

A I would have conducted a sensitivity analysis of -- you know, associated with the predictive simulations that were done, and I think I would have referred to the ASTM standards on that. When you do sensitivity simulations, the ASTM standards have very clear guidelines in terms of identifying different types of sensitivities and how to document that.

MR. HAYNES: Your Honor, perhaps we could take a short break here. I want to make sure that the next set of exhibits are consistent with where we're going.

JUDGE PATTERSON: Okay.

MR. HAYNES: Thank you.

(Off the record)

JUDGE PATTERSON: Mr. Haynes, are we set?

MR. HAYNES: Yes, in just a few minutes.

Q Dr. Prucha, you testified about the 2006 model that you reviewed, that Kennecott FEFLOW model; is that right?

A The bedrock model, yes.

Q The bedrock model. Did the 2006 FEFLOW model include upper bedrock layers in the model?

A Yes.

Q Did the code used for this model, as far as you can determine, allowed designation of discrete geological features in the model?

A Yes.
Q Do did the 2006 model re-calibrate for current conditions from the 2005 model?
A Well, they didn't calibrate any of the bedrock models to actual site conditions. They only claimed to calibrate the 2006 bedrock model, which they used FEFLOW -- the FEFLOW code for to this 084 well pump test in the bedrock.
Q And, Dr. Prucha, did the modelers for Kennecott, as far as you can tell, attempt to merge the unconsolidated and the bedrock models?
A No.
Q Now, did the Kennecott modelers attempt to predict drawdowns from mining in the groundwater flow regime --
A Can you --
Q -- in the bedrock model?
A Did they try and estimate the drawdown in the bedrock?
Q Yes.
A Yes, with the FEFLOW model.
Q And what was the drawdown that was predicted in the FEFLOW model?
A Well, it was equivalent to where they had their drains in the mine at the different levels. I don't remember off the top of my head what level that was but --
Q And in your view, does the bedrock model accurately predict drawdown?
A No.

Q Why not?
A It's very much based on the assumptions of the faults, their fault lengths, the vertical extent of the faults and how they connect with the upper bedrock and the overburden. I believe the assumptions that they had were very limited in terms of faulting. They did not consider the permeable dikes that -- you know, the brecciated zones around the dikes. They didn't consider the major water-conductive features that were mapped in the area.
Q Now, Dr. Prucha, did you attempt to model the mine inflow for this proposed Eagle Mine?
A I did.
Q And would you describe for Judge Patterson what you did for your model?
A Yes. As opposed to trying to develop a new model from scratch, I wanted to see what a more realistic range of the mine inflows would be, so I started with a model I believed was the more realistic model, which they claimed to be their upper bound model. That was the -- this 2005 version of the model with faults imposed on it that were 1 to 2 kilometers. Those were short in terms of their extent laterally, but I believe they actually didn't extend those faults vertically through the upper bedrock, which really limits the amount of mine inflow to those faults. So I -- that's just said conceptual problem right upfront with that model. My new simulations were intended to extend more realistic assumptions in these -- in this FEFLOW

model.

Q And what did you do?

A So I ran several simulations. One was starting with just extending the upper boundary condition at the contact of the upper bedrock and the unconsolidated material. They did not simulate any flow in the unconsolidated material, which I think was limiting. It was very presumptive to model that that way. I put an actual thickness of the unconsolidated material in there, which allows the model to calculate the amount of flow more realistically to -- from the unconsolidated material into the bedrock. And that was one scenario, where I think I came up with a better boundary condition. That was -- that boundary condition alone increased their upper bound estimate, which I thought was more realistic of the two they'd done before from about 215 gallons per minute to maybe about 280 gallons per minute. The next several scenarios were devoted towards assessing the effect of vertically continuing their faults that they'd specified in the lower bedrock through the upper bedrock so that they stopped at the overburden or the unconsolidated material.

Q And, Dr. Prucha, why did you put those conditions into your model?

A Because it doesn't make sense to me to stop discrete water-conductive features that are more permeable in the lower bedrock right at this upper bedrock and lower bedrock contact.

Q All right. And what else did you do for your model?

A Well, in addition to putting in those -- this extension vertically on the fault, I extended them laterally. And probably the most significant adjustment, which is well within reasonable bounds of adjusting parameters, was I increased the permeability of the actual fault zone by a factor of 10, and that one particular simulation led to over 3,000 g.p.m. mine inflow. So that's where I came up with this range of 280 to 3,000. If you increase the fracture -- fault permeability, it would be even greater inflows.

Q And would increasing the fault permeability be an ordinary task for such a model?

A Yes. The uncertainty associated with major water-conductive features in the area could easily have hydraulic properties that are within what I simulated.

MR. HAYNES: Sorry, Judge. We're having one of those electronic moments again.

Q Now, Dr. Prucha, we've put up on the screen Proposed Kennecott Exhibit 399, which is a technical memorandum relating to additional mine inflow predictions and sensitivity analysis. Do you see that?

A Yes.

Q Have you had a chance to review this document?

A Yes.

Q And what is it that you understand this document to try to do?

A Well, it's a new model that was developed very recently. It has

a number of changes to it compared to the previous Fletcher Driscoll and Golder models for the unconsolidated material.

Q And what changes are those?

A Well, they changed the number of model layers to represent the unconsolidated aquifer system.

Q Is that appropriate?

A I think it's appropriate to use a new set of model layers, but this model is similar to the previous ones and the problems that I saw with the previous ones, which were it didn't consider simulating the whole area of the bedrock that's be de-watered all in one model. So you're not forced to try and guess what the impact of mine dewatering is as it crosses into the unconsolidated material. So this model only simulates the unconsolidated material.

Q And what is the effect on the model outputs of such a simulation?

A I'm sorry. Could you rephrase that?

Q What is the effect on the model outputs of such a limited simulation?

A Well, when I reviewed this report, my sense is that the model output is somewhat uncertain like the previous models, because it's based on the same characterization and conceptual model that was presented before. And I don't see that this is any real improvement over the former models for the unconsolidated material.

MR. HAYNES: Your Honor, I'm going to go to Kennecott

Exhibit 591. But again because of a technical glitch, we don't have the whole exhibit in our system. And I've asked Mr. Lewis if he would be -- if he could be assisted to put it up on the screen, and he's assented. So we're going to make a small technical change here.

JUDGE PATTERSON: Okay.

(Off the record)

Q Now, Dr. Prucha, we've had put on the screen -- and I appreciate Mr. Lewis' indulgence here -- Kennecott Exhibit 591, which is labeled "Technical Memorandum" dated April 1, 2008, and it's a draft. The subject is "Quaternary Groundwater Model." Do you see that?

A Yes.

Q Have you had a chance to review this proposed exhibit?

A Yes.

Q And what is your understanding of what this -- what is contained in this document?

A Well, this is the -- an updated, very recent model for the unconsolidated flow system.

Q And have you had a chance to review it?

A Yes.

Q And does this quaternary groundwater model improve or not improve the previous models that you've testified about?

A In terms of the drawdown estimates?

Q Yes, in terms of drawdown.

A I would say it's equally as uncertain as the previous models developed.

Q And again, by drawdown, just for Judge Patterson's purpose -- edification, what do you mean by "drawdown"?

A In the unconsolidated material above the actual mine dewatering that's occurring, it's going to be drawing water from that unconsolidated material, so the water level in the aquifers above the bedrock will start to -- the aquifer levels will actually start to decline, and the drawdown is simply the difference between what they start at and where they end at.

MR. HAYNES: Now, if we could, go to figure 25 of this exhibit, which is about three pages from the end. Thank you.

Q Dr. Prucha, Figure 25 of Kennecott Exhibit 591 is labeled "Simulated Head Change in Layer 2 Calibration Scenario 2." Can you explain that designation for us?

A This is a plot just showing the change in the groundwater levels and the de-aquifer. The red indicates a drop in the water level, and the greenish color there is an increase in the groundwater level.

Q Now, I noticed that, for purposes of explaining this -- the contour lines on this figure, the red contour lines are in positive integers, and the green contour lines are in negative integers.

A Right.

Q So the positive integers mean a drop from existing?

A Right.
Q And the green and the negative integers means a rise in existing; correct?
A Right.
Q So for the red contour lines, does this Figure 25 show the orebody?
A It does.
Q And would you point that out with your pointer, please?
A It's in this area right here (indicating).
Q All right. And it seems to be in the center of all of the red circles; correct?
A Yes.
Q And the red contour lines start at 0 -- I'm sorry -- start at 0.5, and then they increase in value to what around the orebody?
A 8.
Q And what does the "8" then signify?
A The drop in the water levels in that aquifer.
Q And this would be around the orebody?
A That's right.
Q So the new model prepared April 1st by GeoTrans suggests that there would be a drawdown from the mine operations of 8 feet in the water levels around the orebody?
A That's right. And this is for the case where they only simulate 60 gallons per minute.
Q And so under the simulation that you derived from your models of

between 280 and 3,000 gallons per minute, would you expect the drawdown to be more or less from what this model shows?

A Substantially more.

Q Now, Dr. Prucha, if you can sum up your concerns with the modeling that was performed for Kennecott for this case, what would those concerns be in summary?

A I believe that models developed are inadequate to predict mine inflows, because they weren't -- the underlying conceptualization and characterization was inadequate. I believe that they substantially underestimated the amount of mine inflow, and I believe that they substantially underestimated the impacts to the unconsolidated aquifer zones and the stream flow in the Salmon Trout River.

MR. HAYNES: Dr. Prucha, thank you. I have no further questions at this time.

MR. EGGAN: Your Honor, I think the ball passes to me at this point. I would inquire of the Court's perspective on this. I could begin. I probably have two and a half hours with Mr. Parker. It's about almost -- well, it's five after 4:00.

JUDGE PATTERSON: Right.

MR. EGGAN: What I would propose to do is go back and prune out some of the information that has already been elicited from Mr. Parker that I probably would have asked about. Do you mind if we end now and pick up with him tomorrow at 8:30?

JUDGE PATTERSON: No; on that assurance, certainly not

at all.

(Hearing adjourned at 4:07 p.m.)

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