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. XXXIII (33)

BEFORE RICHARD A. PATTERSON, ADMINISTRATIVE LAW JUDGE

Constitution Hall, 525 West Allegan, Lansing, Michigan

Tuesday, June 24, 2008, 8:30 a.m.

APPEARANCES:

For the Petitioner Keweenaw Bay Indian Community:	MR. ERIC J. EGGAN (P32368) Honigman Miller Schwartz and Cohn LLP 222 North Washington Square, Suite 400 Lansing, Michigan 48933-1800 (517) 377-0726

For the Petitioners Yellow Dog Watershed Preserve and National Wildlife Federation:	JEFFREY K. HAYNES (P25140) Beier Howlett, PC 200 E. Long Lake Road, Ste. 110 Bloomfield Hills, Michigan 48304 (248) 645-9400
For the Respondent Michigan Department of Environmental Quality:	ROBERT P. REICHEL (P31878) Assistant Attorney General Environment, Natural Resources and Agriculture Division 6th Floor, Williams Building 525 West Ottawa Street, PO Box 30755 Lansing, Michigan 48909 (517) 373-7540
For the Intervenor Kennecott Eagle Minerals Company:	RODRICK W. LEWIS (P43968) Warner Norcross & Judd LLP 2000 Town Center, Suite 2700 Southfield, Michigan 48075 (248) 784-5000
RECORDED BY:	Marcy A. Klingshirn, CER 6924 Certified Electronic Recorder Network Reporting Corporation 1-800-632-2720

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Lansing, Michigan

Tuesday, June 24, 2008 - 8:33 a.m.

JUDGE PATTERSON: Are we ready?

MR. REICHEL: We are, your Honor. Counsel, I assume that Mr. Wallace is not attending today?

MR. HAYNES: That's right.

MR. REICHEL: Okay. Respondent calls Charles Thomas as its next witness.

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

MR. THOMAS: I do.

CHARLES THOMAS

having been called by the Respondent and sworn:

DIRECT EXAMINATION

BY MR. REICHEL:

Q Mr. Thomas, could you please state your full name for the record?

A Charles Thomas.

Q And, Mr. Thomas, you work for the Department of Environmental Quality; is that correct?

A Yes.

Q And in what branch or bureau of the DEQ do you work?

A I work in Water Bureau.

Q And is there a particular geographic location you're assigned to?

A I'm assigned the entire Upper Peninsula.
Q Okay. And there's already been some testimony on this, and we'll get into it in greater detail. But were you one of the DEQ staff who participated in a mine review team that was charged with reviewing the mining permit application submitted under Part 632?
A Yes, I was.
Q Okay. Mr. Thomas, I'd like to start by asking you to briefly review your educational background, sir. Where did you attend college and what degree or degrees did you obtain?
A I attended college at Michigan Technological University in Houghton and obtained a degree -- a bachelor of science degree in geology in 1976. I returned to school in 1982 and completed a degree in geological engineering, bachelor of science again, in 1984.
Q And since completing your degrees in those subjects -- let me back up. On geological engineering, could you briefly describe the range of course work that you took to obtain your geological engineering degree?
A When I focused on geological engineering, I had an opportunity to focus on different disciplines. And I focused mostly on the hydrogeology and geotechnical as pertaining to foundation work and that type of things and Precambrian geology, additional expertise when I was getting

my engineering degree in addition to the standard engineering sequences.

Q Okay. And you referred a moment ago to Precambrian geology. I think there's already been some testimony on that. But when you're talking about Precambrian geology, are you talking about geological formations that were formed at a certain period of time in history; is that correct?

A Yes. Basically --

Q I'm not asking you what those dates are. But, I mean, what do you mean by "Precambrian"?

A Precambrian geology is essentially rocks that were formed, you know, prior to the Cambrian period, which is over 600 million years ago. And the rocks of the north central and western Upper Peninsula are predominantly Precambrian rocks.

Q Okay. Since completing your degrees, have you had occasion to take any short courses or further training courses related to geology, hydrogeology or geological engineering?

A Yes.

MR. REICHEL: And I would note for the record that Mr. Thomas' resume, which is marked as Respondent's Exhibit Number 20, has already been included in the record by stipulation of the parties.

Q But does that resume identify some of those short courses that you've taken?

A Yes, it does.

Q Could you tell Judge Patterson if you have any professional certifications in your line of work?
A Yes. I am a licensed professional geologist, license number 961, from the State of Wisconsin.
Q And by way of background, to your knowledge, does the State of Michigan have a licensing provision for geologists?
A No, they don't. There have been some attempts to get it, but it's not there yet.
Q I'd like to ask you now some questions about your professional experience. When were you first professionally employed in the environmental field?
A In 1984 when I obtained my second degree from Michigan Tech, I almost immediately became professionally employed as an environmental specialist for Hercules, Incorporated, an explosives manufacturing plant located in Marquette County.
Q And what sort of duties did you do as an environmental specialist for that company?
A I was responsible for all environmental regulations making sure the plant tried to meet all of the environmental regulation needs. And a couple of specific projects I had to do at that time was set up a groundwater monitoring network for seepage lagoons that the company had permits for, and I also had to basically prepare a Part B permit application for the Resource Conservation -- for RCRA for hazardous waste.

Q And did that require you to review environmental conditions at the site and fill out forms related to them?
A Yes.
Q How were you next employed? When you first went to work for Hercules, how long did you initially work for the company?
A Well, for Hercules, I only worked for a year, because Hercules sold that plant to another company called IRECO. And IRECO -- I worked for IRECO for a period of ten months before they decided to -- well, basically they told us when they bought the plant that we -- all of us ex-Hercules people were going to be out the door at some point. And I lasted ten months.
Q Okay. What was your next employment in the environmentally related field?
A With the County of Marquette doing groundwater education, groundwater contamination prevention activities with the Marquette County Health Department. That was a Department of Natural Resources grant program.
Q Okay. And what sorts of programs or information did you assemble or disseminate?
A The largest portion of that project was to create a training program for local government officials on groundwater, basically what groundwater is, how groundwater moves in the environment, how humans can impact groundwater, what local officials can do to minimize the potential for a negative

impact and then present that program to local government officials.

Q Okay. And this was in the Marquette County area?

A Yes.

Q What was next position that had involvement in environmental issues?

A While I was working for Marquette County, Hercules, Incorporated, contacted me and offered me a position at their corporate office -- their worldwide corporate offices in Bloomington, Delaware, again as an environmental specialist. And I took them up on the offer, because it was a pretty good pay increase.

Q And could you briefly describe the nature of the work that you did for Hercules in that position?

A I was responsible for disseminating environmental regulations nationwide, both federal and local states, on groundwater concerns, surface water discharge, underground storage tanks and drinking water regulations. In addition, I was part of environmental audit teams that went out from corporate headquarters to the myriad of plants and did three-day environmental audits, prepared reports.

Q And did that entail either the collection or the review of environmental data and evaluating it?

A Yes, it did.

Q And how long -- or through what year did you work for

Hercules in your second stint with the company?
A Through mid 1989. And the reason I left was I had an opportunity to come back to the wonderful state of Michigan and work for the State. So we took up on it.
Q Okay. When you returned to Michigan in 1989, what agency did you work for and what was your position?
A The position I took was groundwater engineer, and it was with the Michigan Department of Public Health in the drinking water program.
Q And could you describe what the nature of the work -- specific duties that you had in the groundwater program in what was then the Michigan Department of Public Health?
A The bulk of my duties was to work in the resource -- what was then Act 307, ultimate water supply program, to investigate contamination of drinking water supplies and try to identify source locations and to work for replacement or remediation efforts of the contaminated drinking water supplies. That was the bulk of my duties. My other duties was to perform hydrogeologic reviews of water development projects.
Q Okay. So if I understand you correctly, one portion of your work would involve collecting or evaluating information about groundwater contamination; is that correct?
A Yes.
Q And in the course of doing that, were you -- was it a

regular part of your job to either collect or to evaluate existing data concerning hydrogeologic conditions; that is, groundwater conditions and potential sources of contamination?

A Yes, it was.

Q And the other facet of the work that you described, I believe you talked about water supplies. Was it a part of your duty to be involved in planning for or reviewing plans for the development of replacement water supplies for contaminated wells that you were working on in the other part of your job?

A Yes. That was part of my responsibility. In addition to that, some of my -- I actually did some of the initial design work for replacement supplies.

Q Okay. And in those -- those latter two capacities, to what extent did your work in that position require you to or did it involve collection and evaluation of hydrogeological data that is concerning groundwater conditions, flow, et cetera?

A Quite extensive. Had to identify where -- if they're going to do a replacement water supply in a contaminated area, we had to identify the characteristics of the groundwater environment so that we didn't mistakenly put the replacement water well in a spot where we were going to find more contaminants. We had to identify groundwater movement, groundwater currents, where the contaminants were and where

they were likely to migrate to.

Q And to what extent, if any, did your work in those kinds of projects require consideration of groundwater -- strike that. To what extent did you have to look at issues about where a well could be -- replacement well could be placed to provide a useful and productive supply?

A Well, again we had to look at the horizontal movement of groundwater so that we were putting the replacement wells in an upgradient direction from the contaminant sources, if possible. Or if that was not feasible because of property constraints, we had to look at vertical isolation; do we have good confining layers between the contaminant zones and where we are going for water production and design how the well should be constructed so that we maintain that isolation.

Q Okay. And in that area of work, what geographic areas were you responsible for?

A Again I was responsible for the entire Upper Peninsula. I worked in both -- you know, in basically all three major geologic environments in the Upper Peninsula; the unconsolidated glacial environment, the Michigan basin sedimentary environment and in the Precambrian crystalline bedrock environment.

Q Did your responsibilities change over time?

A Yes, they did. As we worked to resolve contaminated water

supply problems, you know, the nature of that work just kind of -- because we resolved them, the amount of work became less and less. And I needed to find things to fill my time with. And when the Michigan Wellhead Protection Program started, I stepped into that and started working in that program.

Q Could you explain what you mean by the Michigan Wellhead Protection Program, what the program is and what sort of work you did as part of that?

A The federal Safe Drinking Water Act requires all states to have a wellhead -- a community water supply wellhead protection program. And in Michigan, we chose to do that program on a more scientific basis instead of arbitrarily drawing a radius around a well and saying that's the wellhead protection area. We chose to have communities actually go out and do what's called a delineation where they had to identify the characteristics of the groundwater environment where their water well supply wells were and then do groundwater modeling to delineate the potential path lines of the water to that well.

Q And I guess it's implicit in the name wellhead protection. But what was the basic principle of this program?

A The basic principle was to identify the recharge area for the well and for communities to develop management strategies to minimize the potential negative impacts to

their water supply.

Q And again in this aspect of your work, was it necessarily important for you to review and evaluate data concerning hydrogeology conditions in various areas of the Upper Peninsula?

A Yes, it was. Many, many aquifer analysis data collection and analysis of that data to ascertain the hydraulic conductivities, the transmissivities, the store activities of the aquifers.

Q Okay. Let me back to an administrative detail. You testified that, when you first started with the state in 1989, you were employed by the Department of Public Health. Did your agency affiliation, if you will, change over time?

A Yes, it did.

Q And could you briefly explain that?

A It changed when the Department of Public Health was abolished, for lack of a better word -- abolished by executive order from the governor. And most of the functions of the Department of Public Health went to the Department of Community Health except for the drinking water program. The drinking water program was moved to the Department of Environmental Quality.

Q And I assume you went with it, so to speak?

A Yes.

Q But functionally after that reorganization, you carried

forward similar or essentially the same responsibilities; is that correct?

A That's correct.

Q As a part of your work first with the Department of Public Health and later with the DEQ, in addition to what you described, were you -- did you have occasion or do you have occasion to consult with other DEQ staff particularly on projects where the state is regulating community water supplies under the state Safe Drinking Water Act?

A Yes. That's one of the things that I do within my job description is, when a community is looking to develop a new well, they have to do analysis of the aquifer. And the district engineers will seek me out to do the best to ascertain if the work that their consultants have done is true, accurate, represents what needs to be represented.

Q So would it be fair to characterize that essentially doing technical reviews of hydrogeologic investigations and reports?

A That would be a very correct statement.

Q And again, what's the geographic scope of your work on those kinds of projects?

A Again the entire Upper Peninsula.

Q Are there -- during the course of your work for the DEQ, are there or have there been circumstances where DEQ staff from other divisions other than the Water Bureau ever seek you

out or seek consultation from you formally on groundwater-related issues?

A Yes. From time to time some of the other staff in the district office will come to my cubicle and ask me to take a look at a report that they've received. Specifically they're looking for some site-specific geologic or hydrogeologic information from me that will either confirm or not confirm what the person who submitted the report to them is saying.

Q And are there ever occasions in your work where people of the private sector seek advice or information from you on hydrogeologic conditions in various locations within the U.P.?

A Yes. Again, many times over the course of the year people from the private sector, specifically well drilling contractors, will call me up and they'll ask me what they might expect to find in an area when they're drilling a well in an area where they haven't been drilling -- you know, normally don't drill. Typically well drillers stay in a certain area, and then sometimes they go outside the area. And they'll call me up and they'll say, "Hey, Chuck, we're going to be drilling over here. Where will we expect to find such and such a bedrock unit?" or "Where would be the -- you know, is there any water quality concerns we should be worried about in that area?" those kind of things.

I'm also working with a fellow from the USGS on identifying water quantity and quality aspects of the Cambrian ordivician aquifers in the Upper Peninsula.

Q Okay. Could you repeat that last phrase?

A Okay. I'm working with a fellow from USGS. He's out of the Indianapolis office. And he's developing a upper Midwest report on the water quality and water quantity in the Cambrian ordivician aquifers.

Q Could you briefly describe what those aquifers are?

A Those are -- Cambrian ordivician refers to geologic time. And those are going to be the oldest rocks that are not the crystalline Precambrian. So they're mostly part of the Michigan basin sediments.

Q Okay. So to summarize, over approximately how many years have you been professionally involved in working on various aspects of geologic and hydrogeologic conditions in the Upper Peninsula of Michigan?

A 19 years with the state and basically four years with other organizations -- you know, private or county.

Q And in particular focusing on the most recent nearly two decades that you've worked for the state, again has -- what range of geologic -- I should say, water bearing formations have you been involved in either collecting data or reviewing data with respect to groundwater flow, currents, et cetera?

A Basically every geologic environment that you can find in the U.P.; the unconsolidated formations, which are the glacial and alluvial formations, the Michigan basin sedimentary rock formations and then also the Precambrian crystalline bedrock formations.

Q Turning to the particular -- also in your resume, do you also -- that is Respondent's Exhibit 20 -- have you identified a list of some examples of particular projects that you've worked on?

A Yes, I have. I identified -- tried to identify most of the groundwater development projects where I had to do the hydrogeologic reviews of water supply capacity development and also all of the wellhead protection delineation modeling reports that I had to review.

Q Turning to the subject that brings us here today; that is, the proposed Kennecott Eagle Mine; if you recall, sir, during what year -- and I don't need an exact. But during what year do you recall first having any involvement in discussions of the proposed Kennecott Eagle Mine?

A In 2004.

Q And could you briefly describe the nature of your initial involvement; that is, how -- who approached you and what you were asked to do?

A Okay. Joe Maki, the district geologist for Office of Geological Survey, approached me in the office and asked me

if I was interested in being involved in doing some of the hydrogeologic reviews for the project.

Q And again in this 2004 time period, what was -- what did you learn or what understanding did you develop about any preliminary work that was being done at around that time by other parties?

A We were provided a draft or preliminary baseline environmental report of the work that had been done to date by the company at the Eagle project site. And Joe had asked me to -- if I would take a look at some of the information in there.

Q And if you recall, what consultant or contractor as of that time, if you know, was putting together some of that baseline geologic and hydrogeologic data?

A The information from the unconsolidated portions up there was being put together -- collected and put together by North Jackson Company.

Q And did you, during this -- well, let me just summarize. Mr. Maki provided you with some preliminary information that had been collected by the North Jackson Company; is that correct?

A That's correct.

Q And what were you asked to do with that?

A I was asked to take a look at it and see if the array of data collection made sense for determining the regional

hydrogeology and if the -- some of the preliminary conclusions were reasonable.

Q And at this preliminary stage of your involvement, did you have any understanding as to whether the data that you were given to look at was complete or was intended to be just a stage in an ongoing data collection process?

A My understanding was it was just an ongoing data process and this was just a stage of preliminary data collection.

Q Moving forward in time into the 2004 time period -- excuse me -- 2005, during that time period -- and I don't -- if you know the exact date, great. If not, it's not critical. During that time period, did you have occasion to meet informally with representatives of Kennecott or their consultants to discuss this ongoing data collection effort?

A Yes. Based on the review the preliminary stuff, we put together basically a series of observations, comments to the company, and those were -- mine were given to Joe and Joe put a bunch together and put them through the company. And we had occasion to meet and discuss those things that we had observed.

Q Okay. And again the time period I'm asking just so the record is clear, this is in the 2004-2005 time period; correct?

A Yes, it is.

Q During this time period, did you learn or did you understand

that the state was developing and ultimately enacted a new statute specifically regulating the type of mining that's being proposed here; that is --

A Yes; yes. I was aware that that was being developed and that there was a stakeholder group that was working on the statute and moving forward.

Q Just so the record is clear, you were not a participant in that process, were you?

A Not at all.

Q Okay. But as that process unfolded, did you develop some understanding that was anticipated that Kennecott would ultimately or was considering submitting an application for a mining permit under what we now know as Part 632?

A Yes. I was aware of that.

Q By late 2005 approximately, did you become aware that the DEQ was putting together something called the mining review team?

A Yes; yeah. Joe Maki again approached me and talked about it, so I was aware that it was happening.

Q And were you asked to become a member of that team?

A Yes, I was.

Q And what did you understand the function or anticipated function of the team to be and why was it a team rather than an individual?

A The application -- a permit for a project of this scope

contains so much information and so many variety of disciplines that no one individual would be -- have the expertise necessary to adequately review each of those disciplines. So a team concept in these types of projects makes a lot of sense, because then you have individual expertise in the individual members of the team that can overall review the whole application process.

Q And what role were you asked to play in this team?

A I was asked to focus on -- predominantly on the hydrogeology portions of the application with some focus on some of the geology aspects of the project also.

Q Now, I take it, based on your testimony, given the specific routine job assignments you have at the Water Bureau, this is -- this would be -- this was not something that was in your primary -- strike that. Your duties in the Water Bureau -- strike that. Your primary job position is in the Water Bureau; correct? In the water supply program?

A That's correct.

Q Did you -- as opposed to being a geologist in the Office of Geological Survey; correct?

A Correct.

Q So did Mr. Maki or anyone else explain to you why it is you were asked to participate in this?

A The concept of the team was to try to have people that were located in the district office. And in conversations around

the office, Joe came to the understanding that I had quite a bit of experience with hydrogeology in the Upper Peninsula. So he felt that I would make a valuable member to his team. And he asked me. And then he went to my supervisor to make sure that it was okay with my supervisor that I participated in the team.

Q Now, as I'm sure you're aware, in February of 2006, Kennecott Eagle Mine submitted a series of permit applications to the DEQ including a permit application under Part 632 for a mining permit; correct?

A Correct.

Q And I assume you're also aware that, at the same time, Kennecott applied for a groundwater discharge permit under Part 31?

A Yes, I'm aware of that.

Q As well as an air use permit under Part 55; correct?

A Yes.

Q Just to clarify your role in this process, which of those permit review processes were you involved in?

A The Part 632.

Q So just to be clear, you were -- were you or were you not part of the staff assigned to review the groundwater discharge permit application?

A No, I was not part of that review process at all.

Q One the permit applications were received -- well, strike

that. Actually around the time the permit applications were received, did you obtain or did you -- did Mr. Maki give you any background information to -- in terms of Part 632 or its rules to consider as a part of your review effort?

A Yes. I was given a copy of the Part 632 rules that were developed.

Q Once the application was received, did you obtain a copy of it?

A Yes, of the application.

Q And the entire application or just part of it?

A I was given the specific parts that dealt with hydrogeology, but the entire application was in the library in our office for staff to review any portions that they felt they needed to.

Q Okay. And so independently of what Mr. Maki pointed you to, you took a look at the scope of the application as a whole?

A Yes, I did.

Q Okay. And did you then undertake a review of the application or certain portions of it?

A Yes, I did.

Q And just for informational purposes --

MR. REICHEL: Could you please bring up Respondent's proposed Exhibit Number 212.

Q As that's coming up, sir, did you at my request prepare a page summarizing documents that you've reviewed during the

course of your involvement in this project?

A Yes, I did.

MR. REICHEL: And I'd note for the record that this is what has been designated as Respondent's Exhibit Number 212, which is being offered -- is being used solely for demonstrative purposes. I'm not yet offering it at this time.

Q And again, while we're waiting for that to come up, sir, maybe we could just -- cutting to the chase, does that include, among other things -- identify particular sections of the permit applications and supporting documents that you looked at?

A Yes, it does.

Q And does it indicate or identify some additional information provided either by Kennecott or other parties after the application was received?

A Yes. There was some additional submittals that we reviewed.

Q Now, I want to ask you a series of questions basically moving over time as to the things that you looked at. Obviously you didn't look at all of these -- the things listed on this page at once; correct?

A That's right.

Q Okay. Let me ask you to focus now on your initial review, which I take it would have been in the spring of 2006; is that correct?

A Yeah, if you consider February spring.
Q Or in your part of the world, mid winter?
A Yeah. It started right when we received the application. I basically started a review right away.
Q Okay. And in undertaking the review, what did you understand or what were you attempting to do or look at?
A I was attempting to look at if they had adequately identified the hydrogeological environment that the proposed project would be located in.
Q Okay. And as you proceeded with your review, were you asked to identify any areas where you may want further information or clarification of what was presented?
A Absolutely. That's a part of any review process is that you look at what's submitted and you provide comments back to the applicant. I think in my 19 years in working in state government, I've never received an application for a permit or a delineation report for a wellhead protection area that I didn't find something that needed to be commented and provided extra -- additional information.
Q Okay. And as a result of this initial review process, did you put together in writing some preliminary comments on various aspects of materials that you looked at?
A Yes, I did.
MR. REICHEL: Please bring up Respondent's proposed Exhibit 62.

Q Okay. Now, I would note for the record that this is -- it's on DEQ letterhead, in-office communication. It has a date of May 11, 2006; is that correct?
A Yes.
Q And this is from you to Mr. Maki?
A Yes, it is.
Q And just to perhaps clarify something that's potentially confusing, this has a big "draft" stamp across the face of the document; correct?
A Right.
Q Now, focusing your attention -- it's partially obscured by the word "draft" -- this -- let me back up. Before you prepared this document, which is dated May 11th, 2006, had you taken some of the information that's contained in this document previously and reduced it to writing?
A Yes. It's somewhat confusing. But the information that's in column A represents a prior document that I prepared. After my review of the application -- or the parts of the application I was responsible for, I prepared a series of comments. And I put it in a memo -- you know, I put it in a document form to Joe. And then later we had some additional contact with the company. And this memo, May 11th memo, represents the result of that second contact we had. And that's what column B is. Unfortunately I made a mistake in word processing, and I took my original document that was

column A -- you know, it wasn't columnar then. It was just a document with that information in column A. And I took that document and called it up, and I split it into this two columns. And when I did that, I failed to save the initial document. So that's why this confusion is here.

Q Okay. So the preliminary -- you have written some of your preliminary comments that was done before May 11th?

A Right. Everything that's in column A was done prior to May 11th.

Q Okay. And just to avoid any potential confusion or minimize the confusion that may be -- already exists, as we go through this document or if you look through it, when you prepared this May 11th version, did you take anything out of column A that had been there before?

A No, I did not.

Q So basically you took the previous document, which today exists as well as column A --

A As column A.

Q -- and added some other stuff to it?

A Yes, I did.

Q And you just didn't save on your computer the original version?

A Yeah.

Q Okay. But in any event leaving aside that sort of mechanical detail, you did some initial review. You put

some comments down in writing which are listed in column A; correct?

A Correct.

Q And then you gave that to Mr. Maki; correct?

A Yes, I did.

Q And if you know, what did he do with that in addition to looking at it?

A My understanding is they were passed on to the company. And I don't know in what format. But they were passed on to Kennecott.

Q For what purpose?

A For them to, I guess, respond to provide the additional information that we are looking for, clarifications that we were looking for.

Q Okay. And after that -- Mr. Maki provided that to representatives of Kennecott, what happened after that?

A We had a meeting. We went into the Kennecott offices and we sat down and we met with Kennecott and their consultants to discuss these -- you know, to try to discuss the specific issues that were identified.

Q Okay. And directing your attention back to proposed Exhibit 62 and the introductory paragraph, there's a reference there to during a May 4th, 2006, meeting?

A Yes.

Q Is that the meeting to which you just referred?

A Yes, it is.
Q And what was the purpose of that meeting?
A Again to go through these comments but also for us to -- for their consultants -- their modeling consultants to basically show us how their models were working.
Q Okay. Is that something that you wanted further explanation from the company or demonstration?
A We wanted a demonstration. We thought that was important to be able to demonstrate to us that the models ran appropriately, that they did what's called converge in a reasonable amount of time.
Q So did that demonstration of the modeling occur during that initial meeting on May the 4th?
A The demonstration of the bedrock portion did occur. The demonstration of the unconsolidated portion did not.
Q Okay. And again there's already been a great deal of testimony in this record about this -- about the fact that there were more than one model prepared. When you talk about the bedrock model, if you recall, which consultant was doing that work?
A Golder.
Q Okay. And then you talked about modeling that was focused on the unconsolidated aquifer; is that correct?
A Yes.
Q And if you recall, what consultant was doing that work at

that time for Kennecott?
A Fletcher Driscoll.
Q Okay. And did you -- strike that. Let's look back to this document here. Okay. Column A you've already explained. This is your initial comments based upon your review that was informally provided to Kennecott and may have been the discussion of your -- during your May 4th meeting; is that correct?
A A number of the issues were discussed during the May 4th meeting.
Q But not all of them?
A Not all of them.
Q Okay. And then what is column B? Am I correct in assuming that column B was something that you added to the original document at the time that you put together this May 11th memo; is that correct?
A That's correct.
Q And what were you trying to do in column B?
A I was trying in column B to go through my initial set of comments and see if they were addressed or not addressed during our May 4th meeting and provide that summary to Joe so that he would know where we needed to go.
Q Okay. When you talk about "needed to go," in terms of what? Further information?
A In getting further information or putting them together in a

overall permit application response letter -- you know, formal letter to the company.

Q Okay. And we'll get to that issue in a moment. But in terms of explaining what's laid out in this document, then directing your attention over to the left margin on the first page and it continues on to the succeeding, I believe, three pages as well, I see some handwritten notations there. Whose handwriting is that?

A That's my handwriting.

Q And during -- did you put those handwritten notes on this document sometime after May 11th?

A Yes.

Q Did you do it all at once or was it at different times?

A No. It was done at different times. It wasn't done all at once.

Q Okay. And what was your purpose of adding these additional notes?

A As we received more information from the company, I would take a look at the information and see if it adequately addressed my concerns -- my initial concerns in the application review and, you know, just check it off if it was taken care of or not.

Q Okay. And again I don't need the exact chronology. And I don't want to spend too much time on this. But -- so some of these -- all of these notes in hand were added sometime

after May 11th; correct?

A Yes.

Q But was that over a period of weeks, months?

A Probably a period weeks. They were mostly added, you know, after we received the response to our comments from the company. Most of them were added at that time. There was a few that were added a little bit later.

Q Okay. Well, let's get back around to that. Also there are a number of particular comments that are summarized in column A. The first question I have for you, sir, is, were all the comments that you made in this document -- were all of them related specifically -- were they related exclusively to the geologic and hydrogeologic issues or did they extend beyond that?

A No. There are some comments that extended beyond my charge for the team.

Q And so these were in the nature of general comments that you had reached simply going through the larger part of the document?

A Yes.

Q And as you were going through this overall process, did you -- I think you alluded to this earlier. Was it your understanding that the DEQ or Mr. Maki was planning to put together some consolidated list of comments of the mining permit application?

A Yes.
Q And was this document, if you know, among the materials available to Mr. Maki in putting together a consolidated list of comments of the mining permit application?
A Yes, it was.
Q We talked about this a moment ago. But your memo notes that you had an initial meeting or a meeting with Kennecott and some of its consultants on May the 4th where some of these issues were discussed; correct?
A Correct.
Q And then, if I understood you correctly, because you had an interest, among other things, in following up on some of the modeling efforts done by Kennecott's consultants, was a later meeting scheduled?
A Yes, there was. We originally thought that this May 4th meeting would solve -- you know, would have -- they'd come prepared to do everything we needed to have done. But unfortunately Fletcher Driscoll didn't come with a powerful enough computer to run their model for us. So we had another meeting about a month later with Fletcher Driscoll only at the Kennecott offices to have them with enough equipment, the proper equipment, to run their model.
Q And again you touched on this before. But what did you want them to do during this meeting with respect to the modeling?
A We wanted them to run the model in front of us so that we

could see that the model came to what's called convergence in a reasonable amount of time. And --

Q And why did you --

A If a model doesn't come to convergence in a reasonable amount of time, then there's a larger degree of uncertainty in the model.

Q And let me back up here. We didn't discuss this much initially. I apologize. During the course of your professional work for the DEQ -- I think you did refer to this -- but during the work that you have done for the DEQ and its predecessor agencies over the last 19 years, have yo had occasion to consider or look at groundwater modeling efforts?

A Yes.

Q Has that been a regular part of your job?

A It has been since -- yeah, for quite a long time it's been a regular part of my job looking at groundwater modeling efforts.

Q Now, just to be clear, do you hold yourself out as an expert in groundwater modeling?

A No, I don't.

Q But are groundwater models and the information presented in them -- are these things that you regularly do review and consider?

A Yes. And I feel like I have -- I do believe I have quite a

bit of expertise in setting up the conceptualization, the front phase of a modeling effort. I just am not a computer modeler.

Q So in other words, you do believe that you have experience -- specialized experience in developing conceptual geologic and hydrogeologic models?

A Yes.

Q But you do not yourself construct numeric models?

A Right. That's a correct assessment.

Q Okay. So going back, you've had this follow-up meeting with Fletcher Driscoll about a month after the initial one; is that correct?

A Yes.

Q And they presented what -- the modeling work or some portion of it that they had done as of that time; is that correct?

A Yes, they did.

Q Okay. After that time, to your knowledge, did Mr. Maki put together a consolidated list of questions from the DEQ to Kennecott -- questions -- I should say comments on its overall mine permit application?

A Yes. I'm aware of that.

MR. REICHEL: Okay. Could you please bring up Respondent's proposed Exhibit -- Respondent's Exhibit 67? Again I would note for the record this is already in evidence.

Q Mr. Maki, are you familiar with this document? Mr. Maki -- excuse me. I was reading the heading. Mr. Thomas, I apologize. Are you familiar with this document?
A Yes, I am.
Q And this is the consolidated comment document to which we were referring a moment ago?
A Yes.
MR. REICHEL: Could you please scroll down to that portion of the document. I believe it's page 5 beginning around -- the question in the 60-ish numbers.
Q Again this contains some 91, I believe, separately numbered paragraphs; is that correct?
A That's my understanding.
Q Okay. If you know, sir, based upon your involvement in the project and your review of this, were -- did Mr. Maki include in this consolidated document a number of comments that you had brought forth as a part of your review?
A Yes, he did.
Q And can you from looking at this identify for the record which numbered sections of this document correspond to comments or issues that you raised?
A On this page that's shown on the screen right now, comment 66 and 67 were from me.
Q Okay. And does that --
MR. REICHEL: Could you go to the next page,

please?
A And on this page, comment -- from comment 68 down through and including comment 76.
Q If you know, sir, did Kennecott ultimately provide a written response to Mr. Maki's letter, to this document?
A Yes, they did.
Q And did you have an opportunity to look at and review that response after it was received?
A Yes.
MR. REICHEL: Could you please bring up Respondent's Exhibit 69? Scroll down a bit, please. Yes, to -- keep going, please. Okay. Again this is already in the record. It's dated October 2006, response to MDEQ comments dated June 21st, 2006. Go to the next page, please. Could you just pause there for a moment?
Q The format of this portion of the document, sir, has a series of paragraphs, in this case, comment number 1, response to comment number 1; do you see that?
A Yes.
Q And later in this document -- I don't think we need to go through all of it right now.
MR. REICHEL: But actually could we scroll down to the page that has the response to comment number 66? Okay.
Q Without going through the details of all of this, some of these comments identify, do they not -- let's look at

comment number 69. Comment number 69, "Provide data and results from a groundwater modeling run using the most current data." And the response states, "An additional comparison of modeled heads to the most recent groundwater elevation data is provided in attachment 6." Do you see that?

A Yes.

Q And if you know -- well, first of all, this document refers to -- as a whole refers to certain attached documents submitted at or around the same time; correct?

A That's correct.

Q And were those documents also -- did you also review those attached documents that were referenced as being relevant to the issues you had raised?

A I reviewed the attached documents that pertained to the hydrogeology and other questions that I raised.

MR. REICHEL: Okay. Could you please bring up Respondent's Exhibit 71?

Q And for the record, this has the heading "Attachment 6, North Jackson Company technical memorandum" dated July 2006?

A Yes.

Q Is this a document that you reviewed?

A Yes, it was.

MR. REICHEL: Scroll down, please. Back up to the second page of that document. If you pause there, please.

Q Okay. This has the heading "Technical memorandum." It's from the North Jackson Company to Kennecott. And the subject is "Eagle project hydrologic monitoring update and responses to MDEQ comments"; correct?

A Yes.

Q Without going through the entire document, was this one of the particular documents that you reviewed as a part of your overall review of the permit application and Kennecott's response to your comments?

A Yes, it was.

Q And did this document, in turn, have some attachments to it, if you recall?

A Right, it did. It had an attachment from Fletcher Driscoll on some additional modeling output.

Q Okay.

MR. REICHEL: Is there an attachment or an Appendix A to this document? Perhaps if you go to the last page of the body of this. I'm sorry. I'm sorry. The last page of the body of this tech memo.

Q Rather than spending a lot of time scrolling through this document, let me ask you this, sir. At or around the time you received this document, was there in the same package of information provided by the company a further document submitted by Fletcher Driscoll providing further information about their modeling efforts?

A Yes, there was.
Q And did you review and consider both this document, the preceding document with Kennecott's narrative response and the information from Fletcher Driscoll?
A Yes, I did.
Q Are you aware, Mr. Thomas, that after the DEQ received this October 2006 set of responses by Kennecott to the DEQ's comments, that the DEQ provided access to the -- or basically took that information, put it on its website and invited public comment on that information. Were you aware of that?
A Yes, I was aware of that.
Q And are you aware that in response to that the DEQ received some public comment?
A Yes.
Q And actually I -- sorry to jump around here. Backing up in time, sir, --
A Sure.
Q -- to the spring of 2006, you're aware, are you not, that in I believe April and into May of 2006 the DEQ held a public informational meeting regarding the permit application; is that correct?
A Right. I was part of that meeting.
Q Okay. So you attended that? And were there, as you recall, more than one phase of that meeting back in the spring of

2006?
A Yes. It was set up as a two-part meeting.
Q And briefly describe what that was.
A The first part was more informal opportunity for individuals to come up and approach DEQ staff at tables to ask questions and discuss certain aspects of the proposed mine and permit process. And then phase two was a more formal-type setting where you had people up on a raised front place and a microphone out in the audience and the public could just provide comment through the microphone.
Q Okay. And did you attend that session?
A Yes, I did.
Q And if you recall, again, going back to the period at or around the time of this initial public meeting in 2006, if you know, did the DEQ also provide an opportunity for people to submit comments or information to the DEQ in writing?
A Yes. There was an opportunity for that after the meeting.
Q Okay. And as a part of your involvement in the process, were you provided access to comments that were submitted in writing by the public to the DEQ in the early 2006 time period?
A Yes.
Q And now catching up to where we were a moment ago in October 2006, were you also provided access to comments submitted by the public after the DEQ took Kennecott's supplement

information and put it up on the website?
A Yes.
Q And did you in fact review and consider comments submitted by the public as they related to the subjects of your involvement on team?
A Yes, I did.
Q And then proceeding now chronologically to a period of time in let's say the end of late 2006, early 2007, were you asked by Mr. Maki about -- or did you discuss with Mr. Maki the status of your review of permit application, additional information and public comments on this project?
A Yes. We had -- we actually had a team meeting where we all, you know, were -- where Mr. Maki asked us all if we were, you know, satisfied that everything was where it needed to be and if we had an opinion on if permits should be issued or not.
Q And how did you respond to Mr. Maki's inquiry in that regard?
A I said, yes, that I was satisfied and that I didn't see any reason why a permit should not be issued.
Q Okay. Did either in that discussion or subsequent discussions did you indicate to Mr. Maki whether your recommendation that a permit could be approved involved consideration of possible conditions on that permit?
A Oh, absolutely. I didn't think that a carte blanche permit

was appropriate. I think we need to have a permit with some performance-based conditions attached to it.

Q Okay. And did you at or around that same time period; that is, late 2006 or early 2007; put together a document where you identified what you recommended in terms of proposed conditions for a Kennecott -- for a permit if one were to be issued?

A Yes.

MR. REICHEL: If you'd please bring up Respondent's Exhibit Number 86?

Q What is this document, sir?

A This document is the list of conditions that I thought needed to be attached to a permit for a Part 632 permit.

Q Okay. And just so the record is clear, the heading on it says, "Conditions for Kennecott mining permit - from CHT." I assume you, sir?

A That's me. That's my initials.

Q And with the date of 1-29-07; is that correct?

A That's correct.

Q Okay. So this documents your recommendations to Mr. Maki about proposed permit conditions?

A Yes, it did.

Q Could you just read into the record the introductory paragraph of this memo?

A Okay.

"In addition to the extensive groundwater and surface water monitoring program proposed by Kennecott Eagle Minerals, the Department of Environmental Quality believes the following monitoring is required to provide a Holiday Inn degree of protection for the environment around the proposed mining operation in Michigamme township, Marquette County."

Q Okay. And then what follows -- strike that. I'd like to go through these particular recommendations in some detail. The first one, paragraph one, talks about groundwater and wetland water elevations being monitoring and then talks about measuring frequencies in certain locations. Could you explain briefly what you were recommending here and why?

A Well, the Part 632 required certain amount of monitoring be done on groundwater, but I thought Part -- and this -- I thought these particular wells and wetland locations needed to have additional monitoring so that we'd have a better early warning network of any possible or potential impacts that we would not like to see.

Q Okay. Well, let's -- before we go into that, let's talk about that subject a little bit more. Was one of the issues that you were looking at as a part of your review, did it have to do with the possible impact of pumping water out of the mine workings on other water either aquifers or surface water?

A Yeah; absolutely. Everything was based on a predictive model prepared by Fletcher Driscoll of what the potential impacts to surface water or to water table aquifers would be. And due to uncertainty in modeling, I felt that it was very important that we had a very rigorous monitoring program to account for any modeling uncertainties.

Q Okay. So again, the concern or this is addressed to the concern about the potential that mine dewatering could alter geologic or hydrologic -- excuse me -- hydrogeologic or surface water conditions in the vicinity of the mine; correct?

A Right. That was then -- there was that possibility, and the idea was to have a more extensive monitoring than what was required by rule so that we could have an ability to identify if that is actually was beginning to happen and react to it with -- and, you know, with the permit requirements requiring the company to react to it with mitigation methods.

Q Okay. Focusing on your recommendation number one, what was your specific recommendation in terms of where and how frequently measurements would be taken in certain groundwater wells?

A I was recommending that certain groundwater wells be monitored on a daily basis.

Q And how was that done, or how did you recommend that be

done?

A I recommended that they did an automated method using transducers. A transducer essentially just does a continuous measurement and reports that information to a central computer someplace that accumulates the data. It's a fairly accurate way of measuring groundwater elevations in wells.

Q And the next or the last sentence in your paragraph when it talks about taking water elevation measurements in wetland piezometers. Again, there's been some testimony of this. Could you briefly explain what is meant by a wetland piezometer in this context?

A Okay. A wetland -- a piezometer is essentially a water elevation measuring -- it's something that's constructed to measure water elevations. It's not constructed in the sense that you could pull water samples for water quality analysis out of, whereas a monitoring well you can do both. You can pull samples for water quality analysis and you can monitor groundwater elevation. So there was a -- there's a series of piezometers that were constructed by the company in the wetlands surrounding the orebody. And because wetlands can vary -- water elevations of wetlands can vary, you know, based on how much rains come, you know, this week or next week, those kinds of things, daily didn't seem to be a very good method, so I proposed on a quarterly basis for those

wetlands.

Q Okay. Now, I want to -- as we go through these, I want to jump ahead in time to the permit, the mining permit that was ultimately issued under Part 632. And are you familiar, sir, with the terms of the permit as it was actually issued?

A Yes, I am.

Q And if you know, was your recommendation number one ultimately addressed or reflected in the permit as issued or a particular condition of the permit as issued?

A Yes, it was. It was reflected in condition L-4 parts A and B.

Q I'd like to turn to now basically the next three numbered paragraphs in this document, two, three and four, which talk about certain groundwater monitoring proposals; is that a fair summary?

A Yes.

Q And we'll get into the individual recommendations, but do each of these -- what is the -- what are you proposing here in terms of -- are these three recommendations for draft permit conditions intended to add something to what Kennecott proposed?

A Yes, they are. They add additional monitoring locations to the proposal that Kennecott had in the application for monitoring the groundwater environment.

Q Okay. And I'd like to ask you to walk through individually

each of these recommendations. And turning to number two, what were you recommending and why?

A I was recommending that a well -- a monitoring location be placed essentially directly north of the orebody location and west of the surface facilities. And that's what comment number two is focused on. And the reason why is the ground -- the environmental assessment -- the baseline environmental assessment identifies groundwater flow as being to the northeast for the regional flow. And when you take a look at the contours, you know, you can see -- you could say, "Okay. You're right. Groundwater flow is generally to the northeast." But what if there's a slightly more northerly component to that groundwater flow? Well, we need to have something monitoring what would be the -- if there was a potential impact directly north. And Kennecott's application did not have a monitoring location directly north of the orebody, so I felt it was important to have one.

Q And again, in terms of what you were monitoring for, what sort of contingency or event or type of event were you trying to detect if it occurred?

A Any impact -- any impact to the groundwater, excessive drawdown in the water table due to mine dewatering or, you know, even though this is quite far away from the surface facilities and the mine body -- orebody itself, even have

another monitoring point for water quality.

Q And was the recommendation in paragraph two of document, if you know, was this ultimately reflected in the mining permit as issued?

A Yes, it was. It was reflected in condition L-5.

Q Let's go now to item number four in your list here. Again, what are you recommending and why?

A I'm recommending an additional monitoring -- water quality monitoring location immediately south of the surface facilities. And the reason why I felt it was important there is that there is a small local groundwater divide between the surface facility and the orebody or the middle branch of the Salmon Trout. Basically that groundwater divide is there because the middle branch of the Salmon Trout Creek. And they had lots -- and in their monitoring plan they had lots of monitoring points around the facility except for they didn't have a water quality monitoring point south of the facility in case there was any flow of anything that may happen, you know, unforseen at the surface facility, any of the flow back towards Salmon Trout Creek.

Q And was this recommendation ultimately reflected in the mining permit as issued?

A Yes, it was.

Q And in what condition?

A Condition L-6.

Q Turning to your next paragraph four of this document, again, what were you recommending and why?

A Well, Kennecott has in their monitoring plan had a monitoring well at that location, which is basically southwest between the surface facility and the Salmon Trout Creek kind of in a south, south- -- I mean, in a west, southwest direction from the surface facility. But they only had a proposed of monitoring the A horizon. And I didn't feel that that was adequate at that location. I felt like that there was the opportunity, because at that location the C-zone, so-called confining layer, I didn't think was as competent there as it was in some other places. So I felt it was more as important to having monitoring location there that monitored the lower aquifers and the unconsolidated also.

Q And if you know, was this recommendation ultimately incorporated in the permit?

A It was incorporated in condition L-7.

Q Okay. To make this a little more concrete, I'd like to ask you to identify for Judge Patterson --

MR. REICHEL: Could we please have Respondent's Proposed Exhibit, demonstrative Exhibit R213 projected?

Q Sir, is this a map of the proposed mine site and some surrounding areas?

A Yes, it is.

Q Okay. Could you please -- I don't want to have you repeat everything you just said, but I want to go back to the three well locations that we've just discussed and ask you if you can, if you have a laser pointer there, to go through them one by one. Let's start with the well that we have in paragraph two of the document that we just talked about, which is you said is now required by condition L-5.

A Right. It's this well right here (indicating) is the one that's conditioned -- that's by condition L-5, which is essentially, you know, not quite due north but close to the north of the orebody.

Q And again, you've already testified why you wanted or recommended that that additional monitoring point be added?

A Yes.

MR. HAYNES: Your Honor, I hate to interrupt, but could Counsel identify from which document Proposed Exhibit 213 is taken from?

MR. REICHEL: Yes. Sorry, Counsel. For purposes of clarity, this is a demonstrative exhibit. It is basically a variation of Figure 1 from the mining permit application that identified proposed locations onto which have been -- has been superimposed the three -- the approximate location of the three additional monitoring locations that this witness is discussing. So does that answer your question, Counsel?

MR. HAYNES: Again, just to inquire, I noticed that the date on this document says April 2008. So it appears to be a document taken from a document that's not the mining permit application, which is dated in 2005 or '-6. So I'm just trying to place where the document comes from.

MR. REICHEL: Well, the -- to illustrate the location of these proposed wells, our office made a request to Kennecott's consultants to take one of their previous base maps and add to it the locations. I did not prepare this document. I believe that this document may have been independently prepared by Kennecott's consultants in a -- to reflect the mining -- excuse me -- to reflect the additional well locations that are now required by the mine permit. So to summarize, this document is being offered solely to illustrate graphically for purposes of this witness' testimony at least the approximate location of each of the three monitoring locations that I've just asked him to discuss.

MR. HAYNES: I think I understand. Your Honor, could I have some brief voir dire?

JUDGE PATTERSON: Sure.

VOIR DIRE EXAMINATION

BY MR. HAYNES:

Q Mr. Thomas, you didn't prepare this document, did you?

A No, I did not.
Q Did you assist in its preparation?
A Not at all.
Q I notice that the legend for the document in the lower right says, "Prepared by JOW." Do you know who that is?
A No, I don't.
MR. HAYNES: And, Your Honor, if I could ask Counsel, this Exhibit 213 is purely for demonstrative purposes?
MR. REICHEL: Purely. And, again, by purpose, Counsel, just to further explain, is to give this witness an opportunity to by reference to a map testify about his understanding of where the additional monitoring wells that he's recommended would be located in relation to the facilities.
MR. HAYNES: Thank you. Nothing further on that matter, Your Honor.

DIRECT EXAMINATION

BY MR. REICHEL: (continued)
Q Mr. Thomas, let's go back now to the second of the three additional monitoring well locations you've discussed, which appears in part three of Exhibit 86, and I believe you testified corresponds to condition L-6 of the mining permit. Can you indicate on this figure where that's located?
A I believe that's the well right there (indicating). I'm

having trouble reading it from here, but --

Q All right.

MR. HAYNES: I'm sorry, Your Honor. Could you point out --

THE WITNESS: I believe that's the well right there, but I'm having trouble reading it from here. If you could blow that up a little bit, it would help.

MR. REICHEL: Can you enlarge that, please?

A Okay. Yes, that's the well location right there.

Q Okay. And just so the record is somewhat clear on the transcript, can you -- are you pointing to a location that is located where in relation to the main surface facility area?

A It's located directly south of the main surface facility area and east of the Eagle Rock.

Q And where is it related to -- can you relate it to a proposed -- is that the access road?

A This is the access road to the -- the proposed access road to the surface facilities. It's probably a couple hundred feet west of that road.

Q Okay. And again, the purpose of this proposed monitoring well location is what?

A To have a detection system for if there was a contaminant release at the surface facility we'd have a detection system to the south. There wasn't any -- even though groundwater

flow is not expected to go to the south, I still felt like it was prudent to have a detection system surrounding the facility.

Q All right. Turning now, sir, to the next -- the additional monitoring well locations that is in paragraph four of Exhibit 86 and corresponds to condition L-7, could you identify on this figure the approximate location of that well?

A Yeah. The approximate location of that is right here between the surface facility and the Salmon Trout Creek -- middle branch of the Salmon Trout Creek, right in this area right here. And that is -- there is a groundwater divide that comes through here. It kind of -- it divides the -- just in this local area, it's a small divide that where there's some groundwater flow directly to the Salmon Trout Creek here, whereas most of the groundwater flow is to the northeast.

Q And again, for the record -- it's somewhat difficult to do this in words -- can you describe where that proposed well location is in relation to the main surface facility area that's depicted on the map?

A Right. That well is located approximately halfway between the main surface facility and the Salmon Trout Creek wetlands. And it is located off the southeast -- I mean, the southwest corner of the surface facility and west of the

Eagle Rock.

Q And I apologize if I've asked you this. What was the purpose of this well?

A This well also was for water quality monitoring and to be able to have a detection system kind of away from the surface facility if there was an unforeseen release of contaminants.

MR. REICHEL: Could you put that down, please? And I'd like to go back to Proposed Exhibit 86, if we could.

Q Thank you. Mr. Thomas, continuing with your review of the recommendations you made on additional permit conditions, could you turn now that paragraph five of this document? And again, briefly state what your recommendation is and why you made it.

A The recommendation is that the flow of mine dewatering water be monitored on a daily basis with a meter. And the basis of that is the applicant said that they were going to monitor flow from the mine for mine dewatering, but there wasn't any -- there wasn't a -- or at least I didn't see it in the application a definitive description of how they were going to measure that flow. And I thought it was important that we had, you know, everybody on the same page of how that flow was going to be monitored.

Q Okay. And again, why would it have been important to you that there be daily measurements of the amount of water that

was being pumped out of the mine?

A Well, modeling was based on a predicted flow from the mine and if we had, you know -- if we had multiple days of much greater than predicted flow, then things that the model was predicting or the predictive assumptions wouldn't be reflected accurately.

Q And was your recommendation in paragraph five for this daily measurements of flow and reporting of flow reflected in the permit?

A Yes, it was. And it was reflected in permit condition L-8.

Q Your next recommendation in paragraph six, what were you recommending there and why?

A I was just recommending a frequency of reports containing the data from the water quality monitoring, the aquifer water level monitoring, the wetland monitoring, you know, all of the -- all of the water monitoring.

Q If you know -- go ahead. I'm sorry.

A No. Go ahead.

Q If you know, was this recommendation covered in the permit as ultimately issued?

A It was covered in the permit general conditions. And I was not -- when I read the general conditions, I didn't see it the first time around. That's why I had that recommendation. But then Mr. Maki pointed out to me that it was already covered. So this was not covered by a separate

condition.

Q I'd like to turn now to your next two recommendations, 7 and 8 appearing in this document. Could you explain briefly what you were recommending in these conditions -- and we can take them one at a time, if you prefer -- and why?

A The modeling effort that was done to define the hydrogeologic regime, first of all, to find a steady state condition, but then they did a predictive assessment model that was, again, a non-steady state based on the mine dewater. And because there's some degree of uncertainty in any predictive model, I felt like it was important that we had some performance-based trigger measures in the permit for this project. And that if certain levels of water flow from the mine occurred over a certain period of time, that it would trigger additional work. And then the numbers that I chose in condition number seven, 200,000 gallons per day, is essentially two times the predicted base flow from the mine dewatering of 70 gallons a minute. 70 gallons a minute equates roughly to 100,000 gallons a day. So I felt like that if they observed a flow of twice the base condition over, you know, on any given two-day period -- I mean, two days in any given five-day period, that are -- or I'm sorry -- ten-day period, or for more than five days in any 30-day period, that maybe the assumptions that were used for the model needed to be re-looked at.

Q Okay. And you noted that this condition is worded in terms of the observation of flow above a certain threshold over a particular period of time. Could you explain further why in making this recommendation you thought it important or useful to put some limitation in terms of the amount of time over which these elevated flows might be observed?

A Well, if you're observing -- the mine model was based on 70 gallons per minute being pumped out of the mine every minute of the day, every day of the week, every week of the year. And it was very -- it was set as a conservative number like that in the model because it was based on the assumption that the mine was totally open and none of the stopes were being backfilled. I used the numbers 200,000 and 300,000 based on those things. Now, my number of days was somewhat, you know -- there wasn't any particular science behind that. That was just somewhat arbitrary in terms of I had to pick some numbers of days, and I felt like that was a conservative approach to use if we had twice the base flow in two days in any ten-day period or more than five days in any 30-day period just to set some trigger numbers. That's all they are. They're triggers to trigger additional monitoring of the surface waters and wetlands and groundwater environment to see if that added flow, you know, that added mine dewatering flow, was actually having an impact or not, if there was -- if they were seeing a visual

impact. Okay. And if we didn't see any visual impact, the permit condition gave the company an opportunity to relax back to the normal monitoring they had.

In item number eight, there I used a 300,000 gallons per day which is roughly equivalent to the upper bound case that the Fletcher Driscoll model used of 215 gallons per minute. And because the upper bound case had a more higher potential to impact surface wetlands, I felt like we -- if that happened over any short period of time, that we had to trigger not only increased monitoring, but we had to trigger a reevaluation of the model itself and we had to also require the company to develop and propose a mitigation plan so that the wetlands were not impacted.

Q Okay. And briefly going back to this issue of the language in these draft conditions that talks about the persistence of increased inflows of water over a period of days, to what extent if any were you considering the possibility that if there -- that there might be variations over time on mine inflows as new openings were created or expanded?

A Then that's why it's -- you're exactly right. As you open a new area there may be some resident water, for lack of a better way to describe it, resident water. The technical term for that is connate water. The water is resident in the bedrock. And you open this area up and all that water is resident in the bedrock. As you pull it out, it's going

to be there. And that's kind of why I count -- why instead of having it as one day I put as two days. It gives, you know, an opportunity for the mining operations, they open up a new area, they have this resident water so they have a larger flow for one day. Then the next day, you know, after they've gotten rid of the larger flow, the next day they're back to what would be a more considered average or normal flow.

Q If I've already asked you this, I apologize. But, if you know, sir, were the concepts you had recommended in paragraph seven and eight of this memorandum reflected in conditions of the mining permit is actually issued?

A Yes. They were reflected in conditions L-9 and L-10.

Q Okay. And, Mr. Thomas, you have been present during some of the prior testimony in this case; is that correct?

A Yes, I have been.

Q But not all of it; correct?

A Not all, thankfully.

Q Are you aware, sir that during the course of some other evidence in this case some criticisms have been advanced about some aspects of the modeling methodology used by Fletcher Driscoll?

A Yes, I'm aware of that.

Q As you sit here today -- strike that. And you're aware that questions have been raised about potential uncertainties in

the Fletcher Driscoll predictions with respect to the subject that they're modeling; is that a fair statement?

A Yes, I'm aware of that.

Q Notwithstanding some of that criticism and the uncertainties that have been -- some degree of uncertainties pointed to the Fletcher Driscoll model, do you have an opinion as to whether or not the approach that you've recommended in these last two permit conditions is still a useful approach in this context for addressing the potential impact of mine dewatering on groundwater and possibly surface water in the vicinity of the mine?

MR. HAYNES: Objection; lack of foundation. The witness has testified that he is not an expert in groundwater modeling. He's testified that he has expertise in setting up conceptual models. But as we've heard from numerous witnesses, models involve more -- groundwater modeling involves more than just setting up the conceptual modeling. It involves characterizing the bedrock and aquifer characteristics, it involves calibrating models. So for this witness to opine on the adequacy of the Fletcher Driscoll model I think is far beyond his expertise. And I object for those reasons.

MR. REICHEL: Well, Your Honor, if I'd asked him to opine on the adequacy of the Fletcher Driscoll model, that would -- I could -- well, that would be one thing, but

I didn't. My question --
Q And let me restate it, just to be clear, is simply this: Mr. Thomas, do you believe that the permit conditions that you proposed that ultimately ended up in the permit that we've been discussing here are a useful tool for addressing the concern about potential impact of mine dewatering on surface waters and wetlands?
A Yes, I do.
Q Okay. And why do you believe that, sir?
A I believe that the permit conditions, these two in conjunction with the permit condition of the additional monitoring locations, not just the three but, you know, the additional monitoring frequency, I should say -- frequency that's in the first of my recommended conditions plus the conditions for additional hydrology data collection that's in the other part of the permit, all that rolled together is going to provide the agency and the applicant the ability to observe and react very quickly to anything that might come up due to the uncertainties of any of the modeling process.
Q Now, moving forward in time, sir from the date of this document, which was in late January of 2007, shifting forward in time to approximately July of 2007, did you at or around that time were you asked by other Department staff before -- strike that. I'll just represent to you that in late July 2007 the Department notified the public that it

was proposing to issue a mine permit to Kennecott subject to certain conditions. You're aware of that; correct?

A Uh-huh; yes, I am.

Q Before that notification was given, were you asked whether or not you continued or what your -- whether that decision was consistent with your recommendation?

A I'm sorry. I didn't follow that.

Q I'm sorry. Before the Department in late July of '07 announced or reiterated a previously stated decision saying to the public, "Our tentative decision, subject to public comment, is to issue a mining permit" -- okay -- before that happened, did you -- as of that time, did you have a view as to whether or not you supported that recommended action?

A Of issuing a mining permit?

Q Yes.

A Yeah. I -- the conditions that I thought were necessary to put in the mine permit, as long as those conditions were in there, I supported the -- our department issuing a permit.

Q And you're aware, are you not, Mr. Thomas, that later in 2007 there were a series of public hearings on this proposed decision?

A Yes.

Q And you're aware that the Department solicited and received public comment on that proposed decision?

A Yes.

Q And as a part of your involvement in this process, were you asked to or did you look at or consider any of the public comments received in that process?
A Yes, I did.
Q And were you asked to provide any suggested responses to those comments, any of those comments?
A Yes. I was given certain select comments that would pertain to hydrogeology, and I was asked to review and provide any response I may feel is appropriate to -- on those comments to provide those to Joe Maki.
Q And did you do so?
A Yes, I did.
MR. EGGAN: Mr. Reichel, I'm not sure I'm understanding the time period we're dealing with here. Would you mind clarifying that?
MR. REICHEL: Certainly; certainly.
Q I'll represent to you, Mr. Thomas, that the public comment period that I was just asking about, the public comment period ended October 17th, 2007. Did you understand that was about the time period I was talking about?
A Yes, I did.
Q Okay. And so my question again, just to clarify, was there was a number of public comments received during that time period; correct?
A Yes, there were.

Q And after the public comment period closed, were you asked to review and consider comments received that related to geologic or hydrogeologic issues?
A I was asked to consider some of those comments, yes.
Q Sure. And you did so?
A Yes.
MR. REICHEL: Could you please bring up Respondent's Proposed Exhibit 108?
Q Mr. Thomas, can you please look at the screen here? And what is this document, sir?
A It was a memorandum that I prepared to Joe Maki on October 18th that summarized my review of the three particular documents that are identified there below the first paragraph.
Q And those include comments from John Coleman of the Great Lakes Indian Fisheries Commission dated October 12th, and October 16th; is that correct?
A Yes.
Q As well as a reference to October 9th, 2007, "Alternate" I assume Groundwater "Model" --
A Yes.
Q -- "from" -- is that National Wildlife Federation?
A That is correct.
Q And attached to this document are some comments you put down in writing after having looked at that information; is that

correct?
A That's correct.
MR. REICHEL: Can we just scroll to the last page of this document?
Q And that has the heading "Response to NWF Alternate MODFLOW Modeling." Do you see that?
A Yes.
Q And the initials at the top indicate it was by you, CHT; correct?
A That's correct.
Q Okay. To put this in some context, was the particular comment or set of comments that you're responding to, did it -- there's a reference here to an "Alternative groundwater system model prepared by Geomatrix for the National Wildlife Federation"; is that --
A That's correct.
Q Okay. As you reviewed that information, did you reach any conclusion -- strike that. Based upon your review of this alternative modeling that was suggested in this part of the public comments, were you able to arrive at some understanding or clear understanding of the conceptual model that underlay the Geomatrix proposal?
A No, I did not. I felt like the information that was provided was too sketchy on how they -- what they -- how they developed their conceptualization to put into their

MODFLOW model.

Q And again, there's been testimony on this but, when you talk about conceptualization, what are you -- what are you talking about? What sorts of --

A I'm talking about the -- how the modeler is defining the geologic and hydrogeologic environment that exists in the area that they're going to run a predictive model on, they -- basically how they layer the aquifer formations or the confining formations, what values they place on each of the layers in terms of hydraulic conductivity and if there's vertical gradients or not, how thick each layer they're defining is, what the layer materials are made of, things like, you know, transmissivity and storativity to the aquifer but of the aquifer layers, the extent of the layers, you know, cross-sectional diagrams of how they laid out their concept, those types of things.

MR. EGGAN: Your Honor, I'm going to object to this testimony. This witness has indicated he is not an expert in modeling; that he knows something about the conceptual design, but that he is not an expert in modeling. And now he was unwilling to comment on the Fletcher Driscoll model and offered criticisms of those models. Now we have him offering an opinion -- an apparent expert opinion on modeling that was done by Geomatrix. I'd like to have that testimony stricken and the Court should not consider it. He

is not qualified for this.

MR. REICHEL: Well, first of all, he was not unwilling to talk about the Fletcher Driscoll model. He responded to the questions I asked. Number two, I was not asking him to provide a critique of this model. I first asked him if he felt that he -- as he was reviewing this, he had a -- he was able to understand the conceptualization that underlay that model. He responded to that. Then I asked him to explain what he understood when he used the word "conceptualization" what he meant. I think that's a entirely legitimate inquiry. The point of this is not to -- is not to solicit a critique of the model but simply to have the witness expand upon or what he did as a part of his review, what he understood and what he didn't.

MR. HAYNES: Well, Your Honor, if that was the question, the answer went far beyond the question. The answer, then -- the answer from the witness to that question was a critique of the Geomatrix model. And if that was the question, then the answer should be stricken as non-responsive, because the witness did start critiquing the Geomatrix model. And if Counsel didn't mean for him to do that, then the question should have been re-asked and his answer should have been stricken as non-responsive.

MR. REICHEL: I don't necessarily agree with the characterization of the witness' response. But in the

interest to moving forward, let me just restate the original question.

MR. EGGAN: Well, that doesn't resolve it. I would like to have his comments that were a critique of the Geomatrix model stricken, because he's indicated that he is not qualified to do that.

MR. REICHEL: And again, I don't believe that fairly characterizes this.

MR. LEWIS: I don't either, Your Honor. I thought Mr. Thomas has testified that he does have the background experience concerning the conceptualization, which, as I understand it, is the background information and data from which modeling can be done while at the same time saying he's not an expert on the running of these computer models. But the question that's been posed to him, as I understand it, is, you know, "In your job of reviewing this additional report and modeling by Geomatrix," you know, the starting question is, "Did you see in there sufficient background information on which, you know, you could assess whether they had the correct background information?" And that's all he was asked. And he's been describing what appeared to be to him apparently the lack of that kind of information and describing what it is that he would expect to see there that was not there. And I think that's perfectly within the realm of his experience and expertise and his job duties.

MR. HAYNES: On the other hand, Your Honor, the witness has testified he has some experience in conceptualization. But what he's been -- the answer that he gave to Mr. Reichel's question was not dealing with the conceptualization. It was dealing with the characterization of the -- as Mr. Lewis says, the background information. And the witness has not testified he has any expertise in the characterization for such models. So again, it's non-responsive and should be stricken.

JUDGE PATTERSON: I think he's qualified to make the answer based on his experience. I'm not sure it was non-responsive to Mr. Reichel's question. Obviously he has some limitations and about being an expert in the actual running of models. That can certainly go to the weight of his testimony. But I'll let the answer stand.

Q Mr. Thomas, again, going back to what you wrote at the time you put this draft comment here together, you make some observations or comments about how -- strike that. You comment on a question of -- actually you state a question of whose model is correct. Do you see that?

A Yes.

Q And you go on to offer sort of a rhetorical response to that. What was the main point that you were trying to -- if any, that you were trying to convey on this discussion?

A The main point I was trying to convey is that there is an

inherent degree of uncertainty in any modeling process, because what you're essentially doing is you're trying to take a complex environment and simplify it into a series of layers, so to speak, and data or characterizations of those layers so you can enter it into a computer code model and have the model come out with some predictions. Even if the model, you know -- there's a degree of calibration and sensitivity analysis in those models as we've heard in testimony by experts in this trial up to now, and I don't think any of the experts said that a model can be 100 percent -- 100 percent calibrated accurate. I don't think that anybody ever said that. So there's a degree of uncertainty in any model. And based on the data that's put into the model, it reflects or the model itself would then reflect how -- what the degree of that uncertainty is. Obviously the more and better the data that goes in the model the less uncertain that model will become. And I believe that I've over the years reviewed lots and lots of models, plenty of models. And conceptualization is -- all along I've characterized myself as a person when I deal with other consultants on modeling is that this conceptualization phase is where I believe is the meat and potatoes of any model. And that's where I've tried to focus my efforts is, you know, to make sure that I have a good sound grounding in the geology and hydrogeology of an area that how it's

conceptualized before it's put into a computer model.

Q Okay. And again, turning to the comments that you made in this document, what view were you attempting to express regarding how this uncertainty in the modeling that you've understood to exist, how that should be addressed or how do you recommend that that be addressed in the context of the permitting conditions you've proposed?

A Okay. I see what you're -- I felt -- I feel like a permit for a project of this scope should not only be based on the predictive model that is presented by the applicant or presented by if someone from our department ran it themselves or if someone from in public comment ran a particular model of their own, I don't think the permit should be based on what those models say. I think the permit should be based on the entire realm of the information available and that there should be performance-based criteria in a permit.

Q And you used that phrase before. Could you explain what you mean by "performance-based criteria"?

A Rigorous monitoring program and that if certain triggers are observed in that rigorous monitoring program that other actions to minimize or mitigate impacts to the environment are put into place.

Q In the course of your review and recommendations on this project as a member of the DEQ mining team, I think you

touched on this earlier, in making your recommendations, were you or were you not taking into consideration what you understood to be the requirements of Part 632 and its rules?

A I was taking into consideration Part 632 rules and statute.

Q And are you aware that under Part 632 and the rules in the criteria for issuance of a permit include whether or not the proposed activity is consistent with the act and the rules?

A Yes.

Q And are you aware that one of the other criteria is whether or not the proposed activity will or will not pollute, impair or destroy the natural resources of the state?

A Yes, I'm aware of that.

Q And so in making your recommendations to others in the Department who ultimately made this decision, do you believe that those criteria are satisfied under the conditions of the proposed permit -- or excuse me -- the permit that you recommended issuance of?

A Yes.

MR. HAYNES: Objection; lack of foundation. The witness hasn't indicated that he has any ability to testify about the ability or the possibility that this proposed mining project will pollute, impair or destroy. He's testified about his experience in groundwater characterization and some geology, but that's it. And for him to testify now about impacts on wetlands, impact on the

air, impact on other natural resources is far beyond his stated expertise.

MR. REICHEL: Well, Your Honor, two-fold response to that. Perhaps I didn't word it this way, but my question is really addressed to those aspects of the permit that this witness has testified he's focused on. And I'm prepared to restate the question that way. And with respect to those areas, I do believe that there is a foundation for this witness to testify as to his understanding of whether or not, for example, the proposed mining activity under the conditions that are at issue here would impair or destroy the surface water resources in the vicinity of the mine site; that is, whether or not specifically the mine dewatering is -- would cause an impairment of the groundwater and surface water resources. So let me restate the question.

JUDGE PATTERSON: All right.

Q Mr. Thomas, based upon your work on this project and the aspects of the permit application and the permit that you were asked to focus on, do you believe thank you issuance of the permit, the conditions that we've discussed would or would not result in impairment of the resources in the State of Michigan that could potentially be adversely effected by the mining dewatering?

MR. HAYNES: Same objection; lack of foundation.

The witness has testified about his experience in modeling -- his limited experience in modeling, his experience in looking at wellhead protection zone proposals. He's not indicated that he has any expertise in what constitutes impairment of resources, surface or groundwater, what constitutes -- what those resources are, and he's completely unqualified to render such an opinion.

MR. EGGAN: I would join in the objection, Your Honor.

MR. REICHEL: Again, this is addressed to the question -- and this witness has testified at some length and the record reflects that he was asked to review certain aspects of this application, which included, among other things, the potential for mine dewatering to cause reductions in near surface groundwaters and potentially wetlands elevations, water elevations. The thrust of this question was directed to whether or not in making his recommendation to issue the permit under these conditions whether or not that was consistent with his understanding of the requirements of Part 632, including the requirement that the mining activity not cause impairment of resources. I think that's a legitimate line of inquiry.

JUDGE PATTERSON: I'll overrule the objection.

Q Do you remember the question, sir, or can you --

A Yes.

Q Okay. Would you answer, please?
A Yeah. I believe what the -- that the permit with the conditions that were attached to it would result in the mining activity that would not impact or impair the waters to the state.
Q During the course of -- again, you testified that you've attended some of the testimony, but not all of it in this case; is that correct?
A That's correct.
Q And during the course of this proceeding, or have you had the opportunity to review transcripts of the testimony of some of the prior witnesses in this case?
A Yes, I have.
Q And has that included, for example, the testimony offered by the Petitioners by Dr. Prucha?
A Yes. I reviewed that transcript.
Q So it has been suggested in prior testimony in this case that estimates of potential -- the range of potential inflows of water into the mine that have been prepared by consultants for Kennecott may restate -- or excuse me -- may have understated by orders of magnitude the amount of water that could be expected to flow into the mine. Do you recall seeing testimony to that effect?
A Yes, I do.
Q And to the extent that it's been suggested based upon your

review of the available information and your training and experience, do you believe that the scenario of mine inflows of orders of magnitude greater than those projected by the modeling that's been done in this case are plausible?

MR. HAYNES: Objection; lack of foundation. We had the witness who is by training a geologist, who's not a hydrogeologist and not a modeler by his own admission, now opining on the opinions of Petitioner's witness Dr. Prucha, who is a hydrologist, is an expert modeler. And so this witness has no qualifications to opine on that question. and secondly, we don't know what he's looked at. The question assumes that he's looked at some information, but we don't know what that is. So there's no foundation laid for that question to be asked.

MR. REICHEL: Well, let me respond to those in reverse order. What the witness has looked at has already been identified in Respondent's Exhibit 212, number one. Number two, this witness has testified that he has both academic training in geology and geological engineering, which has included aspects of hydrogeology. And more significantly, he's testified that just with the State of Michigan alone he has 19 years of substantial very practical real world experience with hydrogeologic conditions in the Upper Peninsula of Michigan, which frankly substantially exceed any proffered experience by Dr. Prucha. But leaving

that aside, he has specialized training and experience in the area of hydrogeologic conditions in the relevant area. And, again, my question was not directed to modeling, per se, but to the hydrogeological, whether he believes from a hydrogeological standpoint and geological standpoint assertions that the -- that there may be hundreds or thousands of gallons of mine inflow are in his judgment plausible. I think there's a foundation for that based upon both his experience and the information that he's looked at.

MR. LEWIS: Your Honor, if I may, I'd like to add something. Because I conducted Dr. Prucha's testimony, I may have -- I have a fair degree of recall as to the substance of that testimony. And I think it's quite pertinent to the question being asked to Mr. Thomas now and demonstrates that in fact it's certainly within his background, experience, training and education to comment on Dr. Prucha's testimony in regard to his alternative inflow scenarios, because, as I think we can all recall quite readily, there were actually four points to Dr. Prucha's testimony, four changes and assumptions he made, by which he got to his different scenarios. And they were, one, that he assumed that certain so-called faults existed in the area. And as you full well know by now, that's hotly disputed by geologists -- other geologists that have testified. Now, that's a matter of geology. Number two, he assumed that the

degree of conductivity of the so-called faults and lineaments and so forth was much greater than Golder and Kennecott geologists concluded via their testing. Three, he concluded that these so-called water conductive features were of great length and great connectiveness.

Those are the four assumptions that he arbitrarily changed and by which he came up to his alternative scenario. There was no description by Dr. Prucha in the record as to any specifics of any modeling he did. He simply put forth the changes he made in the assumptions, said he input those and got the new numbers. He did testify there was no calibration of the model, so-called modeling that he did, nor any sensitivity.

So given the basis and gist of Dr. Prucha's testimony, I think it's demonstrated full well that Mr. Thomas has the background, qualifications, training necessary to answer Mr. Reichel's question.

MR. HAYNES: On the other hand, Your Honor, Dr. Prucha's conclusions in his testimony were based upon his expertise as a modeler and varying the inputs as modelers are supposed to do as we've heard from modelers on all sides of this question in this proceeding. The witness disclaims any expertise in modeling except for the conceptualization. So for him to now comment on how Dr. Prucha varied the inputs into a model based upon Dr. Prucha's characterization

of the area and then his running his models is completely outside this witness' expertise. And there's no foundation for the question to be asked.

MR. EGGAN: I agree, Your Honor. And I would add that inherent in the question itself -- and Mr. Reichel used the term "modeling" in the question itself. So inherent in the answer to the question is an assumption that this witness has some expertise in the issue of modeling. And he said right at the beginning he is not a modeler and is not an expert modeler. So from our standpoint, there is no foundation for this question.

MR. REICHEL: Well, again, the thrust of the question went to the plausibility ultimately of the characterization of geologic conditions that underlay the model, not to the details of the numeric model. That's the thrust of the question. And I think there is a foundation for this witness to testify as to his understanding of the characterization of the conditions that are pertinent to the issue of a range of inflows into the mine.

JUDGE PATTERSON: I think there's a proper foundation. Again, I think it's a matter of -- it's certainly arguable the weight of the testimony of his assessment against Dr. Prucha's, a highly qualified Ph.D. and modeler.

MR. HAYNES: I'm sorry, Your Honor. I didn't hear

the last part.

MR. HAYNES: I said he's obviously a very well qualified Ph.D. and a modeler, Dr. Prucha. So what I'm saying is, you know, we're going to have to assess the weight of this witness' testimony against that. But I think there's a proper foundation based on his training and experience in geology and extensive groundwater study in the U.P. to answer the questions. I'll overrule.

Q Mr. Thomas, do you remember the question?

A Yes, I think so.

Q Would you please answer it?

MR. EGGAN: Will you please repeat it so that we can all recall it?

A Do you want me to repeat --

MR. EGGAN: Well, I guess I think we probably should go back given we had a colloquy about it and just get a sense of what the question was again.

JUDGE PATTERSON: You're saying you want it read back?

MR. EGGAN: I don't care. Bob, maybe you can help us out by just restating your question.

MR. REICHEL: Okay.

Q Mr. Thomas, based upon your review of the information available to you and your training and experience, do you believe that projections or the suggestions that under the

conditions at this site the suggestion that there are likely to be mine inflows orders of magnitude into this mine if it's built, orders of magnitude greater than those predicted in the Fletcher Driscoll model?

A No, I don't. And I'd like to lay a little bit of reasoning why.

Q That was my next question, sir.

A Okay. The bedrock type that this mien is going to be constructed in, the peridotite intrusive, the peridotite intrusives that I've had some experience with around the U.P. are fairly tight and not very good water producers at all. They basically don't produce water. The so-called country rock that's around there, the metavolcanics of the Michigamme formation, I have had some experience in water well drilling in other locations in Marquette County into Michigamme formation bedrock. And in those areas where wells are drilled into those metavolcanics, six-inch water well, 400 feet deep, is lucky if it produces a half a gallon to a gallon a minute. And generally we have to have some degree of hydraulic fracturing occur before a domestic water well will even produce, you know, twice that or two gallons a minute.

Q Let me just interrupt you. When you talk about having to have some degree of fracturing, what do you mean by that?

A Hydraulic fracturing. The contractor exerts fluid and air

down the well bore under pressure, applies pressures up to 3,000 to 4,000 pounds per square inch, to basically cause existing micro fractures in the bedrock to open up and flush out and increase the permeability to the well bore.

Q Okay. I'm sorry for the interruption. Can you complete your response to the previous question?

A Okay. So going back, then, I don't believe that there's going to be -- first of all, there's not going to be any matrix flow at all. Any flow into the mines is going to be through fracture systems. There has been some talk about the faults that are -- that were identified -- or potentially identified through surface geomagnetics or other geophysic methods back in the 1970's. And the data that was provided to us by the applicant; you know, the borehole data -- the rock borehole data they provided, you know, didn't lead us to believe that there was any presence of any large conductive features that would seriously increase the water inflow to the mine by great orders of magnitude. And my understanding and experience with these particular bedrock types that are at the Eagle Project site is, they generally are fairly tight and somewhat dry.

Q I believe it was also during -- Dr. Prucha also testified at one point in his testimony in this case that -- he made a reference to mine inflow conditions at the Mather Mine?

A Yes.

Q First of all, are you familiar with where the Mather Mine is?
A Yes, I am.
Q And do you have some understanding of the geologic setting of the Mather Mine?
A Yes. It's a completely different geological setting than what's at the Eagle Project site.
Q Well, my question really is, do you believe that the geologic setting at the Mather Mine provides a relevant analogy to geologic conditions at this mine site as it relates to the subject of potential inflow of water into this mine?
A No, I don't think it's a relevant comparison. The geological conditions at the Mather Mine are completely different.
Q Could you explain why you say that?
A The geologic conditions at the Mather Mine are in a metasedimentary iron formation that was deposited in a risk zone that went -- underwent extreme periods of compression, folding, faulting, whole block movement. There's a lot more structural features due to stress in the rock formations in the iron -- Marquette iron district. And as you leave the Marquette iron district and head to the north of to the west outside of what's called the Marquette Synclinorium, you get into more -- you get into rock -- bedrock that has not

undergone quite as much extreme periods of folding and faulting. Yes, it has undergone folding and faulting; I'm not saying it hasn't. But the amount of stress that was put into the formations that are around the peridotite intrusives and the Michigamme metavolcanics is nowhere near as extreme as what was in the Marquette Synconoriam.

Q So bottom line, in your view do you think the geologic and hydraulic conditions at the Mather Mine and the site of this proposed mine was comparable?

A No, I don't.

MR. REICHEL: Your Honor, I'd like to suggest we take a short break. And I should be able to wrap this up shortly, but it would be helpful to do that if I could take a break.

JUDGE PATTERSON: Okay.

(Off the record)

Q Mr. Thomas, I want to follow up on a few points we touched on earlier. Earlier this morning I asked you whether you considered yourself an expert on modeling. Do you recall that?

A Yes.

Q And just to further clarify that, you do not -- is it fair to say that you do not yourself regularly develop, construct numerical groundwater models?

A That's correct, yes.

Q However, during the course of your professional experience, have you had -- have you developed some understanding of how numeric groundwater models work?
A Yes, I have.
Q And how have you developed that understanding?
A I've taken a couple of short courses on numeric and analytical modeling. And over the course of my professional career I've reviewed a number of models, and I understand how models are constructed. I understand what the nature of the output is. I understanding how models are calibrated. I understand, you know, what needs to be done to test sensitivity of models. In fact, in terms of the wildlife protection delineation modeling work, I have numerous times responded back to consultants that I didn't think they did enough sensitivity analysis, and I requested they do sensitivity analysis in certain areas where they failed to do it. I think I thoroughly understand how models work, what they should be doing, what their analyses are, how to assess if the model has been properly calibrated or not or if it's had enough sensitivity analysis done on the model. You know, my lack of experience is in actually doing the modeling itself.
Q And again, I think you've touched on this, but as you understand the modeling process, is part of the development or use of any numeric groundwater modeling -- require some

preliminary conceptual understanding of the geologic and hydro geologic that's the subject of the modeling exercise?

A Personally, I think that's the most important part of any modeling exercise, is the foundation that's laid through conceptualization.

Q And again, during the course -- based upon your training and experience, do you in fact -- or have you in fact, during much of your professional career, been involved in projects where it's been important for you to develop conceptual understanding of geologic and hydro geologic conditions at a particular site?

A Absolutely. Just about everything that I've been involved with pertains to the hydro geology -- that would be the accurate statement -- that has to be done.

Q Let me go back.

MR. REICHEL: Would you please bring back up Respondent's Proposed Exhibit Number 62?

Q While we're waiting for this to come back, this was the memorandum that you wrote in May of 2006 that identified some specific comments that you made during your initial review of the permit application. Do you recall that?

A Yes.

Q And I had asked you earlier about some handwritten notations in the left-hand margin. Do you recall that?

A Yes.

Q Let me ask you a series of questions. Now, these were preliminary comments; correct?
A Yeah, Column A; yeah.
Q During the course of your work on this project -- again, I think this is clear -- did you -- I think you've already testified you obtained some additional information about some of these issues? Is that correct?
A That's correct.
Q Including information submitted by the permit applicant or its consultants?
A Yes.
Q And since you authored this document, have you, with respect to some of these comments, had further opportunity to review the permit application itself?
A Yes.
Q And finally, again you've testified that since you authored this document, a permit -- a mining permit has in fact been issued with certain specific conditions, some of which you contributed to; correct?
A That's correct.
Q Based upon those considerations that I've just asked you about, from your standpoint as of today, have each of the comments or questions that you raised in this initial review that appears in Column A of your memo from May of 2006 -- have those been or not been resolved from your standpoint?

A All of the comments have been resolved in one way or the other. They either were resolved in response from the applicant explaining something that maybe we missed in our review process and they pointed out to us that it was there in the application; they pointed out where it was. And going back and reviewing what they pointed out, I said, "Oh, yeah, that's right." And I wrote "okay." Or it was in some of the response documents that they provided to us. They provided us the additional information we sought, and again I was able to say, "Oh, yeah. OKAY." And in some situations maybe we didn't get what we wanted, but we reflected it then in the permit conditions that we put in there "okay." There are some things that I commented on in this May 11th document that were -- that ended up being outside my area of concern. And also there were a couple things that I talked about here that weren't really even part of the Part 632 permit. And those -- by reflection of my handwritten notes, they remain non-addressed, but they were -- really didn't need to be addressed.

Q Now, you testified about certain permit conditions that you had a role in recommending; correct?

A Correct.

Q During the course of your work on this project, have you also had occasion to look at other conditions in the mining permit as it was ultimately issued?

A To a limited extent, not a lot.
Q Okay.
MR. REICHEL: Would you please bring up the mining permit, Exhibit 117?
Q Sir, do you have with you by any chance a hard copy of the mining permit as it was issued?
A Yes, I do.
Q And we've just put up on the projector Respondent's Exhibit 117, which is a copy of the mining permit as issued. Could you go to -- sorry. I don't remember what the -- Special Condition E-8?
A I'm here on my paper.
Q Okay. I'm just waiting for the electronics to catch up here, so the judge can follow along. Okay. Which for the record appears at pages 6 and 7 of the Special Conditions section. Is this one of the conditions of the mining permit that you have some knowledge of?
A Yes, it is.
Q And do you have an understanding of whether under this permit condition there is a requirement that -- during the course of the development of the mine, that certain supplemental geologic, geotechnical and hydro geologic data are required to be collected?
A Yes, I --
MR. HAYNES: Object; leading.

Q If you know, does this condition of the permit require the collection of some additional information during the course of the development of the mine?

A Yes, it does.

Q And do you understand, among other -- what understanding do you have, if any, of whether or not this condition of the permit would require collection of data -- ongoing collection of data with respect to hydraulic conditions in the sub-surface area?

A My understanding, this permit condition is in here to require the applicant, or /Kennecott, to, as they proceed with mining operations, excavation operations, that they do continuous data collection of the geotechnical and hydrologic environment around the excavation area and within the bedrock structure of the mined-out area, to assess if there is any change in the hydraulic conductivity or characterization of the bedrock from their initial data collection and modeling.

Q And would such supplemental information be useful in -- would or would it not be useful in developing a further understanding of hydraulic conditions that might affect the amount of water that potentially could flow into the mine?

A Absolutely. It would be very useful to have continuing collection of data as the mining process proceeds.

MR. REICHEL: Your Honor, at this time I don't

believe I have any further questions. I do want to address some exhibit issues. First, I would move for admission of Respondent's Proposed Exhibit 62, the May 11, 2006 memo which was just up on the screen a few minutes ago.

MR. HAYNES: No objection.

MR. EGGAN: No objection.

JUDGE PATTERSON: With no objection that will be entered.

(Respondent's Exhibit 62 received)

MR. REICHEL: Next I would move for admission of Respondent's Proposed Exhibit 86, which was also the subject of prior testimony. It's the draft permit conditions prepared by this witness in January of 2007.

MR. HAYNES: No objection.

MR. EGGAN: No objection.

MR. LEWIS: No objection.

JUDGE PATTERSON: Hearing no objection, that will be entered.

(Respondent's Exhibit 86 received)

MR. REICHEL: Next I would move for admission, solely for demonstrative purposes, Respondent's Proposed Exhibit 213, which was the figure of the site on which I asked Mr. Thomas to describe the location or illustrate the location of the additional monitoring wells that were required under the permit conditions that we discussed.

MR. HAYNES: With that limitation, your Honor, I don't have an objection.

MR. EGGAN: And I would continue the objection that I've had all along about demonstrative exhibits, your Honor.

MR. LEWIS: No objection.

JUDGE PATTERSON: It will be entered, subject to Mr. Eggan's continuing objection.

(Respondent's Exhibit 213 received)

MR. REICHEL: And finally I would move for admission of Respondent's Proposed Exhibit 108, which was a memoranda that -- dated October 18, 2007, that this witness prepared in connection with his review of certain public comments submitted during the permit application process.

MR. HAYNES: No objection.

MR. EGGAN: What number was that, Mr. Reichel?

MR. REICHEL: 108.

MR. EGGAN: 108. No objection.

MR. LEWIS: No objection.

JUDGE PATTERSON: No objection; that will be entered.

(Respondent's Exhibit 108 received)

MR. REICHEL: And with that, I would now pass the witness.

MR. HAYNES: Your Honor, since I was absent last

week, I'm not sure of the protocol; if Mr. Lewis perhaps has further direct questions? Or is he going to reserve as Mr. Reichel did with Mr. Lewis' witnesses?

JUDGE PATTERSON: Well, let's ask him.

MR. LEWIS: I will reserve any questions I may have.

MR. HAYNES: Mr. Thomas, my name is Jeff Haynes. I represent the National Wildlife Federation and the Yellow Dog Watershed Preserve. I have a few questions for you this morning.

CROSS-EXAMINATION

BY MR. HAYNES:

Q In your resume, which is --

MR. REICHEL: Exhibit 20, Counsel.

MR. LEWIS: Thank you.

Q -- Exhibit 20, you list some experience with water supply source identification in various portions of the Upper Peninsula; correct?

A Yes.

Q And you list experience with aquifer analyses in various places in the Upper Peninsula; correct?

A That's correct.

Q And also experience in groundwater models for well head protection areas also in the Upper Peninsula; correct?

A That's correct.

Q Now, you don't have any experience, do you, with dealing with groundwater models for proposed underground mines except for this case; correct?
A That's correct.
Q You don't have any experience dealing with hydrology -- let me say this right -- hydrological analyses of proposed groundwater mines except for this case; correct?
A I don't understand the question, "groundwater mine."
Q Underground minds. Did I say "groundwater mines"?
A Yes.
Q I misspoke. I apologize. You don't have any experience, except for this case, with any analysis or review of the hydrology for proposed underground mines; correct?
A That's correct.
Q Well head protection area, that's a term that you used. Well head protection areas deal with water supplies; correct?
A That's correct.
Q For drinking water; correct?
A Yes.
Q We don't have well head protection areas here with this proposed Eagle Project, do we?
A No.
Q Well head protection areas don't deal with impacts to resources like wetlands; correct?

A No.
Q They don't deal with impacts to resources like surface water resources?
A The delineation of the well head protection area can intercept a surface water source. And when that happens, then the surface water is part of the recharge. And, yes, if the drinking water well is pulling water enough, then the surface water can be part of that area.
Q Right. But well head protection questions deal with drinking water wells -- correct? -- not specifically with impacts to other natural resources, but well-head protection areas deal with whether drinking-water wells are going to be safe from some threat?
A That's an accurate statement, yes.
Q Okay. We don't have any of those here. I think we've already established that; correct?
A Yes.
Q You testified early with Mr. Reichel and then later after the break with Mr. Reichel about your familiarity or lack thereof with modeling techniques; correct?
A Yes.
Q Is it accurate to say that in the Upper Peninsula -- that there is no one with any more expertise than you for groundwater modeling questions?
A In the --

Q I'm sorry. Let me limit the question. That was way too broad. Is it accurate to say, Mr. Thomas, that within the DEQ there is no one in the Upper Peninsula with more experience than you have with groundwater modeling?
A I guess I don't know if that's accurate or not. There are other individuals in the office who have done groundwater modeling, so I can't say if they're more experienced or less experienced than I am.
Q Did you consult any of those persons as part of your work?
A No.
Q Is there anyone in the DEQ in the lower peninsula, down here where the trolls live, that has more expertise than you do in groundwater modeling?
A Yes.
Q Who?
A Probably any number of people. I mean, there's a whole section on it. I mean, there's a group that does groundwater modeling work, I believe.
Q Oh, I see. In the Water Bureau?
A No, not in the Water Bureau.
Q Which bureau or division?
A You know, to be honest with you, sir, I don't know the exact reference there.
Q I see. And did you consult with any of those --
A No, I did not.

Q -- folks? For the court reporter's purposes, you have to wait for me to finish my question before you answer.
A I'm sorry.
Q Okay. Thank you. You didn't consult with any of those folks?
A No, I did not.
Q Were you asked to consult with any of those folks?
A No, I was not.
Q Mr. Maki didn't suggest that you talk to people with more expertise than you --
A No.
Q -- about your conclusions?
A No, he did not.
Q So in other words, as far as you know, Mr. Maki, as head of the mining team, perhaps didn't draw upon the most -- the people with the most expertise in groundwater modeling within the DEQ; correct?
A From the way the question went, yes. Of course, that wasn't the object of the team.
Q Well, wasn't the object of the team to provide -- Mr. Sygo I think you said was the one who signed off on the permit; is that right? Or was it Mr. Chester?
A I --
Q Well, whoever signed off on the permit, the object of the team was to provide them with the most experienced --

A Mr. Sygo, yeah.
Q Mr. Sygo? The object was to provide them with the most experienced -- expertise within the Department to review the application. Wouldn't you agree with that -- with that object?
A I don't know. I don't know what the object of the management would be.
Q You think that that would be an appropriate objective, don't you, to provide the decision-maker with the most expertise within the Department to review such a complex mining application?
A I don't know if that's necessarily true or not. Because sometimes it's more important to have people who are more familiar with site-specific conditions than someone who might be technically more highly qualified.
Q Even for such things as highly technical groundwater models?
A If they don't know the site-specific conditions, they don't have the basis or background to assess if the conceptualization was accurate or not.
Q And you're saying that you have the most knowledge of the site-specific conditions of anybody in the DEQ relating to hydrology?
MR. REICHEL: Objection. That's not the witnesses' testimony.
MR. HAYNES: I'm simply asking, your Honor.

MR. REICHEL: Well, the question --

MR. HAYNES: It's a fair cross-examination question.

MR. REICHEL: The question was phrased, "You are saying." He didn't say that.

MR. HAYNES: Well, let me rephrase.

JUDGE PATTERSON: All right.

Q Mr. Thomas, do you have, within the DEQ, the most knowledge of any other employee of the DEQ of the site-specific conditions for this particular site?

A I don't know.

Q So you don't know whether or not the mining team is made up of people with the most accurate knowledge of the site conditions?

A I don't know how anybody could know.

Q And you don't believe that it's important to have people with technical expertise with modeling to comment on the model that was prepared by Kennecott and its consultants?

A I believe that the expertise that I had was adequate for the process.

Q Mr. Thomas, would you agree with me that it was important for the DEQ to conduct an independent review of the application and its various appendices?

A No.

Q It was not important to conduct an independent review? Is

that what you're saying?
A Are you talking about having somebody else outside the agency --
Q No, within the agency; within the agency to conduct an independent review; that is, a review that was independent of whatever the applicant had proposed, using your own expertise, your own knowledge, your own education, your own experience. That's an important thing, isn't it?
A Yes.
Q And by "independent" I don't mean necessarily hiring outside consultants.
A Okay.
Q Although you know that the DEQ did that for certain areas; right?
A Yes.
Q For geochemistry and for the geotechnical; correct?
A Yes.
Q And you know that one of the geotechnical consultants that was used by the DEQ was a fellow by the name of Dr. David Sainsbury?
A I became aware of that.
Q And have you read Dr. Sainsbury's reports that he issued on behalf of the DEQ in this case?
A No, I have not.
Q So you don't have any comment as to the veracity of any of

the conclusions arrived at by Dr. Sainsbury, do you?
A That's outside my area.
Q Just to clarify your expertise, Mr. Thomas, you've admitted that you're not an expert in groundwater modeling; correct?
A In running the computer models.
Q In running the computer models; right?
A Yes.
Q You consider yourself to have some experience in the model conceptualization; right?
A Yes.
Q And the model conceptualization is trying to figure out what it is we're going to be modeling, what the sub-surface regime is, what the water regime is, the size of the model, those sorts of things; right?
A Also, how the -- in addition to what you just said, also the layering, how you're going to basically take the -- what's existing and put it into simplified layers for the computer model.
Q The various strata, the sub-surface strata; correct?
A Yes.
Q By "layering" is that what you mean?
A Yes.
Q We have the unconsolidated layer typically at the top, and then we have bedrock below that in some form? At least for this model that's what we have; correct?

A We have multiple layers of each of those formations.
Q Okay. So you don't have any particular expertise in how to characterize a site for purposes of modeling; correct?
A No, that's incorrect.
Q I'm sorry?
A I believe that's an incorrect statement.
Q You don't have any expertise in calibration of models; right?
A If you ask me if I calibrated models, no. Do I understand how models are calibrated? Yes.
Q But you've never actually performed any calibrations?
A No.
Q Have you reviewed the DEQ model guidance document for this case?
A I have now. I hadn't then. I wasn't even aware it existed then.
Q Oh, really? So when you reviewed the Fletcher, Driscoll model and the Golder Model here, you didn't know the DEQ had issued a model guidance document on -- excuse me -- a guidance document on groundwater modeling?
A I'm still not aware they issued a guidance document on modeling.
Q I misspoke.
A Okay.
Q You're not aware that such a -- that the draft guidance

document exists within the DEQ?
A I was not aware of it at the time, no.
Q Okay. You're aware of it now; right?
A Yes.
Q Have you gone back and looked at your comments relating to the Kennecott models in relation to that guidance document?
A No, I have not.
Q You didn't think it was important?
A No, I did not.
Q Mr. Thomas, we're looking at page 2 of DEQ Exhibit 62. And we're looking -- I want you to look at comment number 1 in column A. The last sentence of that says, "How does the model prove the hypothesis of no impact?" Do you see that?
A Yes, I do.
Q So your understanding of the -- this is the Fletcher, Driscoll model; correct?
A That's correct.
Q And this is the model that deals with the potential drawdown to the wetlands; correct?
A From mine dewatering.
Q From mine dewatering; right?
A Yes.
Q And the hypothesis of no impact -- you ask how does it prove that hypothesis. You have in the -- in the handwritten notation to the left you say "okay." What convinced you, if

anything, that the model proved the hypothesis of no impact? Or did it?

A When we had the modeling meeting with Fletcher, Driscoll at the Kennecott office, he provided the model and he ran it. And he showed us the layering that he did and the drawdown. And when you say "no impact," you know, I say no impact there. And in the Fletcher, Driscoll model they do ultimately say a very small of impact on the wetland.

Q There's an impact, but did they provide a range to you of the drawdown in the number of feet or inches or yards?

A They provided a model output that showed the contours; to lay out the highest point right kind of in the center and spreading outwards.

Q So there would be an impact from the mine dewatering; right?

A There was -- there was a very small impact that was within seasonal -- you know, normal seasonal variations of the wetland.

Q An impact. It was added to the normal seasonal variations; right?

A Only if the prediction of mine inflow was based on -- you know, if the mine dewatering was taking place in the entire opening with no stope backfill, if you take into account the fact that you're going to have stoke backfill, you know, your amount of water coming out of the mine in actuality is going to be lower than what was modeled.

Q And what was the predicted inflow for the mine for that model?
A The base case was 70 gallons per minute, I believe. And the upper bound, if I believe -- remember correctly, it was 215 gallons per minute.
Q And the predicted pumping was what?
A I believe it was 70 gallons per minute for the base case.
Q Right, base case.
A And 215 for the upper flow.
Q The upper bound?
A Yeah, the upper bound. When we had that meeting with Fletcher, Driscoll, one of the things that we asked them about -- you know, to why -- you know, what did they do to -- in the model to predict no impact. And they told us what they did, as far as the inputs to their model. And we believed that they were appropriate and acceptable.
Q That is, you believed that the base case of -- I think you said 70, but isn't it really 75 gallons per minute, the base case?
A I'd have to go back and look. I don't remember that exactly. For some reason the number 70 sticks in my mind.
Q Well, Mr. ? testified it was 75.
A Okay.
Q And the upper-bound case was 215 gallons per minute; right?
A Yes.

Q Now, the base case, you understand, is based upon some assumptions; correct?
A Yes.
Q And the upper bound case is based on some assumptions; correct?
A That's correct.
Q And those assumptions are inputs into a model that a modeler would vary, in order to look at a range of outputs; would you agree with me, with that statement?
A Yes.
Q It's important, isn't it, to look at a range of outputs to determine impacts to the environment? Wouldn't you agree?
A Yes, it is. But it's also important to have those ranges be somewhat within the realm of -- a realistic realm, based on the data collection that was done.
Q Speaking of data collection, how many wells, Mr. Thomas, were used for purposes of collecting data for the groundwater model; do you know?
A Not off the top of my head. I don't know how many total wells there were. There was a lot. There's multiple wells all over the site. You'd have to pull up one of the large maps. We can count them all.
Q For purposes, though, of predicting the inflows into the mine, how many wells were used; do you know?
A Oh, the bedrock wells?

Q Yes.
A I think there was six wells.
Q Six. And those bedrock wells were used from the boreholes that Kennecott had drilled for its geotechnical work; correct? As far as you know?
A The geotechnical end for hydraulic property analysis?
Q Right. Those wells were one and the same for those six wells; correct?
A I guess I don't know if I can -- if what you're characterizing is true or not.
Q Let me back up. You know, don't you, that there were about 109 wells -- excuse me -- holes that were drilled for geotechnical characterization of the site for the permit application? Do you know that?
A No.
Q You don't?
A No.
Q Do you know how many -- well, we've had testimony about that. All right?
A Okay.
Q So just bear with me on that. Okay?
A All right.
Q And of those 109 holes, six were used for the hydrologic modeling? You understand that?
A Yes.

Q They didn't use the other 103 wells, as far as you know, for the hydrologic mining --

MR. LEWIS: Objection to the form of the question. I'm getting confused with wells and holes again, Mr. Haynes.

MR. HAYNES: They're exactly right, your Honor. I'll rephrase.

Q Mr. Thomas, you had 109 holes drilled for the geotechnical work; correct? Bear with me.

A Okay.

Q Go with me on that. Six of those holes were used for the hydrologic modeling. You understand that?

A I understand that six holes were used for hydro geologic modeling.

Q And so as far as you know, the other 103 holes were not used for the hydro geologic modeling; correct?

A As far as I know, yes.

Q Did you ask the modelers why you used -- by the way, six wells. You never had experience with a model of this complexity before, have you?

A I've had some experience with complex models. I don't know if you could characterize this one as being more complex than one that was at another complex site.

Q For this site, however, you felt it sufficient, for purposes of your review, to have six wells for purposes of the groundwater modeling?

A I -- when I looked at the data they provided from their aquifer testing in the bedrock environment, I thought that the data was appropriate; that it was not -- it was reasonable with what one would expect from that type of bedrock environment.

Q Okay. Do you know how many packer tests they ran?

A Not off the top of my head. I know it's in the application, but I don't remember.

Q You felt that the number of packer tests was sufficient?

A Yes.

Q And do you know how many pump tests they ran?

A Again, I'd have to look at the application. I don't remember off the top of my head.

Q You know that Kennecott ran one pump test of longer than a few hours; correct?

MR. LEWIS: Let me object to the form of the question, your Honor. And my concern is that I think that the witness is asking questions about the hydro geologic characterization of the bedrock which bear on the part of the modeling that Golder did, as I understand it, which was as to how much water may flow into the mine. And as the court is aware, that piece of the modeling, the predicted mine inflows, were then taken by the groundwater modelers to assess the potential impact on the groundwater hydrology. And in the sense that we're talking about six wells, I think

the record reflects that that's the wells used by Golder for the bedrock part of this piece. But I do know -- I'm fairly confident that the record indicates there were other wells and other testing, so-called, done for the groundwater aquifer itself. So I think it's become very unclear here in terms of these questions. When Mr. Haynes asked about six wells and refers to groundwater modeling, I believe there's a problem with the form of the question, and the witness is naturally confused about that.

MR. HAYNES: I'll rephrase.

JUDGE PATTERSON: Okay.

Q Mr. Thomas, you know that there were six wells used for the bedrock characterization; correct?

A Correct.

Q And you know that there were some packer tests run on those bedrock wells; correct?

A Yes.

Q You don't know how many, but you felt that the number for sufficient?

A I felt that the data that was gathered was sufficient to make a determination.

Q The data gathered from the number of packer tests that were done?

A And the long-term test.

Q I'll get into the long-term test in a minute.

A Okay.
Q Just the packer tests. You felt that the number of packer tests that were done were sufficient to characterize the bedrock aquifer?
A I don't think you can phrase it that way. I think you have to take all of the data collection together.
Q Well, but the data consists of various parts, doesn't it?
A Yes.
Q And for purposes of characterizing the groundwater aquifer, there were some packer tests done; correct?
A Yes.
Q There were some short-term pump tests --
A Yes.
Q -- which were really slug tests; right?
A Yes.
Q What's a slug test?
A You take a slug of -- take a slug of water, either -- you could do it two ways. You could either withdraw the water in a slug and then measure the time if takes for the aquifer to recover back to equilibrium, or you can take a slug of water and force it into the aquifer; you know, down the borehole; and measure the time it takes for the water that you've put in -- the extra water that you've put into the borehole to permeate out into the aquifer.
Q So you know that there were a number of slug tests taken;

right?
A Yes.
Q And you felt that the number that were taken were sufficient for purposes of the groundwater -- the bedrock aquifer characterization; correct?
A In concert with other data they collected.
Q Okay. That's fine. And along with the packer tests and the slug tests, there was a longer duration pump test; correct?
A Yes.
Q That lasted for seven days, --
A Okay.
Q -- give or take; right?
A Something like that, yes.
Q One test? One of those longer-duration pump tests; right?
A Okay. I don't remember it exactly, but I think you're right.
Q Okay. And you felt that the data collected from the packer tests and the slug tests and the one longer-duration pump test were sufficient to characterize the bedrock aquifer; correct?
A Yes.
Q In your view?
A Yes.
Q You didn't consult with the other modelers in the DEQ about whether your view was correct, did you?

A No, I did not.
Q What standards, by the way, did you use to determine whether or not the tests that were run were sufficiently -- let me rephrase that. What standards did you use to inform your opinion that the number of tests run on the bedrock aquifer were sufficient to characterize the aquifer?
A The only standard -- I don't know if -- I didn't use any specific published standard. I used my years of experience working in these types of bedrock aquifers to assess myself if the data that was collected through these tests provided a reasonable characterization of that type of bedrock.
Q Others might disagree with you on whether or not the characterization was reasonable; isn't that true?
A Reasonable people disagree.
Q And reasonable experts can disagree on that as well; correct?
A Yes.
Q And wouldn't you agree that for purposes of characterizing something under the ground that none of this can see, none of us are there right now. You certainly weren't there, were you?
A No.
Q It's important to have more data than less data for purposes of characterization?
A All hydro geologists love to have more data.

Q Okay. Because more data allows you to more closely define what's underground?
A You can refine your characterizations.
Q To put it in a simple term, if you have one borehole, that's going to tell you less than ten boreholes would tell you, which would tell you less than a hundred boreholes would tell you; right?
A Yes.
Q And the same would be true for things like packer tests, slug tests and long-duration pump tests; correct?
A More data is always better.
Q You would agree with me, wouldn't you, Mr. Thomas, that the bulk -- let me back up. You testified that in your view water in this bedrock regime does not flow very well through the bedrock itself, the peridotite; correct?
A That's correct. There's no matrix flow whatsoever.
Q That is, the bedrock is not sand; it's tighter than that, certainly; right?
A Yes.
Q And so the water that flows through the bedrock area flows through things like fractures and dikes and faults?
A No, I would not characterize it that way. I would characterize it that it flows through fractures and possibly fault zones, not dikes.
Q Not dikes? Do you know what a brachiated zone is?

A Yes.
Q What's a brachiated zone?
A It depends. You have a -- as has been characterized in this testimony, you know, earlier in this trial, a brachia zone is the zone of contact between the intrusive body and the country rock, where -- when the intrusive body came up, it broke up the country rock as being forced into it. And that's that zone around the intrusive and the country rock.
A And the brachiated zone would be a zone where water would flow more readily than through the bedrock; correct?
A No, I wouldn't say that's correct.
Q You wouldn't say that's correct in all the situations?
A No, I would not.
Q It would be important, then, to look at the boreholes through the brachiated zone, to determine if the brachiated zone would be -- would have higher hydraulic conductivity than lower; correct?
A Yes.
Q And by the way, you didn't look at the -- well, did you look at the core samples at the Kennecott core shed in Negaunee?
A No.
Q Did you ask to look at the cores?
A No, I did not.
Q Did you ask to look at the core photos?
A NO, I did not.

Q So you don't know, from your own observation of any data, whether there are additional zones of potentially higher hydraulic conductivity than those presented to you by Kennecott; right?
A Right.
Q You didn't think that was important to find that out, did you?
A No.
Q Let's go to page 4. Mr. Thomas, I'm looking at item 24 on Exhibit 62. This is in column A.
A Uh-huh (affirmative).
Q That item says, "The predicted drawdown cone in the A-zone from the base case and the upper-bound case show some impact. What is the actual impact to the wetlands?" Now, your note to the left says "okay"?
A Right. But my note to the right says, "While this was discussed, we still need to see some model runs."
Q Oh, okay. And so you did see the model runs?
A Yes.
Q And those model runs showed some actual impact to the wetlands?
A Very, very small.
Q But an impact?
A Yes.
Q And that was based on the base-case scenario; correct?

A Both cases, base case --
Q Both cases?
A Yes. Base case and the --
Q Upper-bound case?
A -- upper-bound case.
Q And the upper-bound case has, as I recall, 215 gallons per minute, which is, give or take, about three times the size of the base case?
A Yes.
Q Within a range; okay?
A Right.
Q So was the impact from the upper-bound case three times the size of the impact from the base case to the wetlands?
A To the best of my recollection, no, there wasn't a direct -- straight-line correlation.
Q But there's a greater impact from the upper-bound case; correct?
A Yes.
Q And by "impact" you mean a drawdown of the water level; right? That's what you mean by "impact" here?
A I believe so, yes.
Q You're not talking about whether the wetlands will dry up or whether they'll become -- whether they're going to turn into grasslands or anything like that; right?
A No. I'm not a wetlands expert.

Q You're just talking about drawdown of the water table at the wetlands?
A Yes.
Q Let's go to DEQ Exhibit 86.
JUDGE PATTERSON: Mr. Haynes, I need a break in about a minute. Would this be a good time?
MR. HAYNES: Yeah, this would be a good time, Judge.
JUDGE PATTERSON: Okay. Let's come back at 1:00 o'clock.
(Off the record)
JUDGE PATTERSON: Mr. Haynes?
MR. HAYNES: Thank you, your Honor. Good afternoon, Mr. Thomas.
THE WITNESS: Good afternoon.
Q Let me step back for a moment to some areas that we covered previously, and I want to explore some different issues. When you were handed -- when you were talking to the Kennecott consultants about their model results, they ran the model on a computer in front of you; correct?
A Correct.
Q Okay. And they showed you the outputs. And you said your view was that the outputs were reasonable, you thought?
A My review was that the -- that inputs were reasonable and, you know, expectation was that the outputs then were

acceptable.

Q I see. Did you at any time ask the Kennecott modelers, the folks who were doing this demonstration for you, did you ask for their input files?

A Digitally?

Q Yes.

A No.

Q So you didn't ask for the input files so you could run the model -- run their data through your own models; right?

A No, I did not.

Q You didn't. You didn't think that was important?

A No, I didn't.

Q So you didn't actually double-check to see if their inputs were correct other than what they gave you; right? You didn't double-check that? You didn't do independent evaluation of their work; correct?

A I did not do an independent evaluation of their computer model. I did -- I mean, I evaluated their inputs to the model, 'cause that's what they developed through their conceptualization.

Q Right. But you didn't take that back to your office and do the models yourself to see if it made sense?

A No.

Q And as part of your evaluation, Mr. Thomas, you don't know what the extent of the fracturing -- the fracture regime is

at the Eagle deposit, do you? -- or on the Eagle deposit?

A All I know is the data that was presented.

Q Okay. All right. Mr. Thomas, I've had put up on the screen DEQ Exhibit 86 about which you testified this morning. Looking at the first paragraph of this document, the sentence says, in part,

> "The Department of Environmental Quality believes the following monitoring is required to provide a high degree of protection for the environment around the proposed mining operation."

Do you see that?

A Yes.

Q Do you know whether the phrase "high degree of protection" appears in Part 632 or its rules?

A No.

Q And when you refer to the phrase here "high degree of protection," what do you mean by that?

A I'm expressing a viewpoint that we need to have -- we needed to have these additional conditions over and above what the applicant was proposing to do to better, you know -- to have a better or a higher level of protection or early warning system, whatever, you know -- however you want to look at it that way, you know. This was just some draft language that I put down into a memorandum.

Q Right. So when you say "high degree of protection," you

don't mean if there would be no impact; but there would be more protection to the resources; right?

A Yes.

Q And you don't mean by "high degree of protection" that there would be absolutely no degradation of the environment; right?

A I don't think that even played into my thought process when I wrote that.

Q And when you say "high degree of protection," you don't mean that there would be no pollution of the environment; right?

A Well, again, that doesn't go into play when I say that. I mean, the premise is there would be no pollution if you -- you know, if the applicant followed all the conditions in the permit.

Q You're saying that --

A That's the premise; the premise. We wouldn't intentionally issue a permit that allows an applicant to pollute.

Q And by the phrase "high degree of protection," you don't mean that there would be absolutely no impairment of the environment, do you?

A Again, you're changing the way I said it. I just used those words to say a "high degree of protection" just to -- to increase the ability to monitor what's going on at the site to better protect the environment.

Q So by "high degree of protection," you mean better

monitoring?

A Yes.

Q That's all?

A That was my intent.

Q Okay. And by "monitoring," you mean monitoring to see a couple of things; one, whether there's been a change in the environmental conditions around the site; correct?

A Correct.

Q Two, if there is a pollution event from, say, the TDRSA or from the wastewater treatment plant, that you would be able to detect it sooner than otherwise; right?

A Yes. I wasn't considering those locations. I was considering more of the accidental fuel spills and those types of things.

Q Oh, I see. So your monitoring doesn't concern whether there's going to be a discharge from the TDRSA?

A My additional monitoring was not focused on that level, because there are already in the -- in the permit application and then, of course, in the actual permit itself there are a number of monitoring locations around those types of individual items in the facility.

Q I see. So the three additional monitoring points that you described in your testimony; I think this was dealing with items 2, 3 and 4 of this document; those are for accidental spills?

A In part. They can be used for everything. They could be used as monitoring locations for everything that happens from the surface facility. But my focus and my intent was more on the accidental.

Q And the purpose of those monitoring wells is if there is a polluting event, you would be able to detect it more easily?

A No, I wouldn't phrase it that way. The purpose of those monitoring wells was if there is a polluting event, we now have a complete -- in addition to the other monitoring locations, we have a complete circle around the facility.

Q So the placement of those three additional monitoring wells is not to prevent pollution; it's to detect it if it occurs?

A That's correct.

Q And the -- for instance, the groundwater elevations that you're talking about monitoring in item number 1 here on Exhibit 86, that's to -- those are -- that monitoring is to detect a drawdown if it occurs; right?

A Yes.

Q It's not to prevent a drawdown; it's to detect it if it occurs?

A Yes.

Q So none of the conditions that you proposed here actually go to the question of preventing pollution or preventing impairment; only to detecting it?

A They also go to preventing the spread of the pollution or

impairment beyond those monitoring locations and --

Q Once it's occurred?

A Once it's occurred. Also, the groundwater monitoring, the water elevations, if you do it daily, like we're requiring here, we will see a very small impact happen and be able to react to it much quicker than allowing a larger impact if you had a longer period of time between monitoring events.

Q It's to reduce the scope of any impacts that occur?

A Yes.

Q If we could, go to page 2 of this exhibit, please. Mr. Thomas, on page 2 of Exhibit 86, item 8-D says -- you're proposing in the situation of where the mine dewatering would exceed 300,000 gallons per day for more than 2 days in a 10-day period or for more than 5 days in any 30-day period that the applicant would have to prepare and submit -- this is item D --

A Yes, I understand.

Q -- "Prepare and submit within 30 days of the commencement of weekly reporting a remedy proposal to ensure that wetlands above and around the entire facility will not be impacted by continued mine dewatering." Do you see that?

A Yes.

Q And by "ensure," you mean -- is that another word for "guarantee"?

A The word for provide mitigation measures so that there will

not be impairment.
Q I see. To provide mitigation so that whatever impacts have occurred don't continue?
A Don't continue. Okay.
Q So that if there is an impact or an impairment of the wetlands, that that will be stopped or reduced?
A Yes.
Q After it's already occurred?
A But again, the impairment -- with the frequent monitoring and the permit conditions, there will be a very -- by the time you reach this point any kind of a reduction in water levels or impairment, to use your word, would be very small, and there would be an opportunity for that to stop, reverse itself.
Q Small but not zero; right?
A Yeah.
Q Right?
A (No further response)
Q Let's go to DEQ Exhibit 108. Mr. Thomas, I've had put on the screen DEQ Exhibit 108, which is your memorandum to Joe Maki dated October 18, 2007, with some responses to the comments submitted by National Wildlife Federation and others; correct?
A Yes.
Q All right. And in order for you to write this memorandum,

you had to review the comments prepared by Dr. Coleman; is that right?

A Yes.

Q And that were submitted by the National Wildlife Federation; correct?

A Were those submitted by the National -- I'm not sure they were, but -- they're from GLIFWC; right?

Q Okay. Sorry. I misphrased it.

A Yeah.

Q The comments submitted by Dr. Coleman for -- in relation to the proposed permit; right?

A Yes.

Q Now, you wrote the memorandum presumably because there was something in Dr. Coleman's comments that you considered important to comment on; right?

A I was asked to review the comments and provide any response, so I did.

Q Oh, I see. Mr. Maki asked you to review the comments?

A Yes.

Q All right. And that was -- you considered your preparing your analysis of the comments part of your job as part of the mining team; right?

A Yes.

Q And the comments that were submitted as far as you were concerned were submitted -- well, the comments by Dr.

Coleman are critical of some aspects of the proposed permit, weren't they?

A I believe so.

Q And as far as you know, Mr. Maki felt it important that you respond to some of those comments; right?

A He asked me to review the comments and provide him any response.

Q Okay. Did you provide responses to all comments submitted by members of the public relating to this permit?

A No.

Q You provided comments to Mr. Maki only for the things that he thought -- or that he asked you to provide comments for?

A I believe so. And I think the distinction is, is Mr. Maki asked me to review the comments that were of a more technical nature.

Q I see. And so that was -- this is sort of an obvious point. But that was part of your function as part of the mining review team, to do this task asked by Mr. Maki as part of the process of reviewing the application that Kennecott submitted for purposes of whether or not a permit should be issued? That was part of your job?

A Yes.

MR. REICHEL: Let's go to the second page of this exhibit. If we could, scroll down, please, to the bottom of this page.

Q Mr. Thomas, at the bottom of the second page of this exhibit, which is the first page of your response to Dr. Coleman's comments, the last paragraph here talks about the applicant's post-mine plan to grout any connecting fractures. Do you see that?

A Yes, sir.

Q Have you seen a plan prepared by Kennecott to grout connecting fractures?

A I believe in their -- in this part of the mine closure and contingency plans that there was some -- what am I going to call it? -- expressions of grouting.

Q And was there an actual detailed plan about how the grouting would occur?

A No.

Q Just a mention of grouting might be used?

A Yes.

Q Okay. And that increased your confidence level in the post-mine plan, that mention of grouting?

A Yes, the fact that the grouting would be done if there were any large-scale hydraulic conductive features encountered.

Q All right. So whatever appeared in the mining plan related to grouting increased your confidence level, whatever was said about grouting; right?

A Yes.

Q Let's go to the next page of this exhibit. Mr. Thomas, item

4 of your memorandum, in the first sentence you express your disagreement with the concept that more tests are needed. Do you see that?

A Yes.

Q Your disagreement is based upon what? Your experience?

A I believe, yes, my experience, and I believe that the data that was -- I didn't think more packer testing in the same boreholes are going to provide any additional data that would be useful.

Q And your disagreement is not based upon any sort of standards published anywhere?

A No.

Q Not based on the model guide -- on the model guidance for -- excuse me -- the guidance for modeling?

A No.

Q Now, let's go further down in this paragraph, where it says -- and I'm about seven lines down, the sentence that starts,

> "Then the applicant remodeled the inflow of water into the mine workings and the expected impact to other aquifer horizons based upon a worst-case scenario whereby the bedrock hydraulic conductivity was much higher than their in-situ tests indicated."

Do you see that?

A Yes.

Q "Worse case scenario." Where is the worst-case scenario found in the Kennecott materials?
A I believe that is referring -- my phraseology there is referring to the upper bound.
Q Oh, I see.
A Okay.
Q By "worse case," you mean the upper bound?
A Yes.
Q But the upper bound isn't really a worst-case scenario, is it?
A No. You've got to pick a line someplace where you're going to have your so-called worst-case scenario in any modeling.
Q But their upper bound, which is 215 gallons per minute, is not, in fact, a worst-case scenario?
A No, I guess not.
Q Let's go to the last page of this exhibit. Mr. Thomas, on the last page of Exhibit 108, the first sentence of this page says -- well, it refers to an alternate -- an alternative groundwater system model prepared by Geomatrix. Do you see that?
A Yes.
Q You testified about the Geomatrix model that you thought had some deficiencies; correct?
A I don't know if the model had deficiencies, because I didn't have enough information provided to me to adequately judge

if the model is inefficient or -- deficient or not.
Q Oh, I see. You didn't ask for the inputs that Geomatrix used, Geomatrix --
A Yeah, we asked for it. We never -- as far as I know, I never got it. I never got the additional information I sought.
Q Oh. And who did you ask for it? Joe Maki?
A Yes.
Q And you don't know whether he got the inputs?
A In talking to him, he never -- you know, as far as I know he didn't get the inputs that we were seeking.
Q Oh, I see. You would be surprised, then, if in fact those inputs were provided?
A I was -- we were provided at a late date something electronically that we could not open and, you know, as far as I know that information then imparted back; I don't know how or in what manner. But we did receive something that was supposedly going to be additional information, but it came in kind of a software package that we were not able to access.
Q I see. You didn't follow up to ask --
A I asked Joe. I told Joe.
Q And nothing -- and you never heard back from him about whether or not --
A No. And again, that was at a very late date.

Q "Late date" meaning what?
A Pretty close to the beginnings of these hearings.
Q Oh, I see. In the year 2008?
A Yes.
Q Well, in this sentence you say that, "The Geomatrix model proves that groundwater modeling is more of an art than an exact science." That's a phrase that we're heard before from other modelers. Is that a fairly standard phrase among people that deal with groundwater models?
A I guess I can't answer that question, because I don't know if it is or not.
Q How long did you spend looking at the Geomatrix model?
A Not a real long time; probably a couple hours.
Q Couple hours. And that was -- you were doing that at the request of Joe Maki; right?
A Yes.
Q Okay. Because as far as you knew, he considered it important that you look at this modeling done by Geomatrix?
A It was -- the comment received that it was pertaining to my particular are of the mining review, permit review team.
Q And again, it was one of the more technical issues, so that's why you were brought into it; right?
A Yes.
Q In the last paragraph of this page, the second sentence talks about both models being the Geomatrix model and the

Driscoll model. Do you see that?
A Yes.
Q And the second sentence says, "Both models indicate the potential for an impact to the surface aquifers with the Geomatrix model showing a much larger impact." And by "impact" you mean a drawdown; right?
A Yes, sir.
Q So it appears that both models, both the Fletcher Driscoll model and the Geomatrix model predicted some sort of an impact; right?
A Yes.
Q That is, a drawdown of the wetlands?
A That's correct.
Q And you didn't pursue the results of the models to see if those drawdowns could have been larger, smaller, in between, different sizes, did you?
A Did I make modeling runs?
Q Right.
A No.
Q On direct examination you testified that you took into consideration Part 632 and its rules in your work; right?
A Yes.
Q And you testified that you are aware that Part 632 requires that there be no pollution, impairment or destruction of air, water or other natural resources as a result of this

mining operation; right?
A Yes.
Q Based upon the fact that modeling is more an art than a science, you can't -- you're not able as we sit here today to predict whether or not there will be no pollution, impairment or destruction of the air, water and other natural resources as a result of this mining operation, are you?
A I don't see how anybody can make a prediction of that nature.
Q It can't be predicted in your view?
A All you can do is provide adequate safeguards in the permit conditions to minimize that potential.
Q I see. That is -- in your view, it would be impossible to prove with 100 percent certainty that there will be no pollution arising from this mining operation; right?
A All you can do is model it. You can't prove it ahead of time, no.
Q Okay. And likewise if you use -- I have the same question for the term "impairment." You would have the same answer, wouldn't you?
A Yes, sir.
Q And if we used the term "destruction" in that question, you'd have the same answer; right?
A Yes, except for "destruction" is a much more violent, I want

to say, phraseology. And I think you have to take into account a more realistic outlook on that. And everything that's been presented even, say, modeling is more art than science, you can say that, and still if the modeling doesn't show a huge destruction, I think you have to kind of accept that that it's going to --

Q I see. But you couldn't accept that with 100 percent certainty, could you?

A I don't see how any reasonable person could.

MR. HAYNES: Thank you. I have nothing further at this time.

MR. EGGAN: I have a few questions for you, sir. Mr. Thomas, my name is Eric Eggan, and I am -- I represent some of the Petitioners in this matter primarily related to groundwater-related issues. And I do have some questions for you that I think are probably follow-up on what Mr. Haynes was asking.

CROSS-EXAMINATION

BY MR. EGGAN:

Q Do you recall this morning there were some questions from Mr. Reichel regarding the participation by the public in the process?

A Yes.

Q I think you talked about two phases. There was a part of the process where the public were able to actually ask

questions of DEQ, and then there was another part where the public was allowed to present written comments or present verbal comments?

A Okay. We were talking about the public information meeting that's required by the statute.

Q And that was the initial prior to the application being decided to be complete. And there was another process that occurred in September and October, I take it, that was a process that -- where public comment was taken?

A There were two public comment periods. The first one was not prior to completeness of the application. I think the statute requires that we determine it to be administratively complete within 14 days of submittal and have a public information meeting within 56 days, I believe it was, after that.

Q Okay. You're probably right.

A So there was that public information meeting which was that kind of two-part that we described earlier in our testimony. And then later on the statute requires another public comment meeting, which is what you're referring to that was in the fall.

Q And there were these public comment meetings that occurred in the fall, and there were written comments that were submitted?

A Yes.

Q And I take it that you found that process helpful?
A I believe it's always helpful to receive public input.
Q Okay. And useful even in the analysis that you did. Some of the comments that were presented by the public were helpful in your analysis, I take it?
A Yes.
Q Okay. Have you reviewed any recent materials, materials that have recently been created since April, modeling done by GeoTrans?
A Yes. I've reviewed the report from GeoTrans.
Q Okay. And did you have any discussions with Kennecott about that modeling?
A No, I did not.
Q Did you submit any sort of a written analysis with respect to that modeling effort?
A No, I did not.
Q Okay. The public at large did not have an opportunity to review that GeoTrans information, I take it?
A No. Because it was received after a decision to issue a permit.
Q Okay. Now, I think I heard you say in answer to some of the questions that Mr. Haynes asked that you really don't know the number or the amount or the kinds of fractures that exist at the Kennecott site. You said you relied on data provided by Kennecott on that?

A I also, I think, expressed the -- that I have experience with similar types of bedrock in the Upper Peninsula.
Q Yeah. I'm looking at my notes. And I think what you said was you have the data that was provided to you from Kennecott on those issues from the --
A For -- on one particular question. But it wasn't the only thing relied upon to assess potential for -- you know, relied upon in terms of when we're reviewing the permit application was what Kennecott submitted reasonable and enough.
Q Okay. But my question really is, would the same answer be true with respect to the faulting that exists at that site?
A I'm not 100 percent convinced that there is a lot of faulting at that site.
Q I understand that.
A Okay.
Q But my question is, are you relying on data that was provided by Kennecott?
A I guess I would have to say I'm relying on data presented by Kennecott and information available in professional publications around the site.
Q Okay. And professional publications around the site would be an important part of your analysis?
A If I was -- whenever I look at a geology of an area, I don't just rely on my personal experience and I don't just rely on

what an applicant is telling me. I also look to see what, you know, has been professionally published.

Q Understood. Now, with respect to the inflows at this site, there's been testimony all over the place on inflows. But you testified this morning about the Mather Mine. But I just want to confirm for you. You're aware, aren't you, sir, that the Mather Mine experienced an inflow in that mine of 4,000 gallons per minute?

A Yes, I am.

Q Okay. And there's another mine in the area called the Maas Mine. Are you familiar with that mine?

A Yes, I am.

Q And you're aware, aren't you, sir, that that mine experienced groundwater inflows of approximately 3,000 gallons per minute?

A Yes.

Q And the Athens Mine -- you're aware, aren't you, that the Athens Mine experienced groundwater inflows of some 600 gallons per minute?

A I'm not familiar with the Athens Mine. I know where it's located, but I'm not familiar with the specifics. I understand that's testimony that's been given in this trial, though.

Q Would you disagree with that testimony?

A I wouldn't disagree with it. I wouldn't disagree that it's

possible.
Q Are you familiar with a mine called the Morris Mine?
A Yes.
Q And are you aware, sir, that they experienced inflows of 2,000 gallons per minute?
A Again based only on the testimony of this trial.
Q Are you familiar with a mine called the Rogers Mine?
A No, I'm not.
Q Okay. If I were to represent to you that there is a mine called the Rogers Mine and that that mine experienced an inflow of 4,000 gallons per minute, would that surprise you?
A I'd have to ask you where that mine is located.
Q Okay. So you're not sure about the Rogers Mine?
A No. I've never heard of that one.
Q The Fletcher Driscoll model that you talked about earlier, are you aware that a witness, a Kennecott witness, Mr. Greg Council -- did you review his testimony?
A I was sitting in the room when he gave testimony.
Q Okay. Did you hear that part of his testimony where he opined that the Fletcher Driscoll model did not comply in every respect with ASTM standards?
A Yes, I heard that.
Q And you're -- would you agree with that testimony?
A I have no basis to agree or disagree.
Q Okay. Did your analysis of the various models in this

scenario include an analysis of ASTM standards?
A No, it did not.
Q So you didn't apply the ASTM standards to the analysis that you conducted?
A No.
Q The Part 632 permit authorizes -- and this is as the mine is closing down that, after it closes down completely and mining operations cease, the Part 632 permit authorizes the use of utility water and backfilling into the mine and re-flooding the mine essentially?
A I believe so.
Q Okay. Did any part of your analysis consider those issues?
A It wasn't -- the mine reclamation effort wasn't really part of my purview for, you know, review. But there was the consideration asked of me of the issue of saline water rising upwards. So I did take a little bit of a look at that.
Q Okay. Whose purview was it to consider issues pertaining to re-flooding the mine?
A To be honest with you, I don't know.
Q Do you know whether anybody considered the contaminants in the utility water or the backfill or the water that is going to be used to re-flood the mine?
A I'm not sure what you mean by "utility water."
Q Well, let's just talk about the backfill. Did anybody

consider the contaminants that would arise from the use of backfill in the mine?

A The backfill -- again I guess I'm going to ask you if you could characterize what you mean by "backfill"?

Q There is a plan to put what they call cementatious material into the mine itself. Essentially what they're talking about is a mixture of rock that is stored at the TDRSA --

A Okay.

Q -- and mix that and put it down into the mine itself.

A Okay.

Q Are you aware of that?

A Yes.

Q Did you consider the contaminants that will arise from -- the contaminants that will arise from the use of that material in the re-flooded mine?

A I guess I don't see the issue there, because it's material that came out of the mine in the first place.

Q That wasn't my question. Did you consider that there would be contaminants from that activity?

A No. I don't believe there would be any contaminants that weren't -- by definition, because it's material that came from there.

Q From your perspective, then, the re-flooding of the mine, no environmental consequence whatsoever?

A Yes. That's my opinion.

Q Okay. Did you consider -- did MDEQ consider whether those substances are, in fact, inert?
A I don't know what other members of the review team may have done regarding that, because that's a geochemical issue. And that was outside my area.
Q I see. Are you aware that the rock that is stored in the temporary development rock storage area is reactive?
A Yes, it can be reactive.
Q Okay. So you are aware that mixing the rock stored there with water or with air can create a reaction, a reaction that can generate acid rock drainage or the potential for metals?
A If you take it in total context, yes. You have to take into account the time frame it takes for those types of reactions to occur to create the acid mine drainage.
Q I guess what I'm asking is whether it was any part of your responsibility to consider the impact of that in the mine after mining operation ceased?
A No, it was not.
Q Okay. Did you conduct an analysis of all the various models that occurred in this case that had been done to date?
A No. There was one model that I did not review.
Q And what model --
A That was a model that was done for the discharge to groundwater permit.

Q Okay. But you did do the models that -- you did review the models prepared by the companies who modeled the mine dewatering?
A Yes.
Q So you're familiar with the fact that Golder did modeling?
A Yes.
Q Okay. They did one in 2005; am I right?
A As part of the permit application?
Q Yes.
A Yes.
Q Okay. 2006?
A As far as I know, it's the same model with just a little bit more data put into it.
Q An amendment essentially; right?
A Yes; yes.
Q Okay. And then there was a supplemental -- a second supplemental that was done in 2008. Did you review that one?
A That was done for the hearings?
Q Yes.
A No.
Q Okay. And you said you also looked at the Fletcher Driscoll modeling?
A Yes.
Q And the Fletcher Driscoll modeling, that was part of the

permit approval process, too, wasn't it?
A Yes, it was.
Q And you indicated -- and I guess I need a little more information. The GeoTrans model that was done in April of 2008?
A Yes.
Q Did you say you did or didn't review that?
A I have read the model report. I did not provide -- I didn't provide any kind of review comments or -- you know, I didn't do a technical -- you know, an extremely technical review of it. I've read the report.
Q Did anybody from MDEQ ask you whether or not you consider that report to be valid, invalid?
A No.
Q So it is not any part of your analysis in terms of the approval of the permit or not?
A That's true.
Q Okay. One observation or one question I have for you regarding Exhibit 108. And you may have gotten to this with Mr. Haynes, but I do want to cover it.
MR. EGGAN: Can we have 108 on the board? Good.
Q Now, that interoffice communication is dated October 18th of 2007?
A Yes.
Q Okay. And this is a memo that you prepared. Now, it says

in the first paragraph there -- it says, "Attached are my suggested responses to three comment documents you asked me to review. These three documents were" -- and then you have the three documents listed. And I'm interested in the dates. One says October 12th. Those are comments from John Coleman. October 16, 2007, comments from John Coleman. And then the alternative GW model -- that's groundwater model -- from National Wildlife Federation dated October 9. But these were all documents that were received in one package; am I right?

A I don't know that. I don't know that to be true or not.

Q Okay. Do you know when you actually received these documents to look at them?

A I probably received them on October 17th.

Q Okay. That would have been my question for you. If I were to represent to you that these comments were among a large package of comments delivered to the Department of Environmental Quality late in the day on October 17th of 2007, would you disagree with that?

A I have no basis to agree or disagree.

Q Okay. In any event, these materials were then somehow communicated to you?

A Yes.

Q So they must have been either sent over night to you or sent to you via e-mail in some way?

A They may have been sent via e-mail. To be honest, I don't know how I received them. But I had printed out copies of them.

Q Okay.

MR. EGGAN: Can you go to that last page, please?

Q But what we do know, Mr. Thomas, is that, with respect to the alternative MODFLOW modeling that was done for the National Wildlife Federation, that assuming they were presented to the DEQ on October 17th, by October 18 in time for you to prepare a memorandum, you had already looked at it and decided that it was an invalid model in some way?

A Well, I don't think I said it was an invalid model. I mean, you can see right there I can't fault their modeling. I just said I didn't have enough information to adequately assess it.

Q Okay. And you indicated that, at some point, you asked for additional information with respect to this modeling?

A I expressed to Mr. Maki that, after he had gotten these, you know, and we were talking, I expressed to him that -- you know, he asked me why, and I told him that I didn't have enough of the information about how the model was conceptualized.

Q Okay. If this had been a model that had been presented by Kennecott as part of a permit application, wouldn't you have contacted Kennecott and asked them for questions and asked

them for additional information?
A Absolutely, because they would have been an applicant looking for a permit.
Q Okay. But in this instance given the significance of this particular permit -- you've indicated that this was a matter of some magnitude -- wouldn't it have made sense for you to simply make contact with someone and have asked for that additional information before the permit was issued?
A I don't believe it's standard practice for the department to go back to public commenters and ask them for clarification or more information about their public comments.
Q Any reason -- any prohibition against you doing that as far as you know?
A No prohibition about the department doing that. In terms of our mining team, we were asked to have all communications funnel through Mr. Maki.
Q Any reason why Mr. Maki or anybody else in MDEQ would have been prohibited from making a contact like that?
A I have no idea.
Q Okay. We know, don't we, that the Geomatrix model was predicting 900 gallons per minute of inflow?
A I don't remember those numbers. I don't remember the numbers off the top of my head what it predicted.
Q Well, if I told you it was 900, would you disagree?
A I have no basis to agree or disagree. I would assume you're

telling me the truth.

Q Okay. Well, you looked at the mine?

A Yes.

Q And you apparently looked at it on the morning of October the 18th; fair enough?

A That's probably fair.

Q Okay. And by the afternoon of October 18th, you were ready to simply say, "Well, it doesn't really matter whose model is better. The permit conditions are going to handle this"?

A Yes; yes.

Q Is it a fact that you just didn't really have time to look at the materials?

A No. I could have -- I didn't have a deadline of October 18th to respond to Mr. Maki. It's just, you know, by the end of the day on the 18th -- and I know I did this at the end of the day -- that I was ready. I had finished reviewing the information he asked me to review. And there was no reason for me to have it sit on my desk and wait, you know, until some future time before I prepared a memo.

Q Yes. But you could have made an effort to contact the people that put that model together, the Geomatrix model, and asked for additional information if you had been interested?

A I think that's part of the purpose of this memorandum to Joe was telling him that -- you know, in that paragraph that I

don't have adequate information to do a comprehensive assessment of this model. And I put it -- you know, then the ball is in his court, so to speak.

Q Okay. As far as you know, prior to the permit being issued, did Mr. Maki follow up and make that request for additional information?

A It's my understanding that that was -- the additional information was requested.

Q Okay. You're not sure when?

A I'm not sure when.

Q Okay.

MR. EGGAN: Mr. Thomas, I don't think I have any additional questions. Thank you very much for your patience.

THE WITNESS: You're welcome.

MR. LEWIS: I have one thing I'd like to clarify about one of the exhibits you looked at, Mr. Thomas.

CROSS-EXAMINATION

BY MR. LEWIS:

Q And that was the Respondent's Exhibit 213.

MR. LEWIS: Barb, are you able to show that again?

Q You may recall, Mr. Thomas, that was the exhibit wherein you reference, I think it was, three additional wells that you had recommended as a condition in the permit?

A Yes, sir.

Q Three additional. And they were all monitoring wells, were they not?
A Yes.
Q Were they to monitor both groundwater elevation as well as water quality?
A I believe that two of them for sure were dual purpose. But the third one was more focused on water quality. The one that was south of the facility was focused on water quality issues.
Q Is your recollection clear or not clear on that point at this time?
A My -- let's see. The permit -- if I reviewed the permit conditions, that'll tell me.
Q Certainly.
A But I know the intent -- my original intent was for water quality monitoring of the one directly south and both quality and water level data of the other two.
Q Okay.
A It may have come into the permit conditions themselves differently. They may have required everything. That's what I want to check right now.
Q Are you referring to the permit itself?
A Yes, I am.
(Witness reviews document)
A Yes. The permit came -- the one that was directly south in

the permit conditions requires both water level and water quality.

Q Okay. And the other two are?

A Similar; both water quality and water level.

Q Okay. The other thing I wanted to do on this exhibit -- and do you have -- I'd like to identify the numbers of these monitoring wells. They have an identification on them. And do you have that information or would you have to look at this exhibit itself?

A I'd have to look at the map. Because the permit -- because those wells have not yet been constructed unless they've been constructed since the permit was issued.

Q All right. Would you approach the map then with the court's permission and please identify the numbers? And if we need to blow up a certain area for you to be able to read that, let us know. But otherwise --

A I can't read that right now. It's pretty fuzzy.

Q And before we start, you identified these locations relative to certain landmarks earlier. And I believe this -- the one you're starting to look at now would be the location which is pretty nearly -- pretty nearly north of the proposed mining area; is that right?

A Yes.

Q And by "mining area," I mean the orebody and the facilities to be built in the vicinity of the orebody as opposed to the

more substantial surface facility.
A Yes, sir. That's correct.
Q Okay. And can you read the numbers for that well, please?
A That's QAL068, and it's a cluster well situation. There would be screens in the A, B and D horizons.
Q And is that why there's three reference numbers on that?
A Yes.
Q They're all the same number, but three different numbers and in capital A, capital B and capital D?
A Yes.
Q And then could we go the next one moving east, please?
MR. LEWIS: And blow that one up so Mr. Thomas can read the identification numbers.
Q Now, this one -- I don't recall how you characterized it. But on the Respondent's Exhibit 213, this would be the -- one of the three well locations you described which lies between the westernmost and the easternmost of those three?
A Yes, sir.
Q And it would be -- how did you describe the location of this well?
A I described it as being approximately halfway between the surface facilities and the orebody off the southwest corner of the surface facilities.
Q And could you identify the numbers for this well -- or these wells, please?

A There's and existing well QAL025A at that location, and the permit conditions requires the applicant to deeper that well at that location and construct a cluster well so that the B and D horizons are also screened and monitored.

Q Okay. So there's already a well there, but you're requiring the -- Kennecott to deepen that well and add two different -- two additional screening elevations; is that correct?

A Yes, sir.

Q And then if we could move to and blow up the third location, which would be the easternmost location I believe you identified as -- it would be not too far west of the mostly north/south access road coming into the main surface facility?

A Yes, sir.

Q Okay. And could you read the identification number for that well, please?

A QAL069A.

MR. LEWIS: Thank you, sir. That's all I have, your Honor.

MR. REICHEL: Mr. Thomas, just to briefly follow up on a line of questioning raised by Mr. Eggan in his cross-examination.

REDIRECT EXAMINATION

BY MR. REICHEL:

Q He asked you a series of questions about purported mine water inflows to some other mines in the Upper Peninsula. Do you recall being asked about that?
A Yes.
Q The first one he mentioned was the Mather Mine. Just to be clear -- and I think he indicated to you that someone had stated that that mine experienced a mine inflow at a rate of 4,000 gallons per minute. Do you recall being asked that?
A Yes, I do.
Q Again based upon your knowledge -- and I think you talked about this in direct. But I just want the record to be clear. Based upon your knowledge of the geologic conditions in the vicinity of the Mather Mine site and your understanding of the geology here, what is your view as to whether or not the -- assuming it was 4,000 gallons per minute inflow at Mather, what relevance, if any, that has to the issue of mine inflows at this site?
A I don't believe it's appropriate to compare the Mather Mine or the other mines that Mr. Eggan brought up to the mine -- proposed mine at the Eagle location because of the large differences in the geology of the two locations. I believe the mines in the Marquette Iron Mining District, the geology there is -- as I expressed earlier in testimony, is much more faulted, larger bedding plain features, more conductive of water in general than the type of rock that you will find

at the Eagle location.

Q Just look at my notes. One of the other ones he asked you about was, I believe, Maas Mine; is that correct?

A Yes.

Q Do you have some understanding of what -- or some familiarity with that mine?

A I know about where it was located. And again it's in that same general geology as the Mather Mine is.

Q So would your testimony with respect to the relevance or lack of relevance to the Mather Mine, in your view, also apply to the Maas Mine?

A Yes, sir.

Q It wasn't clear to me whether you were familiar with the geologic conditions at the other three minutes he mentioned.

A I'm familiar with two of the mines. The third mine he mentioned, the Rogers Mine, I don't even know where it is.

Q With respect to the other two I indicate in my notes the Athens and, I believe, the Morris Mines, --

A Yes.

Q -- do you have some understanding of what the geologic setting of those mines are?

A It's very similar to the geological setting of the Mather and Maas mines.

MR. REICHEL: Nothing further, sir. Thank you.

MR. HAYNES: Nothing further, your Honor.

MR. EGGAN: Nothing further, your Honor.

MR. LEWIS: Nothing further, your Honor.

JUDGE PATTERSON: Okay. That's the only witness?

MR. REICHEL: That's correct. I think, as I explained yesterday, your Honor, because of moving some witnesses to accommodate schedule of counsel, our next witness is available tomorrow morning. Mr. --

JUDGE PATTERSON: And would be?

MR. REICHEL: Mr. Koss.

JUDGE PATTERSON: Okay.

MR. REICHEL: And then followed by Mr. -- Dr. Eary.

JUDGE PATTERSON: So I'll have a full day tomorrow?

MR. REICHEL: Yes.

JUDGE PATTERSON: Okay.

(Hearing adjourned at 2:04 p.m.)

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