MANITOBA CLEAN ENVIRONMENT COMMISSION

HEARING

VIVIAN SILICA SAND EXTRACTION PROJECT

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Transcript of Proceedings
Held at Mennonite Heritage Village
Steinbach, Manitoba
WEDNESDAY, MARCH 8, 2023

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CLEAN ENVIRONMENT COMMISSION
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PARTICIPANT OLS/MBEN
Louis-Charles Boutin (Matrix)

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ADDITIONAL SPEAKERS
Peter Crocker (Secretary)
Dennis LeNeveu
Jason Mann (MSSAC)
Sander Duncanson

Reporter: Stephanie Mayerhofer and Shania Chen

WEDNESDAY MARCH 8, 2023
UPON COMMENCING AT 09:30 A.M.

THE CHAIRMAN: -- the -- those indigenous groups, so happy Indigenous Day everyone. And Mr. Secretary, can you please swear in our next person?

MR. CROCKER: Secretary. Can you state and spell your name for the record, please?

MR. BOUTIN: Louis-Charles Boutin, B-O-U-T-I-N.

MR. CROCKER: Secretary. Do you, Louis, solemnly affirm that the evidence to be given by you shall be the truth, the whole truth, and nothing but the truth?

MR. BOUTIN: Yes, I do.

MR. CROCKER: Thank you.

THE CHAIRMAN: Chair. As someone that has spent many an hour in a lecture theatre, I'm aware that it can be tough slogging to sit through a two hour presentation and I think you have a 90 minute to two hour presentation. So, we may take a very short sort of two-minute stand around the -- the one hour mark. If I was to start preaching pedagogy here, I will tell you the attention span lasts 22 minutes, so it's a bit of a stretch to go an hour. But let's -- let's give it a whirl. Over to you.

MR. WILLIAMS: Williams speaking. Mr. Boutin, I'll draw your attention to the screen to your left, and you'll see a PowerPoint titled CEC Hearing Vivian Sands Project, MBEN/OLS Hydrogeological Evidence Presentation. Can you confirm?

MR. BOUTIN: Boutin speaking. Yes, I -- yes, I do.

MR. WILLIAMS: And for the record, Mr. Chair, that's a Hearing Exhibit #24. And Mr. Boutin -- it's Williams speaking, but not for long. I'm just going to invite you to go through your PowerPoint. From time to time, we may interrupt, although I'll try to keep them to a minimum. And for the Chair's benefit, we have identified what may be an appropriate place for a break around -- just before the start of the review of the Southeast Groundwater Management Plan, which may be around an hour or it might be a little bit past. Okay. Mr. Boutin, I'm -- I'm shutting off my mic, Williams speaking, and just inviting you to go ahead, please.

MR. BOUTIN: Boutin speaking. So, let's get started. This is the overview of my presentation today. I'll start with an introduction, go through me -- my evidence summary, and go through some conclusions. Before I do so, I want to introduce the company that I'm working with, which is Matrix Solutions. We do have 19 different offices across Canada. The main office is located in Calgary, followed by Edmonton. There's another -- offices in Ontario close to Guelph and Mississauga office, and myself working from Quebec City by myself. Matrix Solution (sic) is a consultant company doing some environmental work and some engineering work. I've been working for Matrix Solution for the last 14 years. I started my career in Quebec City where I was mainly drilling some water wells for municipal supply doing some well protection areas. And in 2006 I decided to move to Calgary where I've been involved with the industrial project and municipal project over there. I've been quite involved into some environmental -- commutative, environmental impact assessment over there for the development of ozone projects. I did work on some open --

open pit mines where depressurization and dewatering schemes were applied, where numerical modelling was involved. So when I decided to -- for family reasons -- move back to Quebec in 2009, I started working more towards numerical modelling where I did for the last 14 years, mainly doing some modelling for contaminant transport or water supply for municipalities such as City of Guelph, Ontario, or other municipal supply. So, my variety experience goes from the field level to installing some wells, to understanding the sustainability of taking the groundwater from the subsurface. I'm currently a principal groundwater engineer at Matrix Solution (sic). I got 20 years experience. I'm the Technical Lead in Numerical Modelling and I do also sign off on the municipal water well design and testing. I've conducted this work with Mr. Don Haley, which is a Senior Groundwater Scientist with 20 years plus experience, so that he can review the work that I was doing and that we can contribute together to provide the best product possible. And Maurice Shevalier that has 30 plus years experience in Geochemistry. So, I ask Maurice for his advice on specific topics such as the modelling work that was conducted with (inaudible), and as I'm going to show a bit later on. So this is me, this is Matrix. Just want to again highlight the fact that I do have some experience with the Environmental Impact Assessment Committee, impact assessment specifically with regards to the groundwater component. And that I'm as the Technical Lead, responsible for about 15 numerical models -- metrics. Now I'm going to get into the main section, that's going to take between an hour to two hours. We'll see how fast I can go and see how people are interested. So, I'm going to try to make it interesting for all of us. The way that I've -- want to go about it is putting in road maps so that we're clear where we are in the presentation as I'm going through the presentation. So, here's the main points that I'm going to go through. I'm going to start with an overview of concerns related to groundwater, getting to the well completion, give Matrix' opinion on direct effect of the project, talk a little bit about the historical regional and hydrogeological studies that were developed in the area. I think it provides quite a bit of value with respect to understanding where the project fits in with regards with water sustainability. We're going to go about the long-term indirect effects that the project may cause. We're going to talk about the Southeast Groundwater Management Plan that I haven't heard much through the hearing yet, but I'll try to do my best to summarize what's in there -- talk about the cumulative effects before going into the concern that I have with the current numerical model, and I'm going to conclude. So, this is the road map and I'm going to walk you through all those steps and -- in the next little while. Is the tone good? Can people hear me well? Excellent, thank you very much. So, to start with -- I started my process in looking into some documents related with CC and one of the things that I found out is that the -- the project was evaluated by the Impact Assist Management Agency of Canada back in 2020. If I'm correct, it's been proposed twice to be reviewed. Vaguely, thought it was particularly interesting to summarize what they came up with, the list of concern from the project, and as it's shown in my evidence, I've basically highlighted some areas that we were more particularly interested into with regards to the groundwater component on the left. And what I did is I'm just presenting the Section 7.1.2 from the EAP that shows the proponents -- components of the groundwater assessment that they were carrying on to evaluate what would be the impact of the project on the quantity front and on a groundwater quality front. And my take away from this is that what's been presented in the EAP is pretty consistent and -- and fine with respect to what could be the potential impact of the project. So, I don't have any worries at that, I think it covers pretty much a big things as -- as identified by the Agency of Canada. So now I'm going to go and turn over to the Well Completion and Abandonment. So, through the process I did ask -- or through the process of information request, I did ask some specific question about the well completion and the well abandonment process. And the reason why I did that is that as we can see on the far-left side of the slide, I want to bring your attention through three specific areas. The first one is the biggest circle in a red dashed line that I'm highlighting with my cursor presently. It says there there's a Ground Seal For Sandstone/Limestone isolation. So, for me that was kind of a red flag just looking at the schematic. To me, like, I've only seen that once being done where when you create a borehole, it's pretty difficult to go bigger than the borehole underground. It's -- there is some tools -- that's extremely specified tools. So, to me it's kind of a red flag that it's physically really difficult to accomplish that. So, I basically question whether the well design was properly specified. Through my review of the documentation in the EAP, I think it came clear, especially with the responses from The Proponent, that the -- their intention was to drill it really closely to -- as shown on the far right-hand side, which would be the Standard Oil and Gas operation -- which is basically drilling a borehole that's big enough so that your casing can fit in, which is -- seems obvious, but it needs to, and have enough space so that you can run in the hole with the smaller tubes so that you can cement that casing and create some isolation. So, what we -- what we see in the schematic there -- that's where I want to bring your attention to, those two circles -- the red circle that'll be the higher up. But you see it's a casing that is in contact with the rock. So, that suggests that there's no -- cement that would be isolating this -- this casing across the borehole. Whereas -- as -- if I bring your attention back to the bigger circle at the bottom where we see that there is a Grout Seal plot, there would be isolation there. So, my first thought was at looking at this well schematic is that there's definitely something wrong, and as I explained through the process of information request, The Proponents specified that they would be drilling a borehole big enough so that they can put in a outer casing and cement it in place. That they can go back into that outer casing with a borehole that allows enough sufficient space so that they can place the inner casing and run in the hole with the trim line, and then cement that so that we have proper isolation. Som why I'm spending all this time? It's more about the communication exercise that when you look at schematic that doesn't make sense versus what reality can be done and the way that it should be done, it raises some concern. So, my suggestion or the way that I was expecting the information that was part of the information process to be conveyed to the public, was adding a proper well design that shows the borehole diameter, shows the casing -- yeah, and then build trust and that you have a design in place to put a well properly that's going to respect all the standard. And this is an engineering design so that we rebuild trust that what we're going to do -- or I'm seeing what, but the -- the person if that -- the project goes ahead does it, they do it the right way. So, why am I speaking up on this point? The reason why I'm picking up on this point is because we need to understand the context of this project. We're talking about several number of wells to be planned. So, for the period of 20 -- the first year to the fifth year, as reported in initial documents in Table 2-A, there was 1680 wells planned. What we learn in January 2023 from the revised plan, there was a reduction of 400 wells, so that leads us to about 1280 wells planned. So we want to to make sure that if you're going to go and do a project like this, that you have a well planned project and therefore you need clear communication on how you're going to do the well. But more importantly what we -- what we -- we need to -- to understand is that every time that you punch a hole in the ground, you're causing some disturbance to the -- into the soil. And what I'm showing here on that slide, on the far right-hand side is -- in reality there's several ways that fluids, either gas or water, can migrate in the subsurface. And I want to start from the bottom right corner. Every time that you do have an interface in between two materials, you expose yourself to preferential pathways. So the first one with -- where it says Letter F, shows that if your cement is not exactly in contact with the ground -- with the formation, you're basically creating a pathway, a place for water or gas to migrate along that interface. Going to move now to Letter E, where it shows that if the -- the cement breaks which can occur based on different conditions, if the ground moves like subsidence or any seismic activity or deterioration by -- by chemical activities, there can be some fracturing of the cement that happens, and that brings in the second pathway for the fluids to be migrating. Going to move now to Letter D, where it shows that if the casing that you're using is not resistant enough, or that there is some for whatever reason breaks, it exposed the connection between the cement and inside the borehole. So, there is another preferential pathway. On Letter C, what we are seeing here is that the cement is not totally impermeable. There are some permeability associated with cement, there's some small holes in that cement like -- like a sponge, which has quite a significant low permeability. But although of this, there's still some fluid and gas exchange between -- in that goes through the cement. So, that can happen through the cement well plug during the abandonment within the inside of the casing. But this can happen on the outside of the casing where the -- the cement that -- that isolate the -- the wellbore with the formation exist. Moving on to Letter -- number (sic) B, again it's the exact same thing that can happen. Either, like, A and B is the same where between the casing -- material and the cement either inside or outside the casing, there's a potential pathway there. So, why I'm stressing that out is that -- because there's numerous well that are planned, you need to design the well extremely well and you need to minimize any potential adverse effect or creating some preferential pathways to be more specific. We need to realize that the lifespan of the project with 24 years, we're talking about many thousands of wells. I don't have the exact number, but it's not under it. We're talking about thousands of wells. And for each one of those wells, you do have that risk and you do have those pathways that do exist even though you take all the mitigative measure in place. That's shown with history that in some occasion, it works really well, and others not so much. So because it's the main protection against preferential pathways, we really need to pay attention to how that's going to be done. And the other thing that I want to bring your attention to is my last bullet points, is that once you're done with the extraction process, you're going to be abandoning those wells. And those wells are going to be lasting -- or those abandoned boreholes going to be lasting for several hundreds years. I want to be clear here, theoretically it should be perpetual. So, we're talking long-term effect here, and perpetual is a different -- difficult concept to grasp for all of us. I have a pretty hard time to picture myself in 50 years and 100 years, that's even harder. Two hundred? I don't even think about it. We can dream of what reality is going to be like in 200 year. 300? I don't think that anybody really thought about this process. So -- but the reality here is that those wells are going to remain there for perpetuality. Now I want to move to Matrix' opinion on direct effect of the project, which is the next section. Byron, am I doing right with time? Good, thanks. So as The Proponent showed, there's two main categories of impact for groundwater. One is being the quantity and the other one quality. So when I first reviewed the work that was conducted, based the analysis on reviewing the pumping test, reviewing the numerical model, sorta the results that were done -- and I'm going to come back to the numerical model towards the end of the presentation. So, one of the things that we do when we talk about planning water supply for municipalities in confined aquifers is we try to be really conservative. You want to -- you want to bring in the concept of safety factors. We heard about it throughout the hearing, especially on the (inaudible) technical component that you need a safety factor of two, whatever. So, for a water well design, what we use is -- is a safety of factor of 0.7, so gives you kind of some buffer -- some safety of factor in your assessment, and you're going to take some assumptions that are conservative. So, one of the way of doing this is using the Farvolden evaluation. So, you're taking the assumption that there won't be any recharge in that aquifer. You're taking the assumption or you're making a safety factor of 70 percent, you're looking at how much water can be sustainably pumped from a well without consideration of any cumulative effects. So it is extremely local assessment of basically deliverability and an assessment of whether or not you're able to extract that amount of water. And the reason why we did that is to be able to compare the model results to a different angle, analytical solutions. So what came out of it is that the Seine River -- the Seine River, apologize for that. The Winnipeg Sandstone Aquifer and the Red River Carbonate Aquifer has enough transmissivity -- which is the -- the value that we're using to evaluate -- I'll take the aquifer is and how permeable the aquifer is, and evaluated that through this calculation that is conservative. The amount of water that you can withdraw from a single well was in the order of 1700 cubic metres per day, per aquifer. So, if you add those two numbers together, that's 3400. When you look at the water as a predictive scenario that The Proponents moving forward, when you -- you take into consideration the fact that they're going to be withdrawing water for a period of 200 days -- 200 days out of 365 days, at a rate that is -- don't have the numbers in front of me, but roughly 660 U.S. gallons per minute to believe from one of the scenarios. And we're going to get back to it, I have the right numbers elsewhere. I'll have a chance to correct myself if I was wrong. You can average that on a yearly basis, and assuming the project goes 24 years at an average rate, it gives around 1600 cubes per day. And we'll have the exact number a little bit later on in the presentation. So when you think about this, this is half of what -- it's roughly in the same ballpark numbers than what the Farvolden Method suggests for each aquifer. So directionally, our assessment is aligned with the results

AECOM numerical model that it would be feasible to extract that amount of water from those wells. Now I want to bring your attention to the quality component of the assessment. We talked a lot about the addition of oxygen, what it can do, we -- we heard other witnesses talking about that. I particularly ask Mr. Maurice Shevalier that is pretty familiar with the code frequency, and which is the -- the simulator that was used by The Proponent to evaluate what would be the change in the water quality. And basically what he did is he took the latest version of the software, took the input parameters that The Proponent used, and rerun those simulations to figure out if the results would be consistent with what was reported. And so the results from this analysis was that the interpretation and the results that was proposed are valid and within minor differences because of software version. But nothing showed that there would be any similar -- any discrepancies between the results from those two assessments. So Mr. Shevalier concluded that it is valid interpretation and the risk of mixing the two water types is that there could be some potential precipitation of iron and manganese specifically, but that would be -- yeah, that's -- that's kind of the conclusion that he come up with. So, I want to be really specific here -- we looked at the groundwater component, so we did not made any analysis on the possibility of arsenic or any selenium or any other component that could be released to the groundwater from the soil. We talked about the acid rock drainage in the past, we haven't looked at this, it was definitely outside of the scope. The fact that the shale -- have we seen last week through some -- the presentation of the Geotechnical component, that there is some risk for shale collapse. The -- the results of the shale in contact with the groundwater wasn't evaluated, so I just want to make sure that people understand that our scope of work was related to the groundwater component and the mixing of the -- the water itself. So, there was limitation with regards to the geochemical assessment that we did. So, if I look at the short-term direct effects -- and for ones that are not sure of what direct effects are, it needs to have a cause to effect. So, it's a direct relationship between what you do and the effect it has on the environment. Short-term meaning that is -- is -- is imminent. So, when we -- our conclusion through this process is generally speaking, the technical responses from the information request with regards to the hydrogeological assessment was done appropriately to evaluate these short-term effects. So, we're happy with what we saw and the way that it was conducted, which -- which impacts were considered. Despite this conclusion --

and that's what I'm going to be showing in the next couple of sections -- is that we raise some concern with regards to potential long-term indirect effects from the proposed project. And that's I think what brings the complexity of this project, is all those nuance of what is direct and indirect effects. So, now in order to talk about this a little bit more into details, I thought it would be quite important to spatially locate all of this hydrogeological studies that were done in the area. So, I'm on Slide 17 now. So, I think we heard Betcher 1995, Betcher 2002 or Kennedy 2002 -- heard quite a bit of those references. There's nothing new here, it's all been stated by The Proponent and or the other -- the other expert that showed there. So, I went in and -- and look at -- I wouldn't say that I looked at every single word of every single paper, but I did do a cursory review of the content and the meaning of those studies in context to the historical hydrogeological knowledge of the area. And I want to spend a bit more time on this slide because I think it builds or it at least paint the pictures of what's happening in -- in Manitoba with regards to hydrogeological condition. So, if you're going to bear with me, I'm going to try to orient you all on -- on this slide. So, on the left-hand side there's text box, there's stars. The stars is helping you out to -- to identify on a spatial map -- that is in the centre of the screen right here -- where those information are located spatially. And on top right corner there is an inset map that is providing a bit more spatial context at a larger scale. And on the far right-hand side, there is a legend that explain a bit all of those colours and lines and whatnot. So, now what I'm going to do is I'm going to try to respect the chronological -- the historical order or chronological order. Sorry, for my French accent. And -- and find out what is the information that -- that stands out of all those studies. So, we're going to start in 1964 with the Red River Floodway Construction. It was noted and reported in Wang 2008 that groundwater level decreased in vicinity of the -- of Winnipeg City in the vicinity of the project. And in the Carbonate Aquifer -- the Winnipeg Carbonate Aquifer, they've observed a drop in water levels from 234 metres above sea level to 227 metres. So, it's a drop of eight metres of the water level. And it was noted that -- and I think it was even more discussed yesterday in the -- by Mr. Hollander, the effect of large scale dewatering in Winnipeg where it -- it somehow contributed to the progression of the freshwater and saltwater front. So there's documentation, there's discussion of this in the scientific literature that expressed some concern with that or documents --

those effects on the system -- on the groundwater system. In 2005, there's been the Red River Floodway Expansion Project that, if I'm not wrong, was heard by the CEC. And some of the concern raised with the project -- the -- the Floodway Expansion Project, was related to the fact that if you repeat what went on in 1960s, you may induce some adverse effect to the groundwater in the Carbonate Aquifer. And the other thing is that they were concerned that if in -- in -- in time of the year where the river level is really high, there could be some introduction of contaminant in that aquifer because you're creating a pathway, a connection -- physical connection between the river and the aquifer. So, what we learn through the help of the attorney, I'm looking at the -- the information, is part of the -- the -- the recommendation of the reports was to not excavate that expansion in such a manner that it would affect the groundwater levels in the area, to minimize or mitigate the impact on the groundwater. So I think that's important context to understand at -- at -- in the area that of interest. After that, in 2007, there's been the proposed project of Pembina Valley Water Cooperative. The plan here was to get supplemental groundwater supply system. And I want to bring your attention to the map. The idea was to go up in the Sandiland area and build a groundwater facility or some wells to extract water and pipe that water so that it can be provided to the cooperative. The -- the idea there that was to pump 7000 cubic metres per day from this project. There is some -- this project went through the CEC hearing process, and I do believe looking at the -- the CEC reporting, that this project wasn't successful for a lack of cumulative impact assessment. So there was some -- some concern -- regional concern about water use and whatnot. So, in 2008, Wang created a numerical model. This numerical model was created at the same time as the Southern (sic) Regional Groundwater Management Plan was initiated. Now I want to bring your attention to the map once more. I want to really want to show what the numerical model domain was for one, 2008. And what we see is that orange outline that spans to the border of the United States and Manitoba, and that goes all the way up to -- to the lake, and goes back towards the -- following the Red River all the way back South. So, this is the area that the numerical model was covering, and this is the exact area that the Southern (sic? 00:33:39) Regional Groundwater Management Plan was put together for. Through his study and numerical model, what he identifies that between the time frame of 1991 to 2005, there was an area where -- there was a two metre water level decline in a specific area in the vicinity of the Steinbach area, where we're standing right now. This is outlined with that green dashed line over there. I mentioned the fact that the Southern (sic) Regional Groundwater Management Plan was delivered in 2010 -- and just another piece of information that I found is important to understand the context of hydrogeology is this report in 2019 with regards to the Supplemental Municipal Groundwater Supply for Rural Municipality of Springfield. In which they state that first they have a population growth of 8.73 percent per year, their water demand was expected to be 2500 cubic metres per day. And in this study, Mr. Friesen speculated that the Steinbach drawdown was not caused necessarily by the water usage in Steinback but was caused by the 1970s Manning Canal (sic) -- Channel, and that would create a new equilibrium. This water is being currently used by St. Agathe and Ile des Chenes as water supply. So I think it brushes quite a wide understanding of what's been going on in the last 40 years and with regards to hydrogeological assessment in the area. I just want to bring up your attention to the map where there's two things that I haven't -- three things that I haven't described. One is The Proponent project area which is the red outline for the 24-year period. The other one is the purple outline which is The Proponents AECOM 2021 numerical model outlines. And you -- you do see that -- I don't even know what the colour is, we'll say beiger, that dash line, which is the Winnipeg Sandstone Upper Contact. So, anything on the left-hand side of this is where the aquifer is present, and on the right-hand side where it's absent. We -- I introduced the model domain from Wang 2008, that orange line, and if we go into the inset map we see a light grey box here. And this is the Kennedy and Woodbury numerical model domain from Paula Kennedy PhD thesis in 2002 to give you perspective of the dimension of those tools on numerical model that were built historically. So now that we have that, a circle regional context, I'd like to move to the Long-term Indirect Effects section of my presentation. And if I'm right, we would take a break after this section.

MR. WILLIAMS: Mr. Chair, that's what we'd propose is to go through this section and that should get us to the bottom of the hour approximately.

THE CHAIRMAN: Chair. Sounds like a plan, let's see how it works out.

MR. BOUTIN: Thank you. So, let's dive into it. Before I talk about those things, I would like to make some definition the way that I -- I -- I -- yeah, definition of the term. So, Indirect Effects -- The indirect effects are a secondary environmental effect that occurs as a result of a change that the project may cause in the environment. An indirect effect is at least one step removed from a project activity in terms of cause to effect linkage. The other thing I want to bring to your attention, as defined by The Proponent, long-term effects are effects that are described as being greater than ten years. We talk about the reversibility. Irreversible effects are the ones that are likely to not be reversed after the project closure. In Matrix' opinion, there are two critical irreversible effects that the project has on the hydrogeological system that could lead to some indirect effects in the long-term -- again greater than ten years. In my perspective, long-term is -- it's much greater than ten years. So, those two things are the degradation of the Winnipeg Shale -- I'm being careful here because we viewed degradation to be consistent with the documentation from The Proponent. What I'm showing in this figure on the right-hand side is what the sonar data is showing. And I think we are all aware -- I'm going to make that assumption of this information that was provided last week -- or shown last week and referred back to this, which is BRU 92-8. And what we see in blue is the Operation #3 in September 2021 after 4200 tonnes that was excavated. And we see a red outline a little bit higher up that I'm going to move my mouse to. That shows Operation #4 in December of 2021 after 4200 total tonnes extracted. And then you see the -- the cavity -- the subsurface cavity. I think it's important to note that anything below that green line -- below that Shale Formation is the Sandstone Formation, and between the two green lines is the Shale Formation -- the Shale Formation, the shale itself. Above, if we go back to the geotechnical conceptual model, there is a Fractured Limestone, and then you get into the Competent Limestone that was considered in Geotec assessments. What we see in December of 2021 is that the -- the cavity underground is spanning totally across the shale, meaning that the shale totally collapsed. And the fractured limestone also collapsed where the top of the cavity is basically the competent limestone that occurred -- yeah. So, I want to be clear, degradation of Winnipeg Shale is now considered as a collapse of the shale itself. And the second point that I -- we raise is the concern that you'd be increasing the fracture density and the Red River Carbonate. So, I'm going to take a stab at those two specific indirect effects. And we'll start with the Degradation of the Winnipeg Shale Aquifer itself. So, in order to talk about this, let's talk about what is the magnitude of this. And one of the things that we're looking at here is the January 14, 2022 geotechnical assessment from Stantec. And we're looking at Table 9 that shows the allowable extraction disturbance zone dimension as per the design for -- for the geotechnical design. I've basically highlighted one specific row -- that is one case scenario. And this case scenario is the fact that there would be existing 15 metres of -- of limestone -- Competent Limestone, with a combination of 25 metres of Overburden Thickness. So, if you take into consideration these specific settings, they're referring in this table to the Long-term Allowable Limestone Unsupported Span, which is basically the long-term limestone diametre. And long-term, I think it's defined right here -- that on Bullet Point #5, The long-term diameter of the extraction cavity is expected to be 10 metre larger than the short-term diameter. Short-term diameter that we can see here is 25 metres, so the long-term is 35. And the bottom diameter is 6 metre, so we do have the dimensions. So, I think it's important for everyone to understand what those dimensions are. So I basically tried to illustrate that using a -- a bus -- a city bus that is 12 metre long. So, 35 metres is basically three bus long. And because the aquifer thickness is roughly 21 metres -- 20 metres, that's about -- about short of being two bus high. So, this is the kind of cavity that we're working with here, and that's for a single extraction well. So, when you punch in the formula and look at what is that volume, that's about 6735 cubic metres. Now, if the shale collapse, we -- we can have -- have an understanding of -- of what the dimension of that indirect impact would be. Why is it important now? And I think that's a valid question, and I think that's the crux of the exercise here -- the difficulty of the exercise is to understand why that is important. And in the next few slides I'm going to try to do my best to -- to really describe what I think -- why I think it's important. The first thing is I'm showing here two graph, and through discussion with different people, it's not necessarily obvious to understand the meaning of those charts, so I'm going to try to be as descriptive as possible. And really what it shows is the results from The Proponent Isotope Testing Analysis that they provided in the report. And there's two -- two distinct isotopic -- isotopic composition of the groundwater, and I've highlighted this by those boxes in red. The solid box to the bottom in the Winnipeg Sandstone Aquifer, and the dash red line on the top there in the Red River Carbonate. And if you look at it in a different perspective, you see those same groups of water that shows at different areas on those charts. And I won't get into too much details, but basically the take home message is that the water that is in the Sand River (sic) the -- the sandstone -- the Winnipeg Sandstone Aquifer, is consistent with the piston flow recharge type. Which means that when the water touches the ground, it tends to infiltrate underground and get into the aquifer. What -- when we look at the isotopic composition of the Red River Carbonate Aquifer, what we see is that there's a mix of water. And what happens is that with isotope if you leave water evaporates. What it does it preferentially evaporates the molecule of oxygen that are lighter. So, in this case, O-16. So, it leaves with an extra mass of O-18 and then you know that it undergo evaporation -- that's what we call fractionation. So, if I bring your attention to the bottom left corner of the slide, you see that with the conceptual model that were reported over and over in the -- those historical study where the water that recharged the Carbonate Aquifer can occur through the till, it can occur in the Sandilands. So, there's a mix of water that contributes to the recharge of the aquifer. And if we go back deeper where the shale in between those two aquifer is in isolation, then it shows that piston flow, that signature that is totally distinct between the Carbonate Aquifer and the Sandstone Aquifer. So the conclusion with -- with this, and I think that was the same or similar results -- interpretation in The Proponents report -- that those are two distinct water -- water, based on the isotope composition. Now, what we need to understand is the role of the Winnipeg Shale Aquitard. It does act as a barrier to groundwater flow. Before I get into the environmental risk and whatnot, I'm going to bring your attention to the bottom left corner here. I've tried to be as graphic as possible to explain what the effects of the Winnipeg Shale is, and I heard over and over again the example of the bottle of water, right? So the quality of the Red River Carbonate Aquifer is -- is (inaudible). The Winnipeg Sandstone Aquifer is (inaudible). It's two different containers of water, two bottle of water. The role of the Winnipeg Shale here is to isolate -- to create a barrier between those two bottled water. Going to move to the next slide here. What change if the shale collapse is that you're creating a conduit of pathways -- a pipe, a connection between those two bottles. And that occurs due to the shale collapse. So what does that mean? So, my son is 13 years old, he -- he loves playing soccer and obviously, he drinks a lot of water. I do a -- I do like water. So, I'm putting your place in -- in a situation where my son has his glass of water, I do have my glass of water, and because he's playing soccer, he really likes to drink Gatorade. So what he tends to do is you put Gatorade in his water. But I do not like Gatorade, I want to drink water. The connection of two aquifer like this is that because you're putting a -- a pipe in between two glass of water, whatever is happening in one -- in one glass, going to happen and the other one. So, when I want to take a sip of water and I drink Gatorade, it's -- it's not good, right? It's not what I was expecting. So, you're losing the ability to control the water quality individually in both glass of water. I'm going to push the example a little bit further. I'm going to look about the ability to manage those aquifer. And we're going to look at the quantity and I'm going to take you the exact same example. My son plays soccer, when he runs, he's really thirsty. So, if those two bottles of bottled water are connected, if he start drinking all of the water of one bottle and I want to take a sip, there's no more water in my bottle. How can I manage that? So through this example, you understand that you lose the ability to manage individually those two bottles of water. If they were disconnected by the presence of a shale layer in between them, if he drinks all of his water in all of his bottle of water because he did not manage his water well throughout the game, there's still the second bottle where you can rely on. So, I want to make that clear that there's some long-term issue of managing the aquifer and potential issues of mixing the aquifer together, where you lose that ability -- that barrier of flow between the two aquifers. Now -- yeah, we -- there won't ever be Gatorade in that water, right? Okay. So, let's talk about risk and that's why I'm bringing it -- bring you up this graphing on the top right corner here. So this is the Conceptual Description of Environmental Risk. You need three things to get a risk -- you need a source -- source of contaminant, you need a receptor -- ion this case those are the -- the receptors, the aquifer, because people are drinking water from those aquifer -- and then you need a third thing. That third thing is something that connects the contaminant to who's going to drink the water, and this is called a pathway. So by collapsing the shale, what we're effectively -- effectively doing is creating a pathway. I want to bring back your attention to what I presented earlier with when you punch a hole, you're creating some potential pathways, the same word. It has the same principle where you're enabling the connection between the source of contaminant and a receptor and therefore you got a risk. Without the pathway you do not have risk. So it's -- it's a fundamental -- fundamental component of understanding what is the risk. Now I'm going to talk about that second point that I think is critical, is the increase in fracture density of the Red River Carbonate Aquifer. I'm showing here on this slide the geomechanical example of what's going on. So, you got on the top right corner a slice of rock, which we're going to call -- yeah, a slice of rock. And if you apply a force onto it and you hold the two extremity of it, it's going to tend to bend -- we've seen that before. So, the way that it's going to bend is going to depend on the level of weight that you're pushing on that competent limestone. When you do so -- this is what the graphic shows, is that at the base of it, try to expand, your intention is going to try to break in tension and opening some fracture. At the top of that slab, you're in compression. This is where the material tries to collide in each other, so you're going to close those fracture at the top there. So, this mechanism can create some fracture or some opening towards the base of that -- that -- that -- that competent limestone. And I think I'm just pulling out some image your -- that was presented in the geotechnical assessment where we see the Cavity, we see a zone of Possible Fractured Limestone. And on the right-hand side what I'm showing is the conceptual model from The Proponent where you have Till, Fractured Limestone, Competent Limestone, under is the fractured limestone at the base of the limestone -- the Shale unit, and the

Sandstone. But I'm showing over here that white rectangle is the well -- extraction well. As I described earlier and what I'm -- I'm showing in the red is basically some fractures. So, the idea that I want to bring in is that -- the understanding that even though there is not a full collapse of the entire limestone, there is a potential for opening some fracture that are either existing, or create new fracture which may connect or add some vertical pathways through the existing competent limestone. I want to bring the fact to what I mentioned earlier that even though you're putting in some cement, there is some preferential pathway along the borehole. So, this is another potential vertical hydraulic permeability corridor. I want to bring the -- to your attention as well that the -- near the ground surface you do have some weathering that can cause -- depending on the material, some weathering on the top of the till that could increase the number of fracture in the preferential vertical pathways. And the tilling unit as well is - is going to have -- or it's going to -- if there is any subsidence -- subsidence, it's going to bend as well and it's going to be undergoing the same type of stresses -- not the exact same but a different type of stress, which could lead to some fractures in the till as well. So, you're creating some vertical pathways. Now understanding how much that changes in the system is a different question, but that can be an indirect impact. And again I think we need to understand why is it important? And I -- and again, I'm showing in the top right corner that the image of what is the risk that takes those things, and I think it works again on the presence of a specific pathways. So now what I want to do is I want to talk about the risk -- the risk of it and try to quantify it or give some perspective on it. So, the way that I'm going to do this is first look on the bottom left corner, that's Table 4.1 from The Proponent proposal, which shows the Land Cover in the Project Site and Regional Project Area. I've highlighted two specific row -- rows. The first one is the Developed area, the second one is the Agriculture, and what you will see over here is the percentage within those areas. So in this case if you add 13 plus 31, that's 44 percent. So, it's basically saying that in the project site area between 2021 and 2025, there is 44 percent of the land that is in current use, either by agricultural activities or specific development. Now I'm going to bring your attention on the bottom -- bottom right-hand side of this slide. That shows a matrix -- a risk matrix, actually. There's a first axis, which is the horizontal axis, which we call the Level of Development. That can be either light, moderate or heavy. There's another axis, the vertical axis, that is called the Level of Vulnerability. That can be from low, moderate and high. I haven't defined what vulnerability is yet and I will, and the vulnerability of an aquifer can be qualified using the drastic index. The drastic index is a way to measure if the aquifer is near surface or is pretty deep, is there any confining unit? What are the characteristics of the recharge of the vital zones and the permeability of the aquifer? An aquifer that is extremely vulnerable would be sand and gravel near the surface where anything that goes in is going to be -- the aquifer is going to be directly affected by -- by a release or accidental release of contaminant immediately. Whereas something that is not -- low -- that has a low vulnerability, something that has a really thick cover of till, that would not allow significant recharge to the system. So, if we think about the current situation, I want to make sure that I'm clear here -- I'm talking about the baseline, the current situation without any holes have been punched through that -- in that top layer of 25 to 35 metres of overburden. We're in a situation that probably would be a light development and low vulnerability, which is a low risk of potential -- potential contamination. Now, when you start and when you think about the Winnipeg Sandstone Aquifer by breaking off the barrier to the other overlaying aquifer -

- which is the Carbonate Aquifer -- you're breaking that barrier, so you're -- you're increasing the vulnerability of that aquifer. We talked about the fact that you do have some wells that are creating some holes and preferential pathways due to project activities a bit everywhere. Not everywhere, but on a specific location. This creates a pathway as well that works on the vulnerability access. It just goes from maybe something that is low to something that is moderate, really depends on the level of development. So as you go and you -- you develop a project like this, you go from light development to moderate development and you're going from low vulnerability to something that is higher vulnerability, you're effectively increasing the risk of contaminant. Now let's talk about another specific, really important point is that when the shale collapse, it's irreversible. There's no going back to create a conduit that's there indefinitely. In proponents response, it's considered to not be a concern should this occur. Interconnection between two aquifer is a common occurrence because many drinking water wells have been screened across the Red River Carbonate and the Winnipeg Sandstone Aquifer. So, I do have the code for this or the reference and can get to it eventually if -- if needed, but there's hundreds of wells. So, if you look at the -- there's an erratum between the slide that you have, I just change it on the bottom right here. I -- I change to six inch diameter. I realized this morning that I had made a typo, so instead of an area 0.6 because I used the -- the -- the -- the diameter rather than a radius. The surface area of a usual water well -- domestic water well is of -- of six inch, 0.02 square metre. This is an area, so if I'm going to make -- that's -- that's the area we're talking about. Now if we go back on the top right corner and look at the area of where the shale collapsed, that has a diameter of 25 metres and you look at the area. For a single extraction well, you're creating an area of 491 square metre. If we want to do the math -- if you take one well that is complete and across both aquifer that goes through the shale, you got 0.02 square metre. If you take ten of them, get 0.2 square metre. If you had 100 of them, you got two square metre. If you got 1000 of them, you got 20 square metre. If you got 26,000 wells, you get 491 in the order of square metre. How many wells there is in Manitoba? Roughly 20,000. So if you take all the wells that would go through those aquifer, this would be the -- the effect of a single well and the effect of a collapse of 25 metre radius of a single extraction well. We're talking about hundreds if not thousands of wells that's going to have a shale collapse like this. So, the surface area -- we're not even in the same ballpark here. We need to be aware of this.

MR. WILLIAMS: Mr. Boutin, just before we left -- leave -- leave this slide and just for the record because we are making a correction to the -- to the -- an exhibit being Exhibit H-024 -- on Slide 29 -- it's Williams speaking by the way. On the bottom left-hand corner, the assumption -- we're striking out the -- the five and a quarter -- five and a half, I can't -- can't quite read that, and replacing it with a six and that the -- and as well with the area, we're replacing the 0.06 square metres and replacing it with 0.02 square metres. Is that correct, Mr. Boutin?

MR. BOUTIN: Boutin speaking. That's correct.

MR. WILLIAMS: I'm sorry to -- to interrupt. Thank you, Williams speaking.

MR. BOUTIN: Still okay to go a few slides before we take a break? Yes? 'Kay. The risk of contamination. Human activities can lead to groundwater contamination and we usually qualify the source of contamination in two different categories, the point sources or the diffuse sources. In the point source category, there is landfills, leaking above or underground storage tanks, accidental spill at ground surface and whatnot. In terms of diffused source of contamination, we're talking about something that seems to be a contaminant per se if you look at that small quantity, but can become a source of containment if you're looking at it if it's used heavily. A food example of this is pesticide, fertilizers, road salt, highway de-icing salt. What came out from the original Southeast Regional Groundwater Management Plan in 2010 -- and I've quoting -- quoting them here -- is that, The shallow groundwater may be impacted by leaking -- leaching of contaminants for soil zones, but regional sampling programs have shown that most aquifer use in the area are household or municipal water supply, have not been affected to any significant degree. So basically what it's saying is that the water quality from those aquifer are good and there is no real contamination in current state. So, I want to bring your attention now on the top right corner of this figure which shows the graph that's a three-dimensional graph. It's maybe hard to tell, but they've managed to summarize their main messages here on the top right corner point here. This is the summary from the sites -- the contaminant sites in the U.S. -- in the United States, where they looked at the plume length of 604 sites that were contaminated by petroleum hydrocarbons. And the findings from that is that there's just above 1.9 percent of the sites that had a plume -- which is the length of the contaminant in the groundwater -- that would extend more than 1000 feet -- 300 metres. But for 75 percent of them, the plume were less than 200 feet. 200 feet is 60 metres approximately. So in a case of a petroleum hydrocarbon contamination, the likeliness of adding original impact are really low as shown here, and most likely because 75 percent of the site were constrained to an area of 60 metres around that well. So, what does that mean? Is that even if an accidental spill release occur at surface and find its way somehow to the groundwater system, it wouldn't be a dramatic widespread issue, it would be quite localised in -- in a specific area. I want to bring your attention to the bottom right corner where I put a star there where the project area is located that is north of the border from The States. And this is a macro study that shows aquifer vulnerability going from low to high, and the nitrogen input to the system from low to high. And I want to bring -- just take it holistically, like, the big scale picture and you see that there are some areas of green, but there's also some areas of yellow, an important area of orange and red. Those areas of orange and red, she says that there is some nitrogen input into the system and there's -- there's a risk of nitrite -- nitrate pollution in groundwaters in those specific aquifer. Now, I do not have any site specific information, but I do want to say that in terms of the risk of this diffused source of contamination, there are some specific components that need to look at and that are a consequence of anthropogenic activities or human activities such as agriculture that can be presented, then -- and that we should not neglect the consideration when it comes time to make a decision process like this. So, if I want to summarize what I've been speaking for the last ten, 15 minutes here -- I'm on Slide 31, the risk for contamination. Even though the Red River Carbonate and the Winnipeg Sandstone Aquifer are assumed to have a low DRASTIC index -- so low vulnerability, it is unlikely that contaminants migrate from ground surface to the Red River Carbonate under current confined condition. I put that in bold and underline -- under current condition meanings without any wells that are being drilled. But I want also to acknowledge, because I think the -- the way that I -- I read the responses to our evidence is that I never tried to imply that the project activities would have a direct link or direct affect with regards to contamination. What

I said is indirect effects in long-term timeframe, and long term being much greater than ten years that can occur in the future. So, what I'm saying there is that although there's appear under this specific concurrent condition to be low probability of contaminant, there is a risk existing and the effect -- the indirect effect of the project. It is that, like -- it is unlikely that based on thousands of wells that all of those wells be exactly compliant to the proposed design or method and measure that were put in place. And what I mean by that is that human error are possible and there can be development of preferential pathways unforeseen in the future, and that risk can just cannot be waived, it's still going to be there. Second point that I want to make sure that -- that I communicate is that the project effect may cause some enhanced vertical hydraulic connection between the two aquifer by the shale collapse and or within the competent section of the Carbonate -- Red River Carbonate, that may lead to enhanced hydraulic communication. So -- and as I mentioned in a bit earlier, future anthropogenic activities are unknown and we just don't know how that's going to look like in the future. And there's something that -- that I want to flag here is the -- the Ontario legacy well problem. And why I want to flag that is because I think it's kind of good understanding in a different context. I want to say it's that back in the 1900s, the oil and gas industry just started in Ontario, so it would go and drill some wells and because iron was -- still was pretty precious, they would take the casing out of the well to reuse it on the next well. So by doing so, when they were exploring for -- for gas, they would have to abandon the well. The way the things were done back then is throwing rocks down the hole, logs of wood, and if you're lucky you put in the lead plug and you throw additional rocks -- just backfill the hole and walk away. At one point they came to realize that was a pretty bad practice. So the 1950s, they kind of realize that we need to do a better job out -- out of it and use some cement. That was a good idea so that they can isolate some plugs of cement in those holes to isolate any potential migration. But then came somewhere around the '70s where they came to the realization that the cement that they were using were poor quality and it wasn't resistant to sulfate in the groundwater. So, all of the cement that they had been using is being degradated and creating some processes -- the same effect as if you have an abandoned well. So, what I'm trying to point out here is that it's not because they had bad intention in the 90s, nor in the '50s, it's simply that they didn't know. So, we call this unknown unknown. You don't know that you don't know, so you cannot take a mitigative measure to alleviate the risk associated with unknown unknowns. These are the risks that is going to come and bite you in the long-term. So, like, if we forecast this to contaminate problems, there's the type of contaminants that we -- we qualify as emerging contaminants. And this is all a set of contaminants that never been on the radar, these are the contaminants that are unknown unknown that we've been producing for years, but we don't even know that it's out there in the environment and we're not aware of it. I wanted to -- to bring some -- that there's that uncertainty and there is some risk for contaminant in the future and therefore, because these sources of water are used by thousands of Manitobans for water supply, there can be a precautionary approach being taken this case.

MR. WILLIAMS: Mr. Chair -- it's Williams speaking, and with the permission of the panel, I think that would be a -- an appropriate place to stop on or about Slide 32.

THE CHAIRMAN: Chair. Sounds like a plan, I show 10:42, so how about we regroup at 10:47? This is just a short break.

(OFF RECORD: 10:42 A.M.)

(ON RECORD: 10:52 A.M.)

THE CHAIRMAN: Okay, Chair. I have four Commissioners back in the room, I have someone ready to testify, and I have my wife's permission to say that that was her version of five minutes.

UNIDENTIFIED SPEAKER: Do you want a black mark?

THE CHAIRMAN: So, sir -- Mr. Boutin, please pick up where you left off.

MR. BOUTIN: Okay. Now we're going to dive into the review of the Southeast Groundwater Management Plan that I alluded to earlier in the presentation. Is the sound still okay in the back there? Can you hear me well? 'Kay. So between 1997 and 2005 there's been three aquifer management plan that were developed for the Winkley (sic) Aquifer, the Oak Lake, and Assiniboine Delta. Through -- throughout the -- like, I -- I provided a bit of historical overview of the hydrogeological condition and I circled studies that were developed in the past, and there was some concern at one point about the overdevelopment and salt intrusion that I referred to. So, when -- yeah, so this information was considered and was used to develop between 2007 if I had my memory correct -- if my memory serves me well -- to 2010 through two years and -- and almost three years of -- of consulting between different stakeholder in the province, come up with that Regional Groundwater Management Plan in 2010. Within the Groundwater Management Plan, there's a section that talks about the sustainable yield for groundwater and I want to read this section -- Section 3.8 definition of Sustainable Yield. Sustainable Yield is defined as, The amount of water that can be removed on a long-term basis from an aquifer or aquifer system without compromising the ability of the aquifer or aquifer system to provide water to future generation and not imposing an unacceptable impact on parts of the ecosystem which depend on groundwater discharge, or causing other unacceptable impacts. It's a long definition but I hope it's quite simple for people, I'm going to try to -- to make it clear. So in the -- in this report they define that threshold has been 50 percent of the average annual recharge. In areas where they rely on groundwater to discharge, like specific type of wetlands that are dependent on the groundwater systems, they said that it'd be quite important to reduce the water consumption and make that threshold smaller, representing between 15 and 13 percent of the annual recharge. So, now if I bring your attention to the upper right corner, I want to explain a little bit what that graphic is. So, this graphic is divided into an upper part and a lower part. The upper part is the Physical System itself. So, if there is say 100 -- well, we can take the example of a bank account. I think it -- it's makes it easier to explain. So, if every year you win $100.00, the maximum sustainable yield that you can spend during that year is $100.00. Now, if you add some saving, you can always go and look into your savings and spend a little bit more, but if you do that, you're creating a debt and that's called mining the aquifer -- you're mining the yield, you're going beyond what the recharge rate is. So that's why everything that comes in, you can use it, that's a Maximum Sustainable Yield. Now I'm going to bring your attention to the lower part of that chart where it says Governance. So obviously the natural situation is that you don't withdraw any water at all. So, this is the non-use scenario here I'm highlighting. But you do need water to drink, you do need water for activities, agricultural industries and whatnot. So you need to allow through some process of licensing the water use to use that water to some degree, that when it becomes the Permissive Yield -- and I'm highlighting that. So, really what the groundwater management plan defined in there, is the definition of what should be considered as a sustainable yield or the Permissive Sustainable Yield where you're -- you want to try to allow for groundwater withdrawal to the limit of that 50 percent of average recharge. So, I think that's a key outcome from that Groundwater Management Plan. The other thing that I want to point out -- again, tying back in with the figures that I showed up with earlier in the process of original models that were built historically and I want to quote sections of that Groundwater Management Plan. The first one is, The approach of sustainable yield and water use licensing limits in the study area needs to be more continuous, integrated and comprehensive. Such an approach has been initiated in the design of a three-dimensional digital model of groundwater flow regime. They're referring to Wang, 2008. Further along they're talking about the model Wang 2008, Is expected to be completed for initial use in 2011, at which time it will be used to evaluate recharge areas and volumes, local and regional water tables, potential water levels and water regimes impacts from proposed development, adequacy of the monitoring network and as a team management tool to assist local, regional, and regional -- and regime sustainable yield values. So back in 2010, within the groundwater management frame, they framed up everything that should be done in order to evaluate the potential future project and how it could relate to the sustainability of those aquifers. Now, I want to make a (inaudible) with my personal experience in the project that I've been working on in the past, and I want to bring -- I want to define a couple things first that I'm going to be referring to. One of which is SAOS, which is the Southern Athabasca Sands region. Next one is COSIA, which is the Canadas Oil Sand Innovation Alliance, and the third one is RGS, Regional Groundwater Solutions Project. So about the same time as the Southeast Regional Groundwater Management Plan, that project got initiated by the Government of Alberta and they released in 2008 -- and I'm just going to point that out here -- in 2008 the Southern Athabasca Oil Sand Groundwater Management Framework. I'll bring your attention on the left -- no, I'm going to keep going with that slide. So, in 2008 there's the Groundwater Management Framework that gets released. As a second phase, The Alberta Judicial Survey integrate the data, come up with hydrogeological model that turn into a groundwater flow model. And at the same time -- I'm going to go back to the left -- the oil sand industry start to ramp up. So, before -- before to mine that -- the oil sands they had to do open pit mines. To the north of Fort McMurray, where they would excavate -- we're all pretty familiar with this process. But back in the 2000s, what they realized that they could get the oil using wells. You relate that to the -- define that as the cyclic staining assisted drainage, or the Steam Assisted Gravity Drainage, SAGD Process. Process is -- is simple in a sense where you're taking water, creating some steam, you inject steam in some reservoir and you're able to extract and a mixture of water and oil. In order to do that you need some water, so you start trying to find some sources of water. And this is where my involvement in Environmental Impact Assessment for Groundwater was, is that you'd be looking at finding the water and evaluating the impact of withdrawing the water in this area. And now I'll bring your attention now to that -- that -- that part is that -- you definitely need a way to manage or define your Sustainable Yield on an operational front as you need the number of wells to extract the water you need, but you need also the Consensus Yield, which is what we just introduced before the Sustainable Yield, which creates some legal constraint to what degree you can extract water to a Consensus Yield as we define. Now in 2013 when things were getting developed quite heavily for the oil sand industries, the COSIA put together the RGS Project, which basically consisted into asking for that numerical model that the government of Alberta developed, take the industry information, recalibrate the numerical model, update the numerical model as they see the needs to reflect the information that they had at that given point in time, and give back that numerical model to the government of Alberta so that they can use it. So through this process, the industry was able to try to predict what could be the potential future growth of the industry. So they defined three specific scenarios of Status Quo maintaining same operation through 2040 before it goes down, and Medium Growth scenario where there's a couple more project that is going to come online, and the High Growth scenario where the -- the economy goes really well and we're going to be -- the -- the industry is going to be developing several more projects. So, then you can evaluate how much water is needed to generate that steam. Using numerical model again and running those predictive scenario, then you got an outcome -- a matrix of potential outcome of the system on specific aquifer. And this is what we're trying to -- to showcase here is that depending on which you're looking at and which scenario you're looking at, you can evaluate how much stress there is in the -- in the system and take the right decision if one of the aquifer is over allocated, overused. Then you can react and plan accordingly several years before you get to the point where the aquifer is not sustainable. So, there's lots of parallel to be made. The fact that there is a groundwater management plan that is existing, the fact that the government had at one point built a numerical model -- there's several benefit of using that because you foster collaboration between the industry, the (inaudible) between different stakeholder. You share a common understanding of the water balance in the system, you gain understanding over time and you increase your level of confidence of using that tool because it's going to get revised and refined overtime, and you can evaluate future scenario which was the objective of the right built into the Southern Athabasca Groundwater Management Plan. So now that we have that framework in mind, and -- need to go down into the cumulative effects. Cumulative Effects Assessment are defined by the Canadian Environmental Assessment Act as following, "Any cumulative effects that are likely to result from a designated project in combination with other physical activities that have been or will be carried out." So, there's that component of foreseeable activities. Now if we look at the bottom right corner of that slide, we see the Water Strategy -- Water Management Strategy released in November 2022, and I just took an abstract of the definition of what the culmulative impact is in that Water Management Strategy. Culmulative impacts are changes to the environment -- positive or negative, direct, or indirect, long-term, or short-term -- that are caused by an action in combination with other past, present, and reasonably foreseeable future human actions. Each individual impacts may not be significant if taken in isolation but can be significant when considered as a whole. So -- and Matrix' opinion is that the Cumulative Impact Assessment should consider the effect from the existing and foreseeable future activities. In our opinion, foreseeable does consist of a full project development for 24 years. It does also consider the fact that the population is growing. It should also consider the fact that the agriculture and the industry will grow. And if we look back at the last ten years between 2013 and 2022, we do see that the average annual growth is 1.21 percent in Manitoba. If you calculate with based on the assumption of 500 litres per day as per the Groundwater Management Plan, every single year you're basically adding 8000 cubic metres of water that is needed for consumption. This being said, this doesn't mean that it all comes from groundwater, but there's a portion of it that comes from groundwater. I want to put that in perspective with the impacts of the project and the water usage and so on. Now, the future development plan from Vivian Sand Project did not use the Southeast Regional Groundwater Management Plan numerical model, for which the model domain was adopted by multiple stakeholder and decision maker. To me it's totally unclear to why Wang 2008 model was -- if the model was approved or not by Manitoba Water Stewardship and water -- Groundwater Management. It also unclear to me if the use of this model was even discussed after stage of the EAP process, I can't comment on this.

MR. WILLIAMS: Mr. Boutin, before you go on to Slide 41 -- just building or going on the point of the model domain that was adopted, I wonder if you could take us back to Slide 18 for a moment and illustrate the domain that was selected for Wang 208 (sic) versus the domain selected by AECOM.

MR. BOUTIN: Boutin speaking. So, the model domain from Wang 2008 is the orange outline that spanned been from the border with the United States on the south, goes all the way north here, goes to the lake, come back through Winnipeg, and goes down. The Proponent that I've labeled as AECOM 2021 Numerical Model Domain, spanned from Winnipeg City to the north here, goes east and come back there. So it's a smaller area than the overall Wang

2008 Model Domain.

MR. WILLIAMS: Williams speaking. Thank you and please proceed.

MR. BOUTIN: Boutin speaking. So -- so one of the concerns that I have is the model domain selected by The Proponent exclude the original areas of overdevelopment and salt intrusion concern that I've illustrated previously. So that was kind of a concern for me on a big picture scale, on regional scale. So, that really on a aquifer basis, right? As per the Groundwater Management Plan, you can assess the cumulative effect assessment. Second thing is that as outlined in a -- within responses to -- to our evidence, thanks to The Proponent to pointing out that domestic wells within the regional project area were considered in the -- in their assessment, but the domestic well outside of the regional project area were not. The other thing that I considered is the fact that the foreseeable population and industry and agricultural growth was not considered by The Proponent. So, this is where it ties everything up together with regards to the quantity or the sustainability. I know there's a lot of figures on the slide and I'm going to try to walk you through it --

through it and try to be as consistent -- or not consistent but precise as possible. So, the first table I'm going to look at is the one on the right-hand side, that list series of Groundwater Users. You got Licenced water wells -- sorry, forgot to introduce a second column, which is what we can find in AECOM 2021, the Consumptive Groundwater Use. So we've got, Licenced water wells that are approximately 5,241,820 cubic metres per year, which equates to 14,361 cubic metre per day. We've got, Domestic wells within the Regional Project area. And now I'm going to -- referring to only cubic metres per day, just for simplicity, roughly 1200 cubic metres per day. The Domestic wells that are outside Regional Project Area that were not considered. The Proposed Project Conservative Scenario of zero injection, that is roughly 1,625 cubic metres per day as a annual average. This is the number I was referring at the beginning of my statement that I would come back to it, this is the -- the number I came up with. So -- so when you look at the total within the Model Domain of water usage is the total of 7,000 under that zero injection conservation of 17,189 cubic metres per day. Now I want to point out one of the things that I've noticed in terms of inconsistency throughout my review is that within the Southeast Regional Groundwater Management Plan in 2010, the water consumption person was evaluated to 500 liters per day per person. In the Municiple Supply study that was done by Friesen in 2019, they're using 300 liters per day per person. And in AECOM 2021 which refer a discussion with Friesen which I'm unclear to what that reference exactly is. He referred to 200 liters per day per person. I want to point out that it's not a direct comparison and why I'm saying that is because I'm going to be comparing different studies, different numerical models that are being used in the region and try to bring some -- some insight to what those models were saying. And now we're going to look at this table over here. The first row shows the Model Domain of the tools that were developed on those four specific studies, AECOM 2021, The Proponents proposal, Friesen 2019, the Wang 2008 model domain within the Groundwater Management Framework -- that plan, and Kennedy and Woodbury 2005. I don't want to be confusing one Kennedy 2002 is -- is Paula Kennedy PhD thesis report, and Kennedy and Woodbury 2005 is the paper that got published. So we're talking about the -- the same Model Domain, the same work, the same numerical model here. So that's the big area that I've highlighted in the inset earlier which span for 60,000 square kilometre, Wang 2008 17,000 kilometre and Project Proponent Model Domain 3,176 square kilometre. Now I want to bring you back to yesterday's discussion.

Mr. Hollander's discussed the fact that of -- described what is Aqua Finality, the fact that you can have a really good well matched to the hydraulic heads but have two different recharge. Assigned to the model with different natural properties is going to give you the exact same -- same fit. So, no matter of looking at the mean residual error or normalized residual error, if you compare those two metre the two models are going to tell you that they're equally good. But as he showed up, those two solution equally good with the (inaudible). One has way more recharge, which is the key matrix in evaluating sustainable yield, and the other one much less recharge. That's what I'm trying to depict here with the second row where Recharge Applied to those models. In AECOM 2021 when you look at the mass balance -- the water balance from their report, they state that there is 620,000 cubic metres per day that goes into the model. In Friesen 2019, they referred to a report that is undisclosed. So, we don't have a source to that 32,000, we don't have the model domain so that is the number that's getting reported. I cannot comment on the validity of this number, but this is what's reported. For Wang 2008 I want to bring your attention to Wang 2008 itself. It's a paper submitted in a conference, it's not -- it's -- it has validity, but it's not a -- a report by itself. And within that paper it does not state what was the Recharge Rate Applied, hence why it says not available right here. Go back to 2005 and Kennedy and Woodbury and you look at the Recharge Applied and you see that there is 164,160 cubic metres per day of water that's recharging that model. If you go back to the Model Domain, the area of that model domain is 60,000 square kilometre. When you compare that to AECOM, it's several folds greater and -- in the area, but yet that's six times less water going into that model. So there's a significant difference between those two report and the amount of water that goes through the system. So what does that mean? In my opinion, when we look at the last row of that table, Groundwater Use as a percent of a Recharge, if you go back to the definition of what is sustainable yield that basically says in the Groundwater Management Plan that we should be targeting permissive sustainable yield of 50 percent of the recharge. Now you get -- now you start looking at -- okay, what those number means? So in Friesen 2019, basically they're saying that they're using 39 percent of the available recharge in the area. That brings you that blue star really close to that permissive sustainable yield in the area. When you look back at Kennedy 2005 -- Kennedy and Woodbury 2005, they're claiming that there's roughly around 33 percent of the techarge that has been currently used back in 2005 without consideration to the growth and whatnot. So, those are not the current numbers. But nonetheless, if you make the same calculation, Groundwater Use in the Model Domain compared to the Recharge Applied, you get down to 2.8 percent, which is basically that it's -- it's an area that is -- that where the water consumption is really far away from that.

MR. BOUTIN: Not discrepancies, but difference in assigned recharge rate, and that recharge rate is critical in understanding the sustainability of the system. And that the local scale when you're trying to predict what's going to be the effect of the project on local resident, the use of original numerical model might be, it might not be the right tool to do so. So, this concludes my evidence, and I appreciate your patience, and listening to me. Thank you very much.

THE CHAIRMAN: Chair. Thank you very much, Mr. Boutin. Mr. Williams, is there anything you wish to add? Otherwise we will adjourn for a few minutes to allow the proponent to collect their thoughts.

MR. WILLIAMS: Mr. Williams speaking,

and just the witnesses available to examination by other participants or by the panel. Thank you.

THE CHAIRMAN: Okay. So, following the practice direction, the proponent has the first -- first in line for question. So, how long would you like to collect your thoughts?

MR. DUNCANSON: Thank you, Mr. Chair. Sander Duncanson. Would 15 minutes be suitable for the panel?

THE CHAIRMAN: Chair. That will be my 15 minutes, not my wife's.

MR. WILLIAMS: Mr. Chair, it's Williams speaking over here. I'm not sure, but there may be some questions of clarification from one of the other participants. I'll leave that for them to discuss with the panel, but I just want to bring it to everyone's attention.

THE CHAIRMAN: So, ordinarily, Chair speaking, the proponent would ask questions first. The participants may ask questions if they are of an adverse position. I'm not quite sure what necessarily you might want to draw out otherwise in terms of clarification. Do we need to start with the clarification? Chair. Hold for a minute. Bill? Chair. Other than Mr. Mann, are there other participants that are seeking clarification? Mr. Mann, how many points of clarification do you have? And I'll remind you that they need to be points of clarification, not an attempt to extract favourable comments from the witness. Then let's get the clarification out of the way please. Please come up.

SPEAKER 4: Thank you chair, thank you panel. It's Jason Mann with MSSAC. Thank you for the opportunity to ask this one question. I had three. They literally were actually for clarity, but this one question that I'll ask is the most important relative to clarity I think. And so, it refers to your slide deck on page 27 where you're showing or describing the area of enhanced interconnection in red with that fracture zone sort of up in the top corner of the void space. And my question would relate back to schematics we've seen in the geotechnical work prior. In your slide deck you're showing them on pages 21 and 26 in terms of what the crown or roof of the potential void space might look like, and I would then also if I might please refer to the -- the sonar scan, which we've seen a number of times, and I'll forget the actual bore hole name because I can't read it on here, but you're showing it for example on your slide deck of page 29. And my question would be based on the geometry that you might expect would be the crown or roof of these void spaces, which again, schematically on for example page 21 is shown as a -- a triangular shape. The side scan sonar shows it as a -- a very flat and -- and broad roof. So, my question is would you expect perhaps that zone of enhanced permeability to be greater than what you've maybe shown on page 27 depending on what the upper geometry of the void space is in the carbonate? That's really my question. And -- and -- and maybe it's -- it's not an easy one to answer but presume -- or let me ask it in a different way. If -- if the shape of that upper roof or crown area of the void space was more like something shown on page 21 where it's propagated further up into the carbonate section, would you interpret then that your zone of enhanced permeability that you've shown on -- on your slide to be greater?

MR. DUNCANSON: Sander Duncanson. Mr. Chair, this is the type of question that is not -- not appropriate in the sense that Mr. Mann is -- is trying to get the witness to provide an answer that supports the position that MSSAC appears to be taking in this proceeding. I don't believe that the witness is actually qualified to speak very much to this in any event, btu I do object to the type of questions being asked.

THE CHAIRMAN: Chair. Hang tight for a minute, and you can see who's hovering behind me. Chair. So, the witness will not answer that question.

SPEAKER 4: Thank you for the opportunity to ask for a question of clarity, and thank you for your time.

THE CHAIRMAN: Chair. Thank you. Mr. LeNeveu, I missed your hand earlier. I am sorry. Do you also have a question or two of clarification? And -- and I will also caution you, please do not lead the witness looking for a sweetheart answer.

MR. LENEVEU: It's Dennis LeNeveu, and I have some questions for clarification. In your table on the cumulative effects assessment of the full project, I'm -- have a clarification of your question for the zero percent re-injective conservative amount of 593 cubic metres per year, 1,625 metres cube per day, and I was of the -- I thought that Stantec -- or AECOM -- Sio Silica, the only one they've identified for Waterloo they use is 15 percent going of water into their sand piles, and at 1.36 million tonnes per year, and using a density of dry sand to 1.7 tonnes per cubic metre. I get 120 cubic metres -- 120,000 cubic metres a year, which is significantly less than 583,000 cubic metres per year. So, could you please clarify where that bigger number of 593,000 cubic metres per year of permanent draw from the aquifer comes from, and why it's so different than if you just have 15 percent of the water permanent draw going into the sand piles? I assume there are other sources of draw here, but can you clarify that?

MR. BOUTIN: Boutin speaking. This number is found in the response to the -- that information request that we asked, and there is a table from the proponent that shows those number. So, for consistency, I use the number that they provided in their assessment of the scenarios. Now, in terms of clarification, I personally also think that conservative zero percent reinjection, or 15 percent, or 30 percent is a bit difficult to understand in a sense that like theoretically if you're withdrawing, and I put myself into a position of we're talking groundwater here, so if you're taking groundwater and you're not putting it back, you're consuming 100 percent of it, in this case, zero percent is telling you that you're not reinjecting water in the system. So, it -- it really depends on how you perceive what that percentage means, and I found this confusing at the beginning, but I -- I do believe that last week in the proponent presentation where they describe the amount of water and -- and salt that's -- and the sand that's being excavated, it was well put. So, when I refer to conservative, I'm referring to the fact that the proponent is mentioning that you're not reintroducing water. So, the worst case is that they extract sand, it comes with water, and you're not reinjecting. The worst case is, when you think about it, it's not practical in a sense that if you have two big tanks that surface that you produce water, you produce sand, it's going to overflow. You only have a certain limited volumes to handle the sand and the water. I heard if -- and I might be wrong, but I think I heard that last week there was -- there would be two 50 cubic metre tanks. So, when you think about it, water, and the air, and the sand comes in one tank, the overflow of the water would move to the other tank, it would come with an excavator, excavate the sand out of the tank, and the water would flow to the second tank, and at that point in time if it takes two hours to fill those tanks, if you're not reintroducing the water in the aquifer, you're going to have overflow. So, you need to manage your -- your water. So, conservative in terms of running a scenario where the worst case is that you're not reinjecting water in the system. So, you're being conservative to evaluate the sustainability of the project. That's how they describe the zero percent reinjection. It's not a realistic scenario in a sense because obviously if you're producing water at surface, you need to deal with it. It just cannot just let it run underground. So, you're going to be reinjecting it, but in terms of (inaudible) of the impacts, it goes along the lines of doing a communitive impact assessment where you're taking some safety factors in consideration, and that's one of them where you're assuming that you're not returning water, you're going to consume all this water, and therefore you're able to do good assessment of what cold be the impact on the water levels. I hope it helps understanding what zero percent reinjection means, and what conservative means, but those number comes from the table provided by the proponent.

MR. LENEVEU: Thank you for your answer. Did I hear you say that because of time delays and so on, and spilling from one tank to another on the surface, you may not be able to return all that water that you're -- is going into those tanks back to the aquifer, and if so, where -- where's it going? I'm not -- I didn't quite understand your answer. I'm sorry.

MR. BOUTIN: Don't have to be sorry. They're just very good questions. Boutin speaking. When you do engineering work, you need to be planning with the -- an idea in mind, a design in mind. So, usually when you do that, you take assumption. You want to achieve a goal of either like in this -- in this case, extracting sand, and making sure that the limestone's going to resist, it's going to be resistant. So, you're introducing some safety factor. If you take a case where you know that the break -- the rug's going to break at say 100 pounds, you put a safety factor of two, so it's going to take -- it's going to assume with a safety factor that it's going to be resistant to 200 pounds and is going to be deemed okay in an engineering design to resist to that 100 pound. So, you're basing some safety guards in your calculation. It's the exact same -- I'm not sure that I was clear on that, but a safety factor is saying that with an equation, you come up to a result, and if it takes that much weight to break something, you got to apply a factor -- safety factor to make sure that it's going to be resistant to as at the minimum twice as much as you're designing it for. So, if you take this and think about groundwater, you know that you're going to be returning water that you're going to be producing by gravity feed into the system, but as a measure of conservativeness, as a measure of safety factor, you're going to assume for the calculation that you're not returning it. So, again, you're in an engineering design, you're not -- you're trying to build in some safety nets throughout the process, and that's one of them. Assuming that you're not returning the water, you're simulating that you're going to be extracting more water than the -- the -- the reality's going to happen. So, it's a theoretical exercise. It's not something that's going to really happen. You're not trying to reproduce reality. You're trying to design a project, you're trying to build in some safety of factor in evaluation of the sustainability of the aquifer.

MR. LENEVEU: Thank you for that answer. I'm just -- one more further point of clarification. If you're extracting more water than the aquifer can handle, and you're talking about these safety factors, but in any case if you are extracting more water than you can put back, what happens to the extra water you can't put back?

MR. DUNCANSON: Mr. Chair, Sander Duncanson. I think we're -- we're strained beyond what this witness is actually able to speak to, but in any event, this is the type of questioning now that has now strayed into sweetheart questioning, and I do object on that basis.

THE CHAIRMAN: Chair. I understand this is your last question?

MR. LENEVEU: It's Dennis LeNeveu. I -- I just have two short exert questions.

THE CHAIRMAN: Chair. I'm -- I'm happy to pass.

MR. LENEVEU: Oh, okay. My next question regarding clarification of your (inaudible) which you ran yourself, and you said that for instance no other sources of other contamination, like selenium, was used. Is that because it couldn't be done? We know that from the shape flash test that selenium was coming out from both the carbonate and the shale, and up to 13.6 parts per million of selenium was in the shale. So, that selenium contamination is quite possible. So, I'm just wondering when you ran the (inaudible) model, and you just did the iron and the manganese, for instance why, is it because the model couldn't handle for instance selenium, or can you just clarify that? Because you said it -- you didn't do it.

MR. BOUTIN: Boutin speaking. First of all, I want to correct the record. I never said that I did the (inaudible) modelling. As I initially presented in the presentation when I introduced the team, that work was conducted by Mr. Maurice Chevalier (ph), that is our senior geochemist. Therefore, I'm -- I do geologist, and it's beyond my expertise. So, I will decline answering this question.

MR. LENEVEU: Okay. Thank you. That's fair enough. Now, my last question is you did mention that -- about a local model, and you actually showed a -- a picture concerning a local model, but I asked the proponent about it, and he said, 'Well, it's just not possible.' I think that was the answer, or to -- and I heard another answer from Dr. Woodbury, it's conceptionally problematic for a local model to more discern the effects. Can -- but then I hear you mention that a local model would be beneficial. So, I have a bit of a contradiction here I hear from the proponent and Dr. Hollaender, sorry, that a local model from what I think I heard is not possible, and then I hear from your testimony that maybe it is possible. Can you clarify your talk about the use of a local model in -- in that context? In that I hear two people say that it's maybe not feasible or conceptionally different -- difficult.

MR. DUNCANSON: Sander ---

THE CHAIRMAN: Chair. I'm going to rule that question out of order.

MR. WILLIAMS: Williams speaking. And I'm not aware of Sio Silica's plans. I'm just mindful that the -- the witness has been testifying for, you know, quite a long time, and I'm -- I'm hopeful that we can at least give him a water break and a leg stretch break, at the very least, Mr. Chair and members of the panel.

THE CHAIRMAN: Chair. I'm actually wondering about an early lunch, if that might be a useful -- we are four minutes to noon. Straw vote in the room. Who's in favour of an early lunch? Hands up. Not a lot of you. Okay. Let's give the -- let's take a 15 minute water break, and I guess you'll get a 15 minute warm up, and then we'll go for lunch. Back to our seats. Great to see a handshake at the start. Mr. Duncanson, the floor is yours.

MR. DUNCANSON: Thank you, Mr. Chair. It's Sander Duncanson. So, I'll -- I'll start asking some questions, and I'll try to find a natural break somewhere around 12:30, but good afternoon, Mr. Boutin. I'll just start off by observing, I know from my own personal experience that Matrix is a very reputable firm in the area of groundwater modelling, at least in -- in my experience in Alberta. But have -- have you ever prepared an EAP in Manitoba?

MR. BOUTIN: Boutin speaking. No.

MR. DUNCANSON: Duncanson. And Mr. Boutin, are -- are you familiar with the EAP guidelines in Manitoba that set out what should be included or what needs to be included in EAP's in Manitoba?

MR. BOUTIN: Boutin speaking. I did review the bulletin. I also did review in the information request of (inaudible) number one, the response to Arcadis stating that bulletin that I did review. I also did review CC reports on (inaudible) that do states the recommendation of doing some cumulative impact assessment. So, I did look at different information, and based on my professional experience on cumulative effect assessment, that's what led to this discussion.

MR. DUNCANSON: Duncanson. And I can assure you, Mr. Boutin, we -- we will get to some of those other things later on in the questions, but if -- if you're reviewed the EAP guidelines, you will confirm for me that there is no reference or requirement in that document to the need for a cumulative effects assessment in EAP's, correct?

MR. BOUTIN: Boutin speaking. I did not say that I looked at the guidelines. I said I looked at the bulletin.

MR. DUNCANSON: Duncanson speaking. I think we're talking about the same thing. There's the -- the document that I'm referring to is entitled, "Information Bulletin Environment Act Proposal Report Guidelines." And first maybe I'll ask, is that the same document you're referring to when you reference the bulletin?

MR. BOUTIN: May I have a look at it? Boutin speaking. Boutin speaking. This is the document that I did review.

MR. DUNCANSON: Duncanson. Thank you, sir. And -- and can you confirm for me that there is no reference anywhere in that document to EAP's, including cumulative effects assessments?

MR. BOUTIN: I would have to look for those exact words into it. My -- Mr. Byron, can I just do that, and look carefully at every single ---

MR. WILLIAMS: Williams speaking. From -- certainly from our clients perspective, we would be prepared to stipulate that the expressed language of cumulative impacts assessment does not appear in that document, as long as Mr. Boutin can confirm that.

MR. DUNCANSON: Duncanson. So, perhaps based on the guidance from your counsel, you could accept that subject to check, Mr. Boutin?

MR. BOUTIN: Boutin speaking. Agreed.

MR. DUNCANSON: Duncanson. On slide eight of your presentation this morning, Mr. Boutin, on the left portion of the screen, you reference a number of bullets under the heading, "Impact Assessment Agency of Canada." To be clear, those were summaries of comments received by the public -- or by the Impact Assessment Agency of Canada from the public. The IAAC did not provide any views about whether it actually agreed that any of those concerns were valid, correct?

MR. BOUTIN: That is correct. Yeah.

MR. DUNCANSON: And you would agree with me, Duncanson speaking, that IAAC determined that this project does not warrant a federal impact assessment, correct?

MR. BOUTIN: Boutin speaking. When I did review those documents that I'm referring there, they did conclude that it -- there wasn't any reason to conduct a federal assessment because it wasn't any aspect that are related by the federal government (inaudible) to. So, I do agree with your statement. Yeah.

MR. DUNCANSON: Thank you. Duncanson speaking. In your presentation this morning, Mr. Boutin, you cited the EAP that was prepared by Freisen drillers in 2019 for the RM of Springfield, is that right?

MR. BOUTIN: Boutin speaking. That's right.

MR. DUNCANSON: Duncanson. And when you were reviewing that document, sir, did you note that it was for a net groundwater withdrawal of 262.1 acre feet per year of water? You can accept that subject to check if you don't have all the numbers memorized.

MR. BOUTIN: Subject -- Boutin speaking. Subject to change -- to -- to confirmation.

MR. DUNCANSON: Duncanson. And for those of us who are not familiar with the terminology acre feet per year, would you also accept subject to check that that equates to roughly three times more net groundwater withdrawal that what Sio is proposing under the 85 percent reinjection scenario?

MR. BOUTIN: Subject to check. I can't prove that.

MR. DUNCANSON: Duncanson. Can you confirm, Mr. Boutin, that there was no groundwater modelling done for that EAP?

MR. BOUTIN: Boutin speaking. I cannot confirm. As I mention in the presentation, there is a reference to an unpublished document in there. So, it was for assertive purposes, and I don't know if a numerical model or not was used. There is really limited information in that specific appendix that you're referring to.

MR. DUNCANSON: Duncanson. So, for clarity, Mr. Boutin, I'm referring to -- and I just want to make sure that we're referring to the same thing. I'm referring to the supplemental municipal groundwater supply -- rural municipality of Springfield EAP document dated May 2019 by Freisen Drillers that is 371 pages long. Is that the same document you're referring to?

MR. BOUTIN: I viewed a -- Boutin speaking.

I looked at the specific appendix of this document. So, to be clear, I looked at the assessment from Friesen itself that was in appendix to the main document. Does that make sense?

MR. DUNCANSON: Duncanson. Yes. I think that -- that clarifies that. Thank you, Mr. Boutin. So, to confirm, you just you don't know whether Friesen developed a model to support this EAP or not, correct?

MR. BOUTIN: Boutin speaking. That's correct. And as I mentioned earlier, I do not know if a numerical model was used to evaluate the recharge, and therefore there is even question if it was a numerical solution, if it was any other kind of assessment done to derive that number. So, yeah. This number is questionable whether or not the -- the percentage of utilization of recharge it is.

THE CHAIRMAN: Chair. I'm struggling a little bit to hear, Mr. Boutin. Cal, is -- can we either do some gain, or we're going to have to ask Mr. Boutin to expend some more energy.

MR. DUNCANSON: Duncanson speaking.

And let me know, Mr. Boutin, if -- if this was evident to you in -- in reviewing the appendix or not, but can you confirm based on your review of that 2019 EAP that it did not include any cumulative effects assessment?

MR. BOUTIN: Boutin speaking. I did not look actually for that. So, I cannot comment on whether or not cumulative effect assessment was used, but what I can say though from that appendix is that Friesen is referring to an integrated water management plan, and it should -- there is some next steps that needs to be used in order to go for that supplemental. So, in my review of this appendix, what I was looking for is trying to put into perspective the water usage, which in my mind was greater than what the proponent is -- is presenting. So, I agree with that statement.

MR. WILLIAMS: Williams interrupting just for a second. And with all respect my friend, just in terms of the previous preamble, I think it was based upon a review of the EAP, and I believe the evidence is that it's -- that Mr. Boutin has done a review of the appendix. So, just for the purposes of further -- further questioning if we're going down that angle, I just want to clarify the premise. Thank you.

MR. DUNCANSON: Duncanson speaking. You may have heard me ask some questions of Dr. Hollaender yesterday in relation to another EAP that Friesen prepared in 2015 for the city of Steinbach. Is that a document that you're familiar with, Mr. Boutin, or did you review it?

MR. BOUTIN: Boutin speaking. I'm -- I don't remember having look at -- don't remember looking at it. So, I would say no.

MR. DUNCANSON: Duncanson speaking. That's -- that's perfectly fair, Mr. Boutin. So, I'll -- I'll move on to another area. You discuss in your report, and you discussed a little bit this morning, the technology that Sio is proposing to use to extract the silica sand and water from the sandstone formation. You characterize that in your report as standard technology for water supply wells, and you talked about the difference between the airlift method that -- that's -- Sio's proposing to use relative to conventional water wells. Would you agree with me that the concept of using airlift wells in a drinking water aquifer is a common well understood practice?

MR. BOUTIN: Boutin speaking. I would agree with that statement. The use of airlifting is -- is -- is a critical part in providing a really well efficient well, and what I mean by that is that in a well with a screen, in order to reduce the entrance velocity, you need to dislodge those fine particles. So, in order to do that, airlifting is being used. We're introducing the airlifting tool around the screens, and we're working the screens, and we call this a procedure of air development of the well, and by doing so, you're producing water, and you're producing some sand silt, or part of clay, so you're dislodging that arrow, and you bring that to surface, and the reason why you're doing this is that when you put in the submersible pump in a well, those are really -- pumps not are designed to produce water, not sand. So, if you bring some sand with your pump, you're going to be burning your pump, sorry for the term, but -- so, it's pretty bad practice. So, by using airlifting technique, which is an aggressive technique in the sense that you're creating a lot of velocity, and the nice thing about it is by introducing air, you don't need any engine down the hole. So, you're producing a lot of water, and with a lot of water means a lot of entrance velocity, dislodging fine, so you're basically effectively moving up water and sand, that is getting start or discharge at ground surface, and by doing so, you're -- yeah, you're developing the well. So, at the end of the process, what happens is that you're producing clean water, that usually is not turbid, and then the pump -- the submersible pump that you're putting into the well is going to be pulling the water into the well to a lower velocity, and therefore there won't be any fines with it, meaning that you're going to have crystal clear water, and going to be able to use it for portable. So, this is a -- a regular learning standard process of putting in a water well for either domestic or municipal supply wells.

MR. DUNCANSON: Duncanson speaking. Thank you, sir, for a thorough response. And so, I take it from that answer -- there's been some discussion in this hearing, you've probably heard it, about whether the technology that Sio is proposing is new and unproven, or -- or -- or not. You would agree with me that the technology itself is standard well understood technology. It's the application of that technology to silica sand extraction that is not.

MR. BOUTIN: Louis Boutin speaking. I would agree with this. Actually, yes. I would agree.

MR. DUNCANSON: Duncanson. Thank you. Mr. Chair, just looking at my notes, we're about to move to a different area that will take a little bit of time. So, this might be a natural time for a break.

THE CHAIRMAN: Chair. Thank you. I agree. So, using the National Research Counsel of Canada atomic clock, we will reconvene at 1:30. Chair. Notwithstanding, the official NRC time is 1:26:53. Are we ready to go? Mr. Boutin, are we good to go?

MR. BOUTIN: (inaudible).

THE CHAIRMAN: Chair. Well, over to you folks.

MR. DUNCANSON: Thank you, Mr. Chair. Sander Duncanson speaking. Mr. Boutin, I'm going to start off on a -- a new line of questions for you this afternoon. And just to start off, would you agree that several different groundwater modellers in this area including -- people, we've heard lots about over the last couple days, Dr. Hollaender, Dr. Kennedy, Dr. Woodbury, Wang, and -- and others, each developed different groundwater models with different modelling domains?

MR. BOUTIN: Boutin speaking. Yes.

MR. DUNCANSON: Duncanson. And would you also agree that each of those models had different objectives?

MR. BOUTIN: I'm not sure that would -- Boutin speaking -- wouldn't necessarily agree with this in the sense that when 2008 the objective to understand the comitative effects in a region, and by comitative effect meaning the sustainability of the water usage. If you look at Kennedy 2002, they had a question with regards to another effect, which is an effective of looking at the density and the salt water intrusion. Again, it reflects to the fact that they are both original study with a come and go of understanding the dynamic on the system. So, hence why I -- I'm -- my interpretation is that the objective is to understand the (inaudible) effect on a hydrogeological point of view.

MR. DUNCANSON: Duncanson. Thank you, Mr. Boutin. So, you'd -- you would agree that each of those models had similarities, and they were each looking at understanding the groundwater dynamics. But would you also agree that there were different objectives as well within each of those models? So, for example, you referenced Kennedy looking specifically at density effect, that's a different objective than was considered in the other models.

MR. BOUTIN: Boutin speaking. Yeah. I mean, if you want to think of this way, it's -- it's -- it's your opinion. I do believe that they're both in the sense that they're evaluating original resources. Think about the complexity of a system as a whole. So, in my opinion, it is a common objective. Now, you're pointing out through some specific differences in those models, and I have to agree with that. They were one model, like such as the one that Kennedy developed that had the density dependent flow was able to look at the component, then maybe another model could've like one for example that was submitted with the EAP that does not take into consideration the density effects. It's not that the code is not doing this. It's simply a decision that was made of not looking at this. So, yeah. Objective why, I think you need to question yourself why would they take a third of the province with Kennedy? They want to look at the original system. Thinking about the objective ground water management plan, they have the common objective of looking at the sustainability of a system. So, in that regard, they have, but I will agree with what you mention. They have subtle differences to look at specific point within them.

MR. DUNCANSON: Duncanson. Thank you. And Mr. Boutin, as -- as someone who is in the business of -- of developing groundwater models, and Matrix is in the business of developing groundwater models, would it be fair to say that it is the decision of the modeller to determine model boundaries that are appropriate for the specific objectives of the particular modelling project that you've been asked to carry out?

MR. BOUTIN: Boutin speaking. It's a great question. Obviously, it is a professional decision when you think that, and there are some standard about our best practice it is to choose a model (inaudible). Now, the -- this being said, there are some times and some provinces (inaudible), such as the example that I just provided with the (inaudible) model, but there may be some expectation as I've shown in my presentation with the groundwater management plan that we specified like you should be using a -- a specific model. If that condition exist, then it becomes not the responsibility of the modeller to make those decision, but to use what the regulation is in place. So, to answer specifically your question, it depends.

MR. DUNCANSON: Duncanson speaking. I -- I always love that -- that response, Mr. Boutin. You would agree with me that in this part of Manitoba, there is no regulatory guidance like exists in the oilsands where groundwater modelling needs to be carried out in a prescribed way. Do you agree with that?

MR. BOUTIN: I was waiting the question. Generally speaking -- not generally speaking. I would agree with that. Yeah.

MR. DUNCANSON: Duncanson. And -- and turning to the AECOM model that was prepared for this project, you agree that the hydrogeological model that they developed for this project was developed consistent with industry standards, correct?

MR. BOUTIN: Boutin speaking. I do agree with that statement, and I would want put additional information with -- with that answer if possible. So, the challenge with numerical models is that, like I tried to explain during my presentation, it's subjective in some sense, right? You just mentioned to me that there's no specific guidelines. So, yeah. There is a professional judgment involved with developing a numerical model. So, I do agree that from what I've seen, in terms of protocol, meanings that you look at the region, you build a conceptual site model at the original scale, you understand the dynamic of the system as much as you can, you impose some (inaudible) condition, and through the entire process you're making small decision. Several -- several decision point. So, you need that professional judgment. It's not a checklist exercise that you can say it takes a boundary condition here, check. Takes a numerical model, check. Doesn't matter if it's good or bad. That's not what it is. It's about the profession, and the -- the trust that you build by developing and making those assumptions, and being able to extract the information, and answer the question that is being asked. So, it comes down to the fact that what are we trying to achieve, and what is the objective of numerical model? And in a context that there is an existing groundwater management plan that is in place where they spend two years plus defining what is the area of interest and building trust with population and stakeholders in the southeast homeowner and whatnot, you need to make at least an effort of considering what was done in the past in order to move forward in the future, and improve, build on on what's been done. And that was kind of my line of presenting when I refer to that. With regards to the model itself, no, I do believe that effort was made in understanding original conceptual model, effort was made in building the model, using it as a decision tool for the -- the benefit of the project with a specific scope in mind, and I question whether or not the recharge was adequate in comparison to the original study. So, this is my -- my opinion.

MR. DUNCANSON: Duncanson. Thank you. And I will follow up with you on -- on recharge specifically in a bit, but I believe, Mr. Boutin, you were here yesterday when I was asking some questions of Dr. Hollaender. We had a lengthy discussion about calibration, lengthier than I was anticipating, but based on those same key metrics that I discussed with -- with Dr. Hollaender yesterday, based on your experience as a groundwater modeller, would you consider AECOM's model to be well calibrated?

MR. BOUTIN: Boutin speaking. So, this is the biggest grey area in numerical modelling. What is a well calibrated model? So, when you build a numerical model with the question to -- to be answered, you need to frame that numerical model to answer that question. And from the -- the get go in the standard operation procedure, what you need to define is what is a good, calibrated model. Is it going to be the (inaudible) absolute air? Is it going to be the normalized (inaudible)? Is it going to be -- what metrics are you using and are you going to be imposing to your system to judge that is calibrated? So, this is a step that should be taken in advance, and in the case where the -- the -- the regulator's going to ask to review your model, that may be a good step to discuss what should be those metrics ahead of time so that you can decide after the fact that, yes, we're meeting the quantitative criteria for good model calibrated. This is just half of the story. The second half of the story is the qualitative measures in a calibration strategy, and that you should be really -- because there's not a quantitative, there's not a number to tell you that your model is good or bad. You need to reflect on those. And a good example of this is recharge. So, in some instance you have very little recharge, on other models you have a lot of recharge. What does that mean? You don't have a single -- when we're talking --

when they were talking yesterday with Mr. Hollaender about the main absolute errors and whatnot, it doesn't reflect to the fact that maybe you have too much water going into your model, but as he demonstrated, you can match your head extremely well. Doesn't tell you that your model is good or bad. So, this is a judgment call, and through the review process usually you can look at those soft metrics, quantitative metrics, and some of those are (inaudible) error. Others are -- is the recharge too high, am I missing some really important conceptual pieces in the original well water flow system in order to make those decisions, and as you pointed out, in some areas of cluster with high residuals, it sometimes means something. There was some illusion or different discussion that went on regarding whether is it because it's selling water in this area, and then they forgot to change that into equivalent freshwater (inaudible) because you take density into account, and then suddenly your error is gone, or is a boundary condition? So, these reflections are done through the process. They're not necessarily captured by a quantitative measures, but there's a qualitive measures that's telling you if it's good and if it makes sense because you need to have that judgment call, whether or not it makes sense, and that's not standard per say, it's based on the -- the experience of the modeller.

MR. DUNCANSON: Duncanson. Thank you, sir. And so, what I'm hearing from you is that this exercise of groundwater modelling is largely based on professional judgment of the modeller, and what is viewed as a reasonable exercise of professional judgment based on the objectives of the model. Is that fair?

MR. BOUTIN: Boutin speaking. Yes.

MR. DUNCANSON: Duncanson. And again, based on your experience in groundwater modelling and your review of the AECOM model in this circumstance, you would agree that this model was conducted in accordance with industry standards.

MR. BOUTIN: Boutin speaking. Yes. From what I've reviewed. I do feel like the process that led to this product makes sense, respects standard industry. Now, with further look at this model, and as I pointed out, there's always some question whether or not it's representative, but with a lack of data to constrain those uncertainties, in this case we're talking about recharge, which is pretty critical -- critical aspect of all this to define if it's sustainable or not, might not be really constrained. So, yeah.

MR. DUNCANSON: Thank you. Duncanson speaking. And -- and just so that I'm clear, when you say that, you know, you looked at the AECOM model, the model made sense, and it respected industry standards, does that include calibration as well?

MR. BOUTIN: Boutin speaking. I talked to -- I reflect to define that it uses a certain protocol of going through the conceptual model, building it, doing the calibration exercise, looking at some residuals. From eye level perspective, those -- this methodology was used, and therefore, I think it does respect standard. Now, to the degree of looking into the recharge rate and -- and having that holistic approach that I tried to take by comparing to others in reported values, I -- I have my reservation on that aspect, right? Whether or not it definitely is valid for evaluating the sustainability of the aquifer. So, I want to make another point on this that just slipped my mind. So, if it comes back, I might ask you if I'm allowed to answer that question, okay?

MR. DUNCANSON: Certainly. Duncanson speaking. Just let me know. So, Mr. Boutin, you --

you've -- you've mentioned recharge a few times as -- as a bit of a qualifier as something that you were still wondering about. In your view, is it appropriate to use measured values from literature as the basis for parameterizing a groundwater model?

MR. BOUTIN: Boutin speaking. You should always look at every lines of evidence, any data that you have. So, yes, literature avenue is one stream of information. Another stream is measured data in the field, which becomes way more important than anything else. One thing that I've identify when I did my -- my -- my -- my review of the recharge is that they're referring Woodbury and Kennedy in terms of recharge rates, and when I did that comparison, I agree with the other study, they use the same recharge rate, but the rate is applied on an area. So, I can tell you that I have a recharge rate of 200 millimetres per year at the specific area like this, but if you do apply it on a large area like this, suddenly your total recharge is just out of proportion. So, by saying that you're using the same recharge rate doesn't mean that it's right. You need to think about how much area that you're imposing that rate, and if it makes sense based on a conceptual site model. So, always need to -- yeah. I mean, you have range of literature value, you got measure information, and then you need to make that decision whether or not it makes sense. Even though the literature review says something, in some specific condition it can totally be off the literature review, and -- and derail because you got additional knowledge. So, you need to consider all those lines of evidence.

MR. DUNCANSON: Thank you. Duncanson speaking. And Mr. Boutin, when -- when you were talking about recharge, and -- and I think you expressed some uncertainty around how AECOM came up with the recharge values that they -- that they did in their model, were you aware that AECOM's approach to assigning recharge to the model was based on specific academic studies of recharge to the Sandilands area by Ferguson and Cherry?

MR. BOUTIN: I would want to review this statement to be able to confirm. Do you have the reference with please?

MR. DUNCANSON: Duncanson. I'm sure we can get that -- that for you, but just to be clear, Mr. Boutin, that was not something you were aware of when you were commenting on the recharge this morning.

MR. BOUTIN: So, that's something that I don't know where we have because I'm not aware that Ferguson had a numerical model. So, they were stating a fact that Kennedy had made a numerical model. So, if you just take the latest discussion, I think you need to go back to the root where we need to. So, again, with reservation to what the information you're going to present me, I might be wrong, but based on what I read so far, you need an -- you need some information, and -- and from what I read, was coming from that same rate with respect to the original numerical model.

MR. DUNCANSON: Duncanson. Thank you, Mr. Boutin. I'm going to ask you one more question about that -- the same slide from your presentation where there was this discussion of recharge, which was slide 43. Might as well pull it up. So -- so, there's a reference on the top left of the slide to volumes of water consumed by individuals per day in different models, and you -- you highlighted that Friesen 2019 used a value of 300 litres per day per person, and that AECOM used a -- a different value of 200 litres per day per person, and when we saw that, that was a little surprising to us, and so we went back and look at -- at Friesen 2019 just to confirm our understanding. Would you take subject to check that in fact the Friesen 2019 study, assuming we're talking about the same Friesen 2019 study that I pointed to you earlier, does in fact use a 200 litre per day per person value, not 300? Sorry, I was just going to say, I -- I recognize you'll -- you'll -- you'll likely have to take that subject to check, but I just wanted to give you that opportunity.

MR. BOUTIN: Boutin speaking. Thanks for that opportunity. I'll -- I'll take it obviously. There's -- yeah. I'll check that. Not a problem. Just want to say though that in terms of the groundwater use, those are reported values from those studies. So, they are just reported here showing some differences, but they don't affect the numbers in those table that are presented.

MR. DUNCANSON: Yes. Thank you.

MR. WILLIAMS: Williams speaking. And I have the utmost respect for my (inaudible) friends abilities. I'll just caution that the previous question including its so called expression of surprise sounded a lot like evidence and not like a -- a question. So, I'll just ask my (inaudible) friend for the panel to be mindful of that.

MR. DUNCANSON: Duly noted. Duncanson speaking. Mr. Boutin, would -- would you agree that a 72 hour pumping test for a semiconfined aquifer meets and in facts goes beyond industry standards in your experience?

MR. BOUTIN: Boutin speaking. Can you define what is -- in your perspective what is industry standard? In which industry?

MR. DUNCANSON: Duncanson speaking. So, really sir I was asking for your view as to what would be considered industry standard, but for a pumping test that is seeking to understand the aquifer properties in a semiconfined aquifer. Would you agree that a 72 hour pumping test would meet if not exceed what is typically done in the industry?

MR. BOUTIN: Boutin speaking. When you look at regulation and the way that you should be conducting your pumping test, there's several criteria that needs to be respected. One of which is to ensure that all times during that period of time that you're going to be pumping, you do not deviate from a -- a constant rate, otherwise this is kind of a -- an issue, right? So, there's also the concept of pumping, and doing a conducting of pumping test for 24 hours, 48 hours, 72 hours, which are the standard in the industry. So, even though I talked a lot, I do believe that 72 hours is a standard in the industry. This being said, it's a judgment call as well because we don't have to obey a guideline. So, in a confining system, 72 hours is -- is great because you're increasing the reduce of influence, and if you're thinking about a long-term water yield, you want to be safe, so you want to do it as long as possible. Now, because you're need -- you're -- you need to make some professional judgment here, and one of those condition would be if you're going to go after a water supply for a municipality that is in fractured bedrock, depending on the type of fractured bedrock, depending on the connectivity of that fractured network, you (inaudible). And in that context, if you limit yourself to the guidelines, and don't go beyond what the guidelines saying, expose yourself at assessing the result of the pumping test, that might not be presentative of long-term yield. So, this being said, again, it's not black and white. Yes, the industry standard 72 hours is okay. When you think about long-term yield, and depending on the geological condition, hydro geological condition, the fac that you're going to be maybe expecting a boundary condition of no flow, that would limit your ability to forecast your water usage. You should make that judgment call on whether or not you need to go beyond 72 hours, and there is some circumstances where you should go differently over that if you want -- if you believe there is any risk between -- with respect and regards to the sustainability of an aquifer.

MR. DUNCANSON: Duncanson speaking. Mr. Boutin, would you agree that it would be industry standard to conduct a longer pumping test for an unconfined aquifer relative to a confined aquifer?

MR. BOUTIN: Again, I would look at the spatial context of that unconfined aquifer. If you have a sand and gravel unconfined aquifer that is (inaudible) that is maybe just 100 metre width and that you -- you're not sure about the sustainability of having that, then you would go beyond what the guidelines telling you, otherwise you're going to take some risk. The risk are building a pipeline, bringing in electricity, drilling the well, and relying on that well for long period of time when you're not -- you haven't proven the sustainability of that water use. So, again, professional judgment should always be on top of guidelines in my opinion. But again, the site specific context does play a role. And I want to say that industry -- by industry you mean consulting industry, meaning professional that are signing off on those reports, professional engineers or geologist. So, that's -- that's my answer.

MR. DUNCANSON: Thank you. Duncanson speaking. And I guess it -- it's easy to start getting into hypotheticals and -- and different circumstances that aren't necessarily relevant to -- to this project, but turning specifically to this project, I took it from your report that you did look at the work that Sio did to characterize the aquifer, and you were comfortable that the pump test that Sio conducted for this project did or I guess was sufficient to demonstrate the sustainable water withdrawal from the aquifer.

MR. BOUTIN: Boutin speaking. The way that I look at it is I looked at the effect of a pumping test, and being able to infer or measure what is the (inaudible) conductivity, which is, well, in fact the trans specificity value because that's what we're calculating, trans specificity, and then you need to derive what is the thickness of that aquifer. So, in the case of a decarbonate aquifer, if you got a zone that is competent bedrock, unless fractured, it's not going to lead into the trans specificity value. In the case of the sandstone aquifer, which is a porous medium, which is more homogenous that the carbonate aquifer, it is -- you got a pretty good understanding of what is the thickness of that aquifer, and for when you're doing your pumping test, you get a good handle on that trans specificity value. Now, this being said, what I looked at when I said that I was looking at the evaluation of sustainability using some conservative assumption, I referred back to the Farvolden approach. Assuming no leakings whatsoever to look at sustainability question. Pumping test gives you the trans specificity value, which is the ease for which the water flow in the system. It doesn't necessarily telling you if it's sustainable or not because as I tried to show, it depends on the recharged, and depends on how much water goes into the system, which is two different question. So, to answer your question, it provides information of trans specificity value. If you do it long enough, you can forecast what the prediction is. If you are really confident about the aquifer geometries, and that is homogenous, porous media, and all these assumption.

MR. DUNCANSON: Thank you, sir.

Duncanson speaking. And -- and just to be clear, Mr. Boutin, you -- you would agree that the pump test that was conducted by Sio was adequate for deriving the hydraulic connectivity within the sandstone aquifer, correct?

MR. BOUTIN: Boutin speaking. Yes, and this is in a specific radius of influence, which is influenced by the duration of your pumping test. So, shorter is your pumping test, smaller is your radius of influence, therefore, less understanding you have on the system, and that comes back to the point from yesterday that was made, is that now you're confident about with your trans specificity in a specific area, and you try to forecast that on an area that is 6,328 square kilometre, I don't know that you can make that projection if you have a pretty specific area where you know what that trans specificity value. So, I think I -- I do believe that the test was conducted in a proper way, industry standard way to derive a trans specificity value in a specific area on the project, and then the question becomes professional judgment if you believe that value should be representative of the entire model domain, or you need to introduce other mechanism to control the representativeness of the aquifer deliverability, and think about your recharge in order to answer your question about sustainability, which is two different distinct questions.

MR. DUNCANSON: Duncanson speaking. Mr. Boutin, we -- we've used the term industry standard a fair bit this afternoon. We -- we heard -- or we have heard over the course of the last week or so different terminologies, one of them being state of the art. When Matrix is conducting a groundwater model or developing a groundwater model for a project proponent, would it typically be looking to develop a model based on industry standards, which are well understood, or would it be looking to develop a model based on state of the art practices? Which when I Googled the term state of the art, that -- my understanding is that would typically refer to, you know, the latest and greatest of technologies, which may or may not be well understood.

MR. BOUTIN: I can have -- Boutin speaking. I believe I understand your question, but could you just rephrase it in a bit closer to what actually you're asking so that I can respond? Yes. Thanks.

MR. DUNCANSON: Duncanson speaking. Absolutely. Really the question is, when Matrix is developing groundwater models for project proponents, does it develop its models based on industry standards, or does it develop its models to achieve state of the art?

MR. BOUTIN: Boutin speaking. This is where the professional judgment comes into play. And obviously if you're a -- a professional, then you have an attitude of what you're going to do and how you're going to do it. Guidelines are in my opinion sometimes minimum requirement that somebody came with reservation of this is what it should be done at the minimum to define this as good practice. State of the art in my opinion are based on the definition that you just mentioned is seeking the aspect of pushing beyond and above the guidelines, and I think maybe it's not just me, but I hope not, that a professional would do as they can to answer a question and go beyond the minimum requirement. So, to answer your question, when Matrix builds a numerical model, we use state of the art and in the industry standard that respect guidelines. So, again, I think we're playing with words there, but thanks.

MR. DUNCANSON: Duncanson speaking. And I think we're -- we're getting back to another area where it depends, but I appreciate you attempting to respond to my -- my question using that terminology. Moving to a different question, Mr. Boutin. In your presentation this morning at slide 40, you reference the SRGMP, which is the Southeast Regional Groundwater Management Plan, and you note that that model was not used for the project. Are you aware that the model domain for that model includes a very large portion of Manitoba, roughly a quarter to a third of the province?

MR. BOUTIN: Boutin speaking. I would want to go to slide number 18, and this is the exact reason why I did put that slide together, is to illustrate what are those model domain. So, something that looks big for yourself might be small for others. So, if you look at the legend closely, and you look on the right hand side of the black box where it says Kennedy and Woodbury, and you look at the inset of the top right corner, you see that Woodbury -- Kennedy and Woodbury model domain is a third of the province. So, when you're asking me the question if it's big, it's relative depending on what the system you're trying to manage. In this case, it's the carbonate aquifer extend, and if you want to do a cumulative effect assessment, you need to consider it in a whole. I'm going to move now to the next slide here on slide -- right over here on slide number 36. If you look at the scale -- just a moment please.

MR. DUNCANSON: And sorry, Mr. Boutin, just while you're searching, I mean, my -- my -- my question -- we will get into the appropriate model domain for a model like this, but my question was simply whether you were aware of the scale of that particular model that you referenced.

MR. BOUTIN: Boutin speaking. Yes.

MR. WILLIAMS: Williams speaking, Mr. Chair. And just for precision, if my (inaudible) friend, Mr. Duncanson, can indicate whether he's referring to the Wang 208 model or Kennedy (inaudible) from 205 because I just want to make sure that there's clarity on which model is being referred to.

MR. DUNCANSON: Duncanson speaking. And if that wasn't clear, I was referring to slide 40 in the presentation, which referenced the SRGMP numerical model, that was the model I was asking questions about. Now, so -- so, Mr. Boutin, you -- you -- you were aware of the -- the geographic scope of that model, and just to be clear because I think you compared it to -- to Kennedy and talked about size being relative, but can you just confirm on the record that the model domain for that model does include a very large portion of the province of Manitoba?

MR. BOUTIN: Boutin speaking. I do concur. I did appreciate the size of this model domain, and it is in my opinion a size that is appropriate to conduct a commutative impact assessment at original scale.

MR. DUNCANSON: Duncanson speaking. Thank you, sir. You -- you anticipated my next question, which is while that may be an appropriate scope for a cumulative effects assessment at a regional scale, in your professional opinion, again, as someone who prepares groundwater models in different contexts, but including to support project applications like this one, in your view, would that be an appropriate model domain for a groundwater model that is developed to understand the effects of a project like this?

MR. BOUTIN: Boutin speaking. I really apologize, but I'm going to use it depends, but truly it is, and that's the point. So, depends what you're wanting to do and achieve, and what you want to complete, and how much trust you want to build with the system. That aquifer, how it's going to get overused or not, there's going to be seven intrusion or not. So, if you don't care about those answer, then it's okay. If you're -- if you're looking at a -- a small model domain, and I'm going to tell you that if you're looking at some specific water usage from a small area that's going to be less than 25 cubic metres per day as an example, the size of the model that Sio has proposed is probably sufficient. If you're looking and -- and that's why I'm quantifying it depends, and it really the objective that you're aiming for is going to be really directing the model size. For the project size and the water consumption that Sio Silica is proposing, fair to say that it's not one of the major users in the region. Fair to say that. Now, the question that we need and the decisionmaker needs to make, it's on the sustainability. And in order to answer that sustainability question goes back to how much water goes into the system, which is the recharge, and how much is leaving the system, which is a groundwater users. So, if you choose your model domain size to answer specific question, what is the project effects, direct effects, and you're not choosing to answer the question is there enough water in the system, then maybe it is sufficient. And again, if you're looking at sustainability and integration of foreseen -- foreseen growth of the industry of the groundwater users, the domestics wells, the municipalities, and other project -- mining project, or industry project, that may go on that take the water in the same aquifer, then the model domain becomes too small. So, and to be clear, it depends on your objective of what you want to answer as a question. Whether or not the sustainability or whether or not it has an impact on the region surrounding the project, and not necessarily looking at the sustainability question.

MR. DUNCANSON: Duncanson. Thank you, Mr. Boutin. So, as -- as I understand what you just said, I -- I think I understand what you just said, which is if you are seeking to understand the direct effects of the project, the model domain that was used by AECOM is appropriate. If you are seeking to understand the broader region and how much withdrawal is sustainable across the region, you may need to use a bigger model domain. Is that fair?

MR. BOUTIN: Boutin speaking. Yes, it is.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And -- and would you agree that that broader responsibility to manage the regional water withdrawal, that -- that is the responsibility of the province, not individual proponents?

MR. BOUTIN: Boutin speaking. I'm going to give you my honest response, and I think it's the responsibility of everyone. You cannot just isolate and provide the responsibility to one individual person. I do believe that there is the responsibility of the government for sure to initiate those -- those studies, and implement the framework, the regulation, and whatnot. So, there is that responsibility of the government. The project itself and the proponent has its own responsibility through that process, and anybody else that using water is responsible to some degree of best practice and sustainability. So, I think every stakeholder needs to communicate together, hence why I believe that integrated water management plan, that is on the water shed basis, is a great tool for that. So, that's my answer.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And I'm -- I'm happy -- I'm happy you gave that answer because that -- that's exactly where we're going to go on that topic in -- in a few minutes. Just to close off on this SRGMP, to your knowledge, is that numerical model itself publicly available for companies like AECOM or Matrix to use for modelling exercises like what was done for this project?

MR. BOUTIN: Boutin speaking. I'm not aware of, and I want to precise things a little bit, in the sense that it is stated as -- as I've shown in my presentation, that -- and I may want to just take the time to go to that slide, if you don't mind. And I want to look at the second bullet on slide number 35 where it is written black and white on the groundwater management plan. The model is expected to be completed for initial use by 2011, at which time it will be used to evaluate recharge areas, and bottoms, and local, blah, blah, blah. So, this is what came out from the groundwater management plan. To my knowledge, I don't know that that tool has got one, and if you go back into the groundwater management plan, there's this complete section that talks about the fact that it should be approved by the authorities before it gets used, and to my knowledge, beyond 2010, beyond that groundwater management plan, I haven't seen any documentation, any report, complete report of Wang 2008, and -- and so on. So, is it fair assumption to say that Matrix or AECOM wouldn't be able to use this model as is, if it's haven't been endorsed by the government.

MR. DUNCANSON: Duncanson speaking. And -- and Mr. Boutin, you're not aware of whether the government of Manitoba internally is using this type of tool to review project proposals like Sio's, right?

MR. BOUTIN: Boutin speaking. I'm not. And that's right.

MR. DUNCANSON: Thank you. Duncanson speaking. I want to turn you to slide 44 of your presentation. So, as I heard you speaking to this slide earlier, you were suggesting that AECOM's numerical model does not represent the conceptual site model at the local scale. Now, while that was not the purpose of AECOM's numerical model, would you agree that AECOM's model did reasonably simulate the behaviour of the aquifers in the local pumping test that was conducted for the project?

MR. BOUTIN: Boutin speaking. I do acknowledge that it was a model with the purpose of evaluating original impacts. So, yeah, I concur that. So, you have that flexibility of simplifying the conceptual model on the original scale, which I don't question at all.

MR. DUNCANSON: Oh.

MR. BOUTIN: I wasn't finished. The ability of the numerical model to simulate a transient pumping test, I think it did a decent job of it, being able to reproduce a trans specificity in a -- in the radius of influent of that pumping test, which again, I describe a little bit earlier about the length of the pumping test, and the radius of influence that is relatively local in the surrounding of that pumping test. So, I would say that, yeah, I think it does a decent job of doing this. Now, when I tried to -- to characterize and I tried to identify kind of a data gap in that model is the presence of a minimum of two layers required to capture the velocity fill that we see on the left hand side. So, in my opinion, is that by using a single layer for that shell aquifer, and I didn't want to spend extra time speaking about the fact that we see some little bit arrow -- some arrows on those figures, I want to point out to the -- to different people. So, every single note is getting calculated the velocity filled, and every single of those arrows is showing you where the water is travelling to. And one of the thing that you can notice and on the right hand size is that there's pretty big arrow on the top and the bottom of that layer number five. That shows that there is a relatively big velocity filled for an aquitard. And that's comes down to the effect that if you're not representing those aquitard appropriately, you're overestimating is vertical leakings. So, although, yeah, you do have the model that match relatively well of the measured response, but if you do not reproduce or take the measure, the appropriate measure to represent the characteristic of the system, in this case the presence of a shell, then you're -- you're averaging the behaviour of a system, and you're -- maybe it's going to mislead you towards tome calibrated value that might not be representative. And if you go down the chain of event, that you might be overestimating the (inaudible) conductivity as a whole, and you're overestimating the recharge to the system, then ends up an overestimation of the sustainability of the system.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. You -- you likely would've heard me speaking with Mr. Hollaender about this yesterday, Mr. Boutin, but as part of your work for this project, I take it that you reviewed the technical report that Dr. Hollaender and Dr. Woodbury authored?

MR. BOUTIN: Boutin speaking. To some degree, yeah. To some depths.

MR. DUNCANSON: Duncanson speaking. And when -- when you were reviewing that report to some degree, did you note the finding in the Hollaender and Woodbury report that it is apparent that in the location of the testing for this project, either the shale is nonexistent, or it is cracked, or it is pervious?

MR. BOUTIN: So, no bad intention there, but can you repeat the question please so that I can refocus on the point you're trying to make?

MR. DUNCANSON: Certainly. Duncanson speaking. When you reviewed the Hollaender and Woodbury technical report that was produced for this project, did you see the finding in that report that it is apparent that in the location of the tests that were done for this project, the shale layer is either nonexistent, or it is cracked, or it is pervious?

MR. BOUTIN: Boutin speaking. It's -- it's a -- it's a difficult question, and I'm not sure I really understand the true sense you're asking, but I'm going to take a stab at it.

MR. DUNCANSON: Sorry, Mr. Boutin, I -- I have a tendency sometimes not to be clear in my questions. So, just -- I just want to make sure that -- that you're -- you're clear on what I'm asking you because it's actually -- it is a very simple question. The -- the -- the Hollaender and Woodbury report found that the shale layer in the location of the pumping test that was conducted for this project appears to either be nonexistent, or cracked, and/or pervious, and my question to you is -- I've got a few questions around that topic, but my -- my first question was simply whether you saw that finding when you were reviewing that report.

MR. BOUTIN: Boutin speaking. And that's why I wanted some additional context because it's indirect evidence. So, why would they know if the shale is fractured or not physically? They're making a deduction. So, they're looking at the pumping test results, and making an interpretation that is a leaky aquifer. That's what you're -- you were asking too, but I want to make sure that I understand your question. Now, the discipline of geotechnical and hydrogeological disciplines are pretty closely interrelated in some really specific aspect, and one of which as I stated earlier is the fact that when you do open pit mine, you can have some pit stability issues. If you're not reducing the core pressure, you may have some issues with wall stability. So, that connected is deep core pressure, and so going to give you kind of a really quick example so that you -- you can understand what I'm going -- where I'm going with this, is the fact that sometimes when you pump an aquifer where the water level is quite -- is higher than (inaudible), by decreasing the pressure you're reducing the effective stress between the grains of that aquifer, in this case it was a sandstone aquifer. By reducing the effective stress, you're creating some kind of consolidation of the aquifer. If that happens, what you're going to measure is instantaneous pressure response, which is a geomechanical response of core pressure that translate on the aquifer above. So, you can measure those pressure response, and we see it in the (inaudible) operation all the time. When they start injecting (inaudible) pressure in a reservoir underground, there is some -- some subsidence, or there's pressure wave that travels all the way to near surface. We do monitor and clean, and more than two -- 200 metre separation distance between where you're creating the stress, and where you're measuring a pressure. So, you need to be careful there, like they're -- they're --

they're saying because you record some pressure changes at one point, that is because of leakance, where it can be a geomechanical response to the system, which could be expected, and that doesn't mean that there is a direct communication between the two. Hence, why I rely my interpretation of the (inaudible) shell acting as a barrier because when you look at the isotope results that was the -- the proponent, pretty much same interpretation of the results, it shows differently that the shell aquifer, the -- the shell is creating an effective barrier to the flow.

MR. DUNCANSON: Duncanson speaking. So, just so that I'm clear, Mr. Boutin, on -- on what you're -- you're suggesting. I -- I mean, I -- I -- I hear you casting some doubt on Dr. Hollaender's conclusions, but are -- are you suggesting that there is currently no intermixing between the carbonate and sandstone aquifers in the area of the project?

MR. BOUTIN: Boutin speaking. No, that's not what I'm saying. It can exist. Can exist, and one of the arguments that was moved forward is the interconnection of some wells across both aquifer. This is -- this can occur. It can occur in areas where the shell is fractured. Yeah. That's another possibility. It can occur in areas where the shell is absent. To my knowledge, there wasn't an isopach map as we like to call it of the shell under the project area. Is it not the top of the elevation of the shell and not the isopach map? You got both. So, I'm answering myself for the record. Thank you very much. I do believe that in the record if I'm -- I'm right, there is an isopach map of the shell aquitard showing that, and I just -- to be totally fair and honest, the interval between zero and 10 if I remember the legend correctly -- am I? Yes, I do. Okay. Thanks. You cannot tell what it is, like there's no way for me to make any assessment and valid -- validity of the extent of that aquitard when it's yellow everywhere between zero and 10 when site specific information says it's three metres. So, that's my answer.

MR. DUNCANSON: Duncanson speaking. Thank you, Mr. Boutin. See, you touched on this, but -- but you are aware that there are currently more than 1,000 wells in the region that interconnect those two aquifers as of today?

MR. BOUTIN: Boutin speaking. I would like to see that reference. I would like to see the proof that somebody went and look at those well and can, like, say the exact number, because from what I read -- because from what I read there's -- sometimes you talk about (inaudible) wells, and other times about thousands. You're referring to thousand, I'm not sure who you're referring, where's your source of information. One thing that I want to point out is that there's some reason why those well would go through the carbonate aquifer, and as shown in the original study is that some of the wells are pretty dry, like they're not able to produce much water all because there's no fracture to whatnot. So, those instances, the well would continue on and go across the aquifer open all, but that wouldn't convey any water or mixing at that specific location, even though that well is cross connected. So, claiming that there's 1,000 wells or 2,000 wells that are cross connecting and not knowing what is the exchange fluid about -- between those two formation doesn't prove any value in my opinion. And the other thing that I think I mention, and I show the effect of the collapse of the shell and a radius of diameter of 25 metres was several square metres. You want me to go back to that slide with you if ---

MR. DUNCANSON: Mr. Boutin, Duncanson speaking, why -- why don't we -- why don't we just focus on the questions that I ask, and then -- and we'll see where that takes us? But you asked me what the reference was for the thousand wells. So, I'm -- I'm referring specifically to Wang Et Al 2008, which I believe was a report you indicated familiarity with, and I'll just read you the -- the reference that I was referring to so that we're on the same page. And I quote, "Historical information indicates that the upward gradient from the Winnipeg to the carbonate aquifer has been decreasing for the last decade or longer, primarily as a result of more than 1,000 water supply wells finished as open holes through the two aquifers", end quote. Do you -- sorry. Do -- do you recall seeing that in -- in Wang at all 2008?

MR. BOUTIN: Now that you're saying it, I don't recall looking at it, specifically that extract of text, but I did recall seeing it throughout some -- some different studies. Yes.

MR. WILLIAMS: Mr. -- Mr. Chair. Williams speaking just for a second. And just to assist Mr. Duncanson, it would help our -- our witness properly if you could define the region of which you -- you're speaking because it's -- it's a little unclear whether you're talking about the project area, the -- the study area, the whole Wang region. So, just to assist the witness so we have some clarity.

MR. DUNCANSON: Duncanson speaking. Thank you, Mr. Williams. Mr. Boutin, to -- to the extent that intermixing is already occurring as indicated by Wang Et All 2008, would you agree that that is irreversible?

MR. BOUTIN: Boutin speaking. If it is already occurring, it's irreversible. If it's designed this way, if the system is implicitly naturally this way. It is not irreversible if it's due to the effect of cross connecting bore holes. It can always go back to those bore hole and abandon them, and get rid of the inter aquifer mixing, but fair enough. If there is some areas that there's no shell and the mixing is occurring naturally, then sure. And -- but I want to point out that you're using irreversibility as a direct effect, and in this case, it wouldn't be an effect because it would be naturally occurring.

MR. DUNCANSON: Fair enough, sir. Duncanson speaking. Now, on this theme of intermixing of waters, I just want to ask a quick question about your analogy with your 13 year old son mixing Gatorade into his water. When I hear that, Mr. Boutin, I -- I view water and Gatorade as tasting very different, and -- and having a very different salinity. In using that analogy, you're not suggesting at all that mixing the water between the carbonate aquifer and the sandstone aquifer would have those types of effects like you would see with Gatorade and water.

MR. BOUTIN: Boutin speaking. Absolutely not. I want to precise that it's a visual example so that we understand the dynamic of the system. I'm not referring at all that it's the same thing, and I do agree as I mention in my presentation that the mixing of those two aquifer, they have good quality at the moment as we speak, current condition, that if you mix them together, they're still going to be called waters, and you'll still be able to drink both of them. So, I want to make that clear as you requested.

MR. DUNCANSON: Duncanson speaking. Thank you, Mr. Boutin. I just wanted to make sure that everybody in the room was -- was clear on that as well. Now, in your presentation this morning you talked about geochemistry briefly, and you clarified that while Matrix validated AECOM's work regarding intermixing of waters, you did not consider the potential for acid rock drainage or acid rock generation. As someone who has worked in the groundwater industry for more than 20 years and having extensive experience, I presume you've been to many conferences and read lots of papers. Have you ever heard of a situation where acid rock drainage or metal leeching was initiated in a formation, saturated with groundwater?

MR. BOUTIN: Boutin speaking. I want to just mention as I mentioned before that I'm not a geochemist, and that I -- I wouldn't be qualified to answer that question, but I can relate to the fact that I went to some conferences, and it was mostly about numerical modelling, and not necessarily about geochemistry component. So, I never heard about it in numerical modelling conversations. No.

MR. DUNCANSON: Fair enough, sir. Duncanson speaking. Now, just quickly, in addition to the hydrogeological assessment that AECOM prepared for the project and which you reviewed, you also reviewed Sio's draft management plans, correct?

MR. BOUTIN: Boutin speaking. Draft management plan, there was a few of them I believe. So, I did have a quick look at them, and more specifically the one addressing the groundwater component, and the well abandonment. Yes.

MR. DUNCANSON: Duncanson speaking. And sir, you agree that Sio's proposed approach to groundwater monitoring is adequate for the purpose of detecting the direct effects of the Sio project?

MR. BOUTIN: Boutin speaking. When I did review it, and again, there was -- to be honest, there's a lot of information that came in at different times, so I haven't reviewed everything to the same precision, but from my recollection, reviewing those plans, generally speaking, there was some good mitigative measures in terms of -- not mitigative, but measures proposed by the proponent in order to monitor the pressures and water quality. So, I haven't seen any major deficiencies from that draft plan. I did offer some recommendation, and I do believe that the proponent were -- was receptive in the responses. So ---

MR. DUNCANSON: Thank you, sir. Duncanson speaking. I'm going to shift now to the theme of increased vulnerability due to contaminant transport, which was a key theme in your written work. And Mr. Boutin, reviewing that portion of your written report, I take it that that was a qualitative observation that Matrix made, and that Matrix did not conduct any sort of quantitative assessment to determine the current vulnerability in the aquifers, and how that much change as a result of the project, is that right?

MR. BOUTIN: Boutin speaking. That's right.

MR. DUNCANSON: Duncanson. Did you review the aquifer vulnerability mapping for the RM of Springfield that was conducted by Friesen in 2019?

MR. BOUTIN: Boutin speaking. No, but as I mention earlier in the presentation and I referred, and you're talking about the drastic index here in terms of vulnerability I'm assuming, I did recognize that it has a low vulnerability. So, which doesn't -- it's not -- doesn't have the propensity for contaminant under current condition. I agree with that.

MR. DUNCANSON: Duncanson. Thank you, Mr. Boutin. And -- and when you're talking about contamination in your report, you're not talking about contamination caused by the project, you're talking about contamination caused by other things like hypothetical spills as well as things like road salting, and landfills, and things of that nature, is that right?

MR. BOUTIN: Boutin speaking. That's correct. Where it was in my opinion taken out of context or it was a lack of clarity in my -- in my evidence in the sense that I wasn't suggesting that the proponent activity would have an adverse effect or a direct contamination. I was agreeing with the fact that is unlikely, and the -- the qualitative statement of likeliness refers to a risk, which is qualitative, and you need to take into consideration the time component, and when I was referring to long-term, I was referring to the fact that is much beyond ten years, it's much beyond the project activities, and we're looking at a much longer time period than the project activities than itself.

MR. DUNCANSON: Duncanson. And as part of your work, did you look at where existing landfills are located in the general region around the project, or what existing road salting practices look like in this area, or things of that nature?

MR. BOUTIN: Boutin speaking. No, I did not. What I did do was as I pointed out in my presentation here referred to the land user, land cover in the area to evaluate how much of it was developed, and if it was under low eye or moderate level of -- of activities, and as I showed again today in my presentation, I referred to that risk Matrix that the level of development is relatively low, and the vulnerability is relatively low as well. This being said, this is current conditions, and as time progress, as any other activities going to be -- human activities going to be going on, and agriculture projects going to rise and whatnot, and unknown contaminants, or emerging contaminants, or any of these type of activities could potentially release a contaminant. I'm not suggesting that at this given point in time there's a huge risk to the resource. I'm just saying that there is a risk, and we shouldn't neglect and consider that risk with respect to where things going to go in the future, and I tied that back to the -- the component of irreversibility of the project effects, and the fact that you have and -- and the project is planning over a period of 24 years of drilling in multiple thousands of wells, and I refer back to my presentation when I showed the image that when in each single bore hole, you're creating a pathway, you're creating some possibility of pathways, and therefore you're increasing the risk, and it's qualitative, there's no like any numerical model from the proponent that I have seen that would suggest travel times for instance from recharge to the -- to the aquifer that I'm aware of. So, in that sense, I can't comment on it.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And -- and I want to sort of build on the concept in your presentation about risk being a combination of source, pathway, and receptor. Do you agree that the quaternary sediments across much of the Sio project area are relatively thick and fine grained?

MR. BOUTIN: Boutin speaking. From the project information that I've seen, and I haven't looked any specific description of geology on those bore hole that were drilled, so to be able to qualify what the matter of properties are, I'm not able to say anything about that. What I read from the -- from the model and the documents that I reviewed, the thickness of the till does vary between 25 and 35 metres, at least on the conceptual side of the design. So, there is a fair amount of thickness, and as I pointed out earlier, in a drastic effect in the vulnerability index is defined as a drastic methodology the depth of the aquifer it is, and the material that covers the aquifer is considered. So, the vulnerability of the aquifer would be low, and I've said it again, it's your line of questioning, I respect that, that's fine.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And I'm -- I'm not going to belabor the -- the point, but I -- I do have a few more questions on this because I think it is important for everyone to -- to understand what we're -- what we're talking about here around contamination because that's a sensitive subject when we're talking about drinking water aquifers. Would you agree that a thick fine grained till layer lying on top of the carbonate aquifer would provide a level of protection to that carbonate aquifer?

MR. BOUTIN: Boutin speaking. As I just mention, if it's low permeability, if it's intact -- if it's intact, yes.

MR. DUNCANSON: Duncanson. And Mr. Boutin, I thought I heard you say this morning, and correct me if I'm wrong, that the project could result in additional fractures in the limestone beyond what Stantec had modelled, and I think I also heard you say that it could even result in fractures within the till layer. Did I get that right?

MR. BOUTIN: Boutin speaking. I haven't compared that conceptual model to the geotechnical analysis that was done. And for the possibility of opening some existing fracture, are creating new ones. I'm not a geotechnical expert, I cannot comment on the -- the presence of absence of fracture. What I did refer is the conceptual idea that if you're bending something, there's going to be some zone of tension that's going to be opening up existing fracture. May create some fractures, and the same phenomenon occurs higher up in the till where you could see similar thing if the material was cohesive. Material cohesive meaning an -- like a clay or something like this. So, there is some possibility. It is possible that no fracture get developed as well.

MR. DUNCANSON: Duncanson. Thank you, sir. And so, just to confirm, given that Stantec has -- has modelled this and they're the geotechnical experts, they are not predicting any fractures to the top of the limestone formation, they're not expecting fractures in the till. Just to confirm, you're not suggesting otherwise, you're not saying we've done geotechnical analysis, and we think that there will likely be fractures beyond what Stantec modelled, right?

MR. BOUTIN: Boutin speaking. I'm not suggesting that we did any geotechnical assessment, and I'm not inferring results from the geotechnical side of things. I want to be clear though, and you can ask a geotechnical, and I would ask a geotechnical expert on that, is that what they -- they tried to -- to look at is the -- with a given certain safety of factor, if it would collapse or not. I think we, from what I understood from the geotechnical assessment, and again, I'm not a geotechnical expert, is that it wouldn't collapse. I haven't read about what could be the fracturation induced, or what is the number of joints in that rock that we -- that I don't think has been characterized yet. It's been offered to be characterized with some wells and different direction to be able to say how many joints there is and whatnot, but I don't know that they were talking specifically about fracture. I may be wrong on this. It's not my expertise, so I would -- I will stop talking about that.

MR. DUNCANSON: Duncanson speaking. I -- I -- I -- I will stop talking about that, sir. That's -- that's all that I had on -- on geotechnical matters. Would you agree that the presence of nitrate in groundwater can be a good indication of downward migration of nutrients from surface into the underlying aquifers?

MR. BOUTIN: Boutin speaking. Yeah. There's couple of tracer like this that you can use. Obviously, yes. What I -- what I want to point out though is that I'm going to talk about my experience in Ontario about water supply well for some municipalities and road salt. Road salt is becoming quite an important consideration for water supply. We've seen some water supply in populated areas having some issues with chloride and realizing that they have an issue with chlorides now when the practice been ongoing for 50 years. So, simply what I'm saying is that, yes, nitrate is a good example. When I looked at the water quality from those both aquifer, there's no nitrate in the groundwater. So, this alone suggest that currently it's not a problem. Does that mean that it won't be a problem in 50 years, and we just going to realize that all that nitrate is still in the till and making it's way very slowly towards those aquifer? Because the exact reason that it protects it, it may take a while before it gets there. So, I don't -- I don't -- I agree that there -- and I pointed out to the groundwater management point plan, that the water quality on those aquifer are good, and there's no indicated of issues with contaminant at this point in time, and again, I'm going to report back to what I'm saying is that in the long-term in multiple generation, it could happen, it's an indirect effect. I'm not saying it's a project -- an effect of the project.

THE CHAIRMAN: Chair. So, you two have been at this for in excess of 80 minutes. How much longer do you think you have? I'm just wondering when we should time a break here.

MR. DUNCANSON: Thank you, Mr. Chair. Maybe I'm having too much fun, but this -- this is taking a little bit longer than I was expecting. I expect I'll probably be about another 30 minutes.

THE CHAIRMAN: Chair. How about we take ten?

(OFF RECORD)

(ON RECORD)

THE CHAIRMAN: Chair. So, I think it's time to return to the fun. Please, continue.

MR. DUNCANSON: Thank you, Mr. Chair. Mr. Boutin, you talked this morning about the area where the shale layer could collapse and result in more opportunity for intermixing between the two aquifers. Would you agree that in those areas, the water levels in the two aquifers would tend to equilibrate, at least locally?

MR. BOUTIN: Boutin speaking. They would eventually equilibrate -- potentially equilibrate. And what I mean by that is that it is a conduit for -- for the pressure to response in both aquifers. Som locally you could have an equilibrium. It depends on your starting point, meaning that say that you got 100 head difference between the two aquifers, and you have a very small holes, it can -- under some circumstances it wouldn't equilibrate, but in others, like in the case that you're asking where there's very little gradient -- vertical gradient across both aquifers, there is a possibility for the equilibrium to occur, yes.

MR. DUNCANSON: Duncanson. Would you agree that it is highly unlikely that removal of the shale layer would affect the level of protection for the carbonate aquifer, in terms of contamination reaching that aquifer from surface?

MR. BOUTIN: Boutin speaking. So, the last word that you mentioned 'from surface', obviously you need to think about pathways and connections. So, if you remove some shales that are in between the carbonate and the sandstone, the lack of shale doesn't influence what's going above. So, if you're visualizing that an impact from surface would go down through the till towards the carbonate, the fact that you're collapsing the shale does not change the vulnerability of the above. Under the assumption, which is key thing here, that not you're treating any fracture above and that you do not have path -- like, pathways due to drilling of some wells. But to answer really quickly your question, I think there's no -- the collapse of the shale does not create additional preferential pathways between surface and the carbonate.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. Yes, that -- that was my question and -- and Mr. Boutin, you understand that the majority of the groundwater wells in the area of the Sio project are producing groundwater from the carbonate aquifer?

MR. BOUTIN: Boutin speaking. This is kind of -- I came to the conclusion as well as I was reading the -- the project, that most of the water resurges from the carbonate, which is the shallowest aquifer of the two. Agreed.

MR. DUNCANSON: Duncanson speaking. You'll be happy to know I'm -- I'm almost finished, my questions about contamination, but -- but there was one thing that you said in your report that I just wanted to make sure I was clear about. At Page 11 of your report, and I don't think we need to pull it up, we can if you'd like, you discuss that if contamination in one of the aquifers were to be detected at a drinking water well, the director would be able to take actions to prevent the spread of contamination across aquifers. And then there's the suggestion that however, with the case of the project, that would not be the case. And I just want to make sure that I'm understanding what you're saying there. If leaching from surface contamination slowly, over time, results in contaminants being detected at a particular groundwater well, and we know that there's already some intermixing of water between the wells based on the 1,000-plus wells that interconnect the two aquifers, would you agree that employing mitigation at that particular well where the contamination happens to be identified, that that would not necessarily prevent spread of contamination across the two aquifers?

MR. BOUTIN: There was some noise at the end of your question. You just -- maybe just the last sentence, I don't want to -- but I think I understand where you're getting, but please repeat the last sentence.

MR. DUNCANSON: Duncanson speaking. So, the end of my question was whether you would agree that in that circumstance I described, that employing mitigation at that particular groundwater well would not necessarily prevent spread of contamination within and across the aquifers?

MR. BOUTIN: Boutin speaking. Basically -- I'm going to try to describe the context of what I was trying to illustrate, because I really don't understand the hypothetical case that you're describing here. What I -- the intent of what I was referring to here is that in a case that there is some contaminant in one aquifer, and you have a well bore that is cross connecting, you can't abandon the well in entirety and that if the shale is existing and there's no (inaudible) between the aquifers, you're minimizing the impact or the mixing of those two aquifers. But that's with the assumption that the shale in between them is a barrier to the flow between them.

Now, you talked and referred to the two aquifers that are currently mixing, and so, if you have a spread of contaminant, if you abandon that well that cross-connect aquifer that is already mixing, if that's going to make a change in this case, no it wouldn't, so.

MR. DUNCANSON: Duncanson speaking. Thank you, Mr. Boutin, for bearing with it. A long preamble. I will do my best not to repeat that again. And I think that you've answered that question sufficiently.

And just to conclude on this theme of contamination, you would agree that this whole discussion of contaminants potentially getting into the aquifers, that is entirely hypothetical and speculative because right now that's not an issue. We don't know if that would ever be an issue in the future, if contaminants would get through that till layer, if there would be sources of contaminants at surface. This is all a hypothetical conversation about if, for whatever reason, contaminants got in there, then you're suggesting that there could be some increase in vulnerability as a result of this project.

MR. BOUTIN: Boutin speaking. That's the -- to some degree that's -- that's right, in the sense that I'm not suggesting any contamination at this point. And again, I want to make sure that it's understood that any effect of the project will go beyond a certain time, and the fact that you have a well that is not 100 percent impermeable, that could result in some pathways. So, obviously there is that component of potential future condition that are hypothetical, but the fact that you're doing -- and what we're referring in the report is the -- the pathways themselves. We're not talking about the source that you're referring to, but the fact that the project has indirect effect and it's creating the pathways in that risk. So, by creating pathways, you're effectively creating a risk and you're playing with the risk factor. I'm not talking about the source, I'm talking about the risk as well. That's all I'm saying. Which is -- which is important because it's proportional -

- it's directly proportional to number of borehole that you're doing. So, more borehole you're doing, higher is the risk.

MR. DUNCANSON: Duncanson speaking. Thank you, sir. I think we've got all that we need on -- on that. So, I'm going to shift now and talk a bit about cumulative effects assessments, which was something that you spoke about this morning, and you talk about this in your report as well. In your report and your presentation, Mr. Boutin, you've suggested that, in your view, a cumulative impact assessment should have been done. For this project, and it should have considered things like future population growth and potential future stressors on the aquifer. Is that right?

MR. BOUTIN: Boutin speaking. Yes.

MR. DUNCANSON: Duncanson. Mr. Boutin, have you conducted cumulative effects assessments for project applications in your career?

MR. BOUTIN: Boutin speaking. The title of those studies are environmental impact assessment, and what I showed with -- that's most of the study that were related to some project, when you look at the COSIA, it look as cumulative impact assessment on the original scale. So, I have to say yes.

MR. DUNCANSON: Okay. Duncanson speaking. In the cases where you have been involved in cumulative effects assessment, such as the COSIA example you just gave in the Alberta oil sands, those were situations where the regulatory framework required a cumulative effects assessment for the type of activity being proposed, correct?

MR. BOUTIN: Are you referring to the underlying regulations that would -- like, please repeat the question.

MR. DUNCANSON: Duncanson. So, my question was in the circumstances in which you have conducted cumulative effects assessments, can you confirm that those were circumstances in which cumulative effects assessments were required for that project under the regulatory framework?

MR. BOUTIN: Boutin speaking. For the COSIA project, it was an initiative taken by COSIA, which is the Canadian Oil Sands Innovation Alliance, so, it wasn't regulatory driven on that specific case, yeah.

MR. DUNCANSON: Duncanson speaking. So, sir, COSIA is perhaps a bit of an anomaly in that that actually isn't a project. COSIA is a consortium of oil sands operators that are coming together to share knowledge and science. For the circumstances in which you have been involved in conducting a cumulative effects assessment for a specific project, would you agree that in those circumstances, a cumulative effect assessment was required under the regulatory framework for that project?

MR. BOUTIN: Boutin speaking. I'm going to have to take that into consideration, the way that you framed your question, because it's unclear to me what exactly you're -- you're asking.

MR. WILLIAMS: Williams speaking and just -- Mr. Duncanson, the confusion may be, are -- in terms of the term regulatory framework, are you talking the laws? Are you talking a request or guideline from a decision maker? There is a difference, and it would just be helpful for you to clarify, I think, for the witness.

MR. DUNCANSON: Duncanson speaking. I'm actually not sure I fully understand Mr. Williams' comments, so maybe what I'll do is I'll continue on and come back to that point.

Mr. Boutin, would you consider yourself an expert cumulative effects practitioner?

MR. BOUTIN: I would consider myself as an expert in hydrogeology and the hydrogeological component of the cumulative impact assessment portion of the -- yeah.

MR. DUNCANSON: Duncanson. And are you familiar with guidance that has been offered around sort of how to scope cumulative effects assessments across Canada? And what I'm -- what I'm particularly interested in is the concept that a cumulative effects assessment, when such assessment is conducted, should consider quote "reasonably foreseeable future projects"? End Quote.

MR. BOUTIN: Boutin speaking. Yes, I am. And foreseeable, reasonable yeah be reasonably that the -- the proportion of that definition entails to if it's foreseeable, and I think I know where you're going with this, which is fine, and you can have some question whether is foreseeable or not. What's -- what is a fact is that when you drill a hole and you're creating some pathways that are irreversible, then it means that the time, foreseeable, you need to define that right. Is it foreseeable for yourself that you're going to look in 20 years, it's foreseeable, or you're talking about the timers on the 50 years? Or anything else. So, I think it's subjective depending on what you're talking about. We're talking about rock formation that took hundreds of thousands of years to develop. Foreseeable comes into play in the planned development case where it does consider the effect that are foreseeable and that's really loose in the sense that back in -- in the days when there was a publication in a paper that say we're going to be putting a project 200,000 barrel project in this area of the province, then you need to take that into consideration to some degree. There is a high uncertainty with that forecast, but you still need to consider it. Hence why you need to do that plan development case of growth of the industry, growth of the population, of the industry, as I said, so yes, you need to foresee and run those simulations.

MR. DUNCANSON: Duncanson speaking.

And sir, I -- being mindful of everybody's time in the room, I don't want to belabor this point, but I do think when you're -- when you're making recommendations to the CEC about what a cumulative effects assessment would -- would look like fir a project like this, I think it is important for the CEC to understand the aspects of what you're recommending that go well beyond what would typically be done, even if a cumulative effects assessment was required. And Mr. Boutin, you would agree with me that there is well established guidance in Canada around cumulative effects assessment that talk about what future activities should be factored into an assessment. And things like possible future growth of population, possible changes in agricultural practices, possible future contamination, those are not things that are scoped into a cumulative effects assessment, because you don't know exactly what those things are going to look like. Instead what you look at, and you mentioned this, is you look at things like press releases to see what has been announced with sufficient precision that the -- whether it's Matrix, or AECOM, or whoever the consultant is, can actually factor that into their model. Isn't that right?

MR. BOUTIN: Boutin speaking. To some extent. So, I was referring to project in Alberta in an area where there wasn't any population growth, the Southern Athabasca Oil Sands region. So, it wasn't a factor at all in that case. So, the population growth wasn't considered, but the project pressure and the stressor on the system were.

If you go back to the groundwater management plan, the Southeast Regional Groundwater Plan, they explicitly say about the future condition and that should be used to -- to predict and make those prediction. So, in an area where most of the groundwater usage are an important proportion, that I don't have the exact number for, that is water supply for potable water, this is your main stressor of the system. You need to do -- consider that and you need to do -- you need to consider what's the growth, otherwise why are you planning sustainability if you're not taking into consideration the major usage of that aquifer. Doesn't make any sense.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And I think -- I think you confirmed what I was looking for in that response. Just to pick up on -- on one minor point, you mentioned a number of times in your responses just now, this view that what Sio's proposed project is doing is irreversible, and that that somehow changes the level of rigour that should be applied in cumulative effects assessment. But you would agree, Mr. Boutin, that any mining project, or for that matter almost any extractive resource project, will, by definition, cause irreversible changes to the geology underground. Right?

MR. BOUTIN: Boutin speaking. I do have to agree with this, but the nuance that you're not making is the fact that when you're doing a mining project, say an open pit mine, there's nobody that lives there. Right? You won't be putting your mine -- open pit mine, and there's going to be a house in the middle of it. So, the -- the nuance that I want to make is that in the case of Sio silica and the -- the part that is new here is that you're going to be mining something in the surrounding -- and you're going to be -- and that's the -- the difficulty of it is that you're sharing the resources. So, the sand that you're taking is the -- is the aquifer that does conduct a role of providing potable water to people. So, by mining it, you're -- there is a cohabitation going on between people that relies on this water for supply and the impact of mining. Whereas, in some other areas if you're talking about the irreversibility of the impact of a ground -- of a mine -- underground mine, one kilometre down there, the irreversibility of the geology there doesn't come in clash with the usage of groundwater for supply. Whereas in the case that we're looking at, there's two utilization of the resource simultaneously. You guys want -- the proponent wants to take the sand and the people that live there wants to drink the water. And there's that circle that there's both utilization of the resource simultaneously and -- and this is kind of what is difficult in this project in the sense that there is probably no regulation that set out what should be the guidelines for step back from residents, or how close should there be setbacks to a municipal supply well? Should it be the same with the resident well? So, there's a lot of question to me that are unanswered. But to go back to your initial question, the use -- well, the utilization of the resource from a mining project and you're comparing this -- it's not apple to apple. There is the use for domestic walls that you're cohabiting, like you're sharing the resources. You need to leave some sand in place so that the aquifer still be name an aquifer. So, I think that's the component that is in a grey area in the nuance.

MR. DUNCANSON: Duncanson speaking. Sir, I will -- I will refrain from debating with you about whether this concept of shared resources and resource development in proximity to residences is, in fact, very common across the country.

But I'm going to talk briefly -- I've only got a few questions left for you. First, you referenced this morning the CEC report for the Pembina Valley project. Do you ---

MR. BOUTIN: Boutin speaking. Yes I do.

MR. DUNCANSON: Duncanson. In that report, you mentioned certain recommendations that the CEC made to the province around cumulative effects assessments for certain future projects. Do you know if the government has taken any steps to implement those recommendations?

MR. BOUTIN: Boutin speaking. I don't recall the exact statement that I used in terms of report or reference, but I'll take it that that's what I said exactly. But I would have to look at the exact text to tell you what the recommendation was. I was referring to that report that -- and my understanding of what was reported in there. So, it was kind of a summary of -- of what was recommended.

MR. DUNCANSON: Duncanson. And just to be clear, Mr. Boutin, do you know what steps the Government of Manitoba has taken to implement the recommendations contained in that report.

MR. BOUTIN: Boutin -- Mr. Boutin speaking. No, I'm not -- I don't.

MR. DUNCANSON: Duncanson. Would you agree that the scope of Sio's proposed project is materially different than the scope of the Pembina Valley project that was considered in that proceeding?

MR. BOUTIN: Boutin speaking. Yes.

MR. DUNCANSON: Duncanson. And are you aware, Mr. Boutin, that the application for the Pembina Valley project was not supported by any groundwater modelling work?

MR. BOUTIN: Boutin speaking. I do believe so. I think I've looked at the documentation and that was one of -- in the CEC report, one of the discussion points to the fact that it wasn't -- that was poorly documented -- there was little scientific evidence of it, yes.

MR. DUNCANSON: Thank you. Duncanson speaking. Mr. Boutin, in your report, and you touched on this briefly in your presentation, but it's -- it's more fleshed out in your report, you discuss a variety of regional planning tools for cumulative effects and aquifer management. Things like regional cumulative effects assessments, integrated watershed management plans, you referenced the groundwater management section of the Manitoba Water Stewardship Branch, you talk about administrative controls on land use, as well as a strategic framework for sand extraction and drinking water aquifers. Would you agree that all of those things are beyond the scope of a project assessment like this and the responsibility of Sio Silica?

MR. BOUTIN: Boutin speaking. In developing those, I do agree, like, they cannot be responsible for developing that kind of -- of guidelines, and framework, and whatnot. Should they be actively participating into those utilities? Fair enough, I do think so.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. Are you aware that the RM of Springfield has already completed some of the work that you're recommending?

MR. BOUTIN: Boutin speaking. I listed the list of resources that I've identified, so, I'm not aware of any new development or any -- no, I'm not aware.

MR. DUNCANSON: That's fine. Duncanson speaking. Would you agree that the -- that the responsibility of regional groundwater resource management is the responsibility of the groundwater management section of the government?

MR. BOUTIN: Boutin speaking. Based on the framework and my understanding of the hierarchy and the pyramid and the way that it (inaudible), yes. I do agree.

MR. DUNCANSON: Duncanson speaking. Thank you, sir. I think I just have one final question for you. In response to questions of clarification for Mr. LeNeveu earlier this morning, you discussed groundwater reinjection as part of Sio's proposed project. Do you understand that Sio has been able to successfully reinject essentially all of the extracted groundwater that was produced during Sio's pilot extraction test?

MR. BOUTIN: Boutin speaking. I'm not aware of these details, but I thought your question was about reinjection or gravity feed terminology, but I understand that the idea is to -- gravity feed in my opinion, and it can be talked about reinjection. We're not -- not talking about injecting some pressure in the system, so, I think we're clear there. Just wanted to make that nuance. I'm a little bit surprised though, that you're saying that 100 percent of the water that was produced would be rejected, because I think in your documentation you're saying that around the grain -- between the grains, there's residual water content. Right? That you cannot extract from the grain because it's just not by gravity. So, you would have to evaporate that water to remove it from the grain. So, in ideal condition if you're producing some sand and water, you're going to be able to reinject a majority of the water, which I would -- I would agree and I'm -- I would expect that we are able to salvage maybe -- maybe it's not the wrong word but reinject 85 percent of the water at least -- not at least, at it. So, you're basically -- the portion of water that is not drainable will stay with a grain of salt -- of sand, therefore, you're going to lose it. So when I described earlier on the predictive simulation that was done that was conservative, of using these zero percent scenario, it was because, like I said, is a hypothetical scenario. And we should expect that there is an important proportion of the water that's going to be rejected. And that's why I haven't flagged this as a concern. Back to the principal concern, which is the collapse of the shale and the fracturation of the limestone, and not the rejection or the -- that component of the project.

MR. DUNCANSON: Thank you, sir. Duncanson speaking. And I just want to make sure that we're -- we're clear, it's possible that I misheard it this morning when you were talking with Mr. LeNeveu. It seemed like you were expressing some skepticism around the gravity reinjection of water and -- and now it sounds like perhaps -- perhaps not. And my question was -- was simply to ask whether you were aware that, in fact, this gravity feed water had been part of Sio's extraction plans and it was proven to be successful.

MR. BOUTIN: I'm not aware of this and -- yeah, my intention again, I tried to explain as explicitly as possible of why we would use a conservative approach of not reinjecting the water for sustainability evaluation. I haven't said that it would be unlikely or whatever. I think it's pretty clear from the proponent approach that they intend -- otherwise they wouldn't invest in the filtration unit, UV unit, and whatnot, if you don't have any intention to return the water back. And what I said is that if you got two tanks on surface, if you're not reinjecting the water, you won't be able to produce, you're going to -- always going to be stopped. So, it doesn't make any sense. So, I -- hopefully, it's clear now.

MR. DUNCANSON: Yes, thank you, sir. Duncanson speaking. I think that does clear it up well. So, I appreciate you being patient with me and answering all my questions today. And Mr. Chair, that's -- that's all that I have.

THE CHAIRMAN: Chair thank you both very much. Mr. Boutin, my -- my congratulations to you for sustaining an excess of 135 minutes of questioning. And I will ask Mr. Williams if he wishes to redirect, at the risk of fulfilling Parkinson's law, and that is the time expands to -- the work expands to fill the time available for its completion, as we have almost run out the day.

MR. WILLIAMS: Williams speaking. And I'm relatively optimistic it can be three questions or -- or less. And I'll make sure that we don't expand to the end of the day.

Mr. Boutin, you recall a question or two from my friend, Mr. Duncanson, about the model domain that was used for the Southeast Regional Ground Management Plan? You remember that, sir?

MR. BOUTIN: Speaking. Yes.

MR. WILLIAMS: And I wonder, Mr. Boutin, if you could pull up PDF page 12 of the Southeast Regional Ground Management Plan, please? Any of those pages will do. But Mr. Boutin, in terms of the domain of the Southeast Regional Ground Management Plan, would it be presented on this page? Sorry, let me try this again. In terms of the model domain underlying the numerical model for the Southeast Region Ground Management Plan, would that model domain beyond this page?

MR. BOUTIN: Boutin speaking. The model domain is not on this page, but if you look carefully and look at light colour and dark colour, you can understand and identify that the outline of the model domain that I presented earlier correspond to the part of this figure that is darker colour. So, hope it answer your question.

MR. WILLIAMS: Thank you. And if we went back to Slide 18 of your PowerPoint presentation, if I could ask you to go there. Where is that model domain that was used to underlie the Southeast Regional Ground Management Plan? Where is it presented?

MR. BOUTIN: Boutin speaking. This would be Wang 2008, which would be the orange outline. And you see most of it on the main plan, and the -- the northernmost tip is cut off and it is better shown in the inset map on the top right corner here.

MR. WILLIAMS: Williams speaking. I have no further questions. I think I was four rather than three, so I apologize for that.

THE CHAIRMAN: Chair. I wasn't counting. They were short snappers, so, that's all good.

Mr. Secretary, is there anything else that I've missed for today, or are we indeed adjourned?

Folks, thank you very much for your attention today. We will reconvene at 9:30 tomorrow morning, when MSSAC will have the stage, figuratively.

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March 8, 2023