JOINT REVIEW PANEL PUBLIC HEARING

IN THE MATTER OF Application Nos. 1844520, 1902073, 001-00403427, 001-00403428, 001-00403429, 001-00403430, 001-00403431, MSL160757, MSL160758, and LOC160842 to the Alberta Energy Regulator

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GRASSY MOUNTAIN COAL PROJECT - BENGA MINING LIMITED

VOLUME 20

VIA REMOTE VIDEO

November 20, 2020

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H. Matthews	Hearing Commissioner
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	J. Gourlay-Vallance	For Eco-Elders for Climate Action
	L. Peterson	For Trout Unlimited Canada

R. Campbell	For Coal Association of Canada
(No Counsel)	For Alistair Des Moulins
(No Counsel)	For David McIntyre
(No Counsel)	For Fred Bradley
(No Counsel)	For Gail Des Moulins
(No Counsel)	For Ken Allred
(Not Present)	
(No Counsel)	For Monica Field
S. Frank	For Oldman Watershed Council
A. Hurly	
A. Porco, CSR(A)	Official Court Reporter

(PROCEEDINGS COMMENCED AT 9:00 AM)

Discussion

THE CHAIR: Good morning, everyone.

Just a reminder that live audio and video streams and video recordings of this proceeding are available to the public through the AER's website and YouTube.

Anyone in the virtual hearing room with their camera or microphone turned on will be captured, and images and recordings of you and your surroundings will be broadcast to a publicly available YouTube video. If you have concerns about this, please contact counsel well in advance of the time you're scheduled to participate to explain your concerns. We'll make best efforts to try and accommodate your concerns considering the need for an open and transparent public process.

Are there any preliminary matters before we return to Mr. O'Gorman's questioning?

Okay. I'll just note that Benga has filed responses to Undertaking Number 19 and Number 21. Undertaking Number 19 was related to confidence intervals for westslope cutthroat trout, and I don't know if it's up yet, but it will be posted as CIAR 877.

Benga response to Undertaking 21 was a revised version of the Nautilus report as an outcome of Mr. O'Gorman's questioning yesterday afternoon, and it will be posted as CIAR Number 878.

With that, Mr. O'Gorman, you can continue.

MR. O'GORMAN: Thank you, Mr. Chair.

GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT, CORY BETTLES, DAVID DEFOREST, SOREN JENSEN, MARTIN DAVIES, LEIF BURGE, DAN BEWLEY, Previously

Affirmed
STEPHEN DAY, NANCY GRAINGER, Previously Sworn
(Water, including surface and groundwater management, quantity and quality, selenium management and aquatic resources, including fish and fish habitat and fish species at risk)
Alberta Energy Regulator Staff and Panel Questions
Benga Mining Limited

Q MR. O'GORMAN: Good morning, everyone. Mr. Houston.

A MR. HOUSTON: Good morning, Mr. O'Gorman.

Q I want to say thank you to you guys for really quickly turning around the updates to the Nautilus study. We just received it, so I'm going to take a look at it on the lunch break, and some of my experts are also going to take a look at it this morning, so we're not going to come right back to that right now, but I expect I'll want to ask you about it this afternoon, if that's okay.

So carrying on. We'll start off a little more -- maybe a bit more easy to handle first thing in the morning.

MR. O'GORMAN: Can we please call up CIAR 69. It's Addendum 5, Zoom Host. And -- oh, sorry. I'm actually -- sorry. I was on the wrong page. I need to start with CIAR 42, Section C, and go to PDF 81.

Q MR. O'GORMAN: I'm going to have a couple of quick questions, Mr. Houston, about the project water demand.

MR. O'GORMAN: So it's CIAR 42, Section C, PDF 81. That's good. Can you scan down to the bottom of the page, please? Actually, we sort of see it -- sorry. Scan down a bit. That's fine. So right close to the middle of that page.

Q MR. O'GORMAN: Mr. Houston, this was back in your original EIS submissions, the CIAR 42. Originally. Right where we see that dotted -- actually, we see the cursor pointing, we see a line that says the nominal water makeup requirement for the coal processing plant is 110 litres per raw metric tonne; correct?

A MR. HOUSTON: I'm having trouble seeing the cursor.

Q It's right where -- I see the -- it's the sentence where the asterisk is pointing. It's about 60 percent of it --

A Oh, yeah. Okay.

Q Sorry. I realize it's now -- it's the sentence where my pointer is pointing, not the Zoom host. Apologize for that.

A I was questioning my -- my eyesight. I think I'll change my glasses.

Q All right. My bad. It was my pointer.
So you see the 110 metres per raw metric tonne value?
A Yes, yes.
Q Okay. So that's what we had when you originally submitted your EIS.
MR. O'GORMAN: We'll take that down, please, Zoom Host, and we'll call up what I asked for the last time, which is CIAR 69, Addendum 5, and we'll look at page 250, PDF 250. If we scan down this page a little bit. Scan down, please. Scan down. Okay. So there we go. And just below. No. Okay.
Q MR. O'GORMAN: Now you see it illustrated.
So after we received the original EIS submission, our water demand and water use folks were looking at Addendum 2 and then Addendum 5. We did receive some updated info, and that -- in between those two documents, you incorporated water recycling and reuse strategies into the mine's proposed operations as a measure to reduce operational water requirements --
THE COURT REPORTER: Excuse me, Mr. O'Gorman.
Q MR. O'GORMAN: -- (INDISCERNIBLE - OVERLAPPING SPEAKERS) measures with incorporating the coarse reject centrifuge --
THE COURT REPORTER: Excuse me. Excuse me, Mr. O'Gorman.

MR. O'GORMAN: Yes?
THE COURT REPORTER: Hi. It's Angela, the court reporter. I'm having an awful time hearing you this morning. I can't hear you. Can I just get you to speak up, please, and maybe start that question again?
MR. O'GORMAN: Okay. Maybe I'll -- I'll try and project a little bit more. I seem to be having some sort of problem with this microphone, so I apologize. How's that?
Q MR. O'GORMAN: Okay. So in a nutshell, after incorporating the plans for the coarse reject centrifuge into your water requirements, we then, in this document, found that the CHPP would require approximately 57 litres per raw metric tonne; is that right? Compared to the 110 value we had seen early on?
A MR. MCCOY: Mr. O'Gorman, it's Dane McCoy here.
Q Hi, Mr. McCoy.
A There were -- we'll confirm that, yes, the -- the -- the new value was 57 litres, and it was -- in an -- in an attempt to make the -- the CHPP more -- more -- have more water recovery, process changes were made, and -- and with the -- with the additions that we incorporated, the -- the value went down, that 57 litres per -- per metric tonne.

Q Okay. Thanks, Mr. McCoy.

I'm going to call up one other document from your submissions.

MR. O 'GORMAN: Actually, it's in this document, Zoom Host. If we can scan down to PDF 329.

Q MR. O 'GORMAN: I think -- and remember, gentlemen, we're on Addendum 5.

So right in the middle of this diagram -- actually, almost exactly in the middle, we see a -- a small object called the "coarse reject centrifuge" with a water flow that comes out of it of 174,000 or million litres per year? Some people use 'M' as thousands and some people use 'M' as millions.

So can you confirm, Mr. McCoy, or someone, what you believe that is?

A MR. HOUSTON: I believe that's million, Mr. O'Gorman.

Q I think in this figure, someone's using 'M' as thousand. 174, I think that's thousands, actually.

But would it be millions per year?

A MR. YOUL: Mr. O'Gorman, Mike Youl here. I can jump in, if you like.

Q A hundred --

A Can you hear me okay?

Q Yeah.

A Right. So we typically talk in megalitres, which is a

thousand cubic metres, so 140 -- 174 megalitres of water --

Q Ah, right. You're right.

A -- can recycle back in. Okay?

Q Okay. You're right, it's megalitres, so it's 100,000 cubic metres?

A Yeah.

Q Okay. Great. So I guess what we wanted to check with you is can you clarify or confirm, is that where the difference arose between the two different values that were submitted around the CHPP water demand?

A It was a combination -- sorry.

Q Go ahead.

A It was a combination of that plus recycling approximately, if my memory serves me correct, about 30 megalitres a year of water that we recover that is free-draining water coming out of the conveyor belt spinning the reject bin, and also as the reject bin fills up and the trucks are under it -- under it, you often get a bit of free water coming out of that that's separating from the -- the rejects, and we collect that in a drain, in a sump, and then recycle that back in -- back in, so the reduction is a combination of those two improvements.

Q Okay. Did you just say an extra 30 megalitres? I'm not sure I heard that.

A Yes.
Q Okay.
A Yes. 30.
Q So --
A Three zero.
Q So most of the reduction, you know, seven-eighths or so of the reduction, comes from the coarse reject centrifuge; is that right?
A That's correct.
Q Yeah, roughly. Okay. That's good.

MR. O'GORMAN: Let's call up please, Zoom Host -- in the same document, let's just go back to PDF 293.

Okay. If we can expand this a little bit, please.

And in this page -- then if we can scan down. Oh, no, sorry we're looking at it. So the -- no, scan back up a little bit please, Zoom Host.

Q MR. O'GORMAN: So the question we -- we had asked in this information request -- you see it written there -- was to discuss contingencies that might be needed in the event of component outages in proposed dewatering process. And you -- you see that you responded -- you -- your operating procedures for the CHPP did have contingency plans. You did say that if that particular situation occurs, the feed rate will be either reduced or stopped until the outage is resolved.

So is that still correct? Is that still your thinking, or do you have -- have you revised your plans on that front?

A MR. YOUL: That's still the thinking, Mr. O'Gorman. If there's not enough water there, we'd either slow the plant down or stop it altogether.

Q Okay. Great. So now I'm wondering if you can tell us whether you have yet selected the dewatering system that you plan to use at the mine? And if you have, have you studied the reliability of this proposed system?

A We have, yes. So the actual exact make and model of components of the dewatering system is still subject to going out to tender and -- and out to the various suppliers, but in general terms, the -- the dewatering through the plant is tried and proven technology. (INDISCERNIBLE), who are our process plant designers, have built many of these plants, and the plant that we'll be installing at Grassy Mountain is very similar to quite a few plants that have been built in recent years. With the exception -- I will point out -- the only new piece of gear is the hyperbaric disc filter, and this was chosen as an alternative to a thermal dryer.

Q Okay. That's good. And, again, are you -- are you confident that this system can be relied on to

consistently provide the desired recycled water stream which you are planning for?

A Yes, absolutely. The -- the technology being employed through screens, vibrating centrifuges, belt press filters, sieve bends, these are all commonly found throughout processing plants through the world.

Q Okay. This particular system, there are other examples of it --

A Yes.

Q -- being used in other plants? Okay.

A Yes. Yes. As I said, the only exception is the hyperbaric disc filter, but that's been used in many other processing installations. Not necessarily in coal but in concentrates -- metal concentrates dealing with fine -- fine particles.

Q Okay. So let's assume that you do experience some operational challenges with it and it doesn't perform as well as you expect, are there any particular other measures that you could then employ to get that extra water, other than applying for additional water allocations?

A We -- yeah, we have looked at this. There are alternatives. Now, what -- I guess the -- the main increase in water recovery or decrease in water consumption, as you pointed out, was through the installation of the centrifuge on the coarse rejects.

And -- and I think I mentioned to Ms. -- Ms. Janusz yesterday that that centrifuge is identical to the centrifuge we had on the product stream, just on the reject stream, and that's purely there for water recovery.

Should we need to push further, there's quite a lot of tweaking we can do with the -- the speed and pressure the centrifuges operate at. The -- the downside of that is where, so that's an operational tradeoff. But if it's all in the name of saving water and that's -- and that has to be done, that's -- that's the direction we'll go.

Yeah. As I said, the pressures, the dimensions of the centrifuge. We also -- in the hyperbaric disc filter there's an option to fit a steam hood to that, which further increases the internal pressure of that to reduce water consumption. And we can look at just larger -- more -- more equipment, which would have an impact on the plant footprint. But there's quite a few options there to -- to deal with water recovery.

Q Okay. Thank you, Mr. --

A MR. HOUSTON: I could --

Q Oh, go ahead.

A I could just add a little bit, Mr. O'Gorman. It would be normal during the detailed design to do a reliability study, and that would drive, you know, the

decisions to have standby units, for example, available to -- to ensure that we do have a reliable operation. But that -- that would come during the detail design.

Q Okay. Thanks. Standby units, not -- not a standby entire centrifuge, though?

A Just -- just -- just to ensure that we have maintenance capabilities or -- or reliability that would -- would meet the needs of the -- of the process. So -- because that would depend on engineering decisions at the time after a reliability study was done.

Q Okay. Thank you, Mr. Houston and Mr. Youl. And, yes, I should -- actually, I meant to acknowledge before I started this -- this round of questions, Ms. Janusz almost beat me to it and managed to take this one out of my package. She went partway down the road but it didn't take us all the way home, so finally, I will ask you my last question in this theme, which is: Can you confirm whether or not you anticipate the need for additional water allocations, either during the operation of the mine, during start-up years, for example , while you're having the raw water pond fill?

A MR. MCCOY: Mr. O'Gorman, it's Dane McCoy again.

I think with the -- with the water allocations that have been -- with the volumes that are anticipated and the allocations that are -- have been applied for,

we do have a -- a bit of contingency within those volumes, so we're at -- at this point, you know, with the -- you know, the reliability of the -- of the equipment getting -- performing as -- as a -- projected, I think Benga believes that the amount of water that's been applied for is -- is and will be sufficient for the -- for the project.

Q Okay. Thank you, Mr. McCoy and everyone. That's it for that group of questions. I appreciate your answers there.

I'm now going to take us to a series of questions on hydrology. If your hydrologists want to get warmed up.

MR. O'GORMAN: Ms. Porco, how's my volume now? I'm doing the best I can. Sorry.

Okay. So I'm going to go through a bit of a preamble, but in the meantime, Zoom Host, if you could please call up CIAR 360, which was Addendum 12, and take us to page 30. We're going to pop around that -- that document a bit.

Q MR. O'GORMAN: And while that's coming up, I'm going to begin my -- my question for you folks.

Mr. Houston, it's up to you who wants to answer this. It may or may not be considered an overly technical question. Some parts of it will be, though, and I think will need your hydrologists to respond.

Okay. So let me provide a brief background. Benga's use of water allocation transfers for this project is going to carry certain implications. One of them is a requirement that water conservation objectives or instream flow objectives on the key rivers and creeks are going to have to be met. That's going to imply that you must release water to augment flows when flows fall below certain critical levels in the Crowsnest River and Blairmore and Gold Creeks.

Now, my good friends our hydrologists at the AER have been -- have issued questions to you about this issue, trying to firm up what we need to understand going back to before the Panel was appointed, so with -- when you were just responding to staff IRs before the Panel became involved, but then even with the Panel, we've issued you a couple of IRs, including most recently in Addendum 12, which you just responded to some months ago.

So in this Addendum 12, which I've asked -- we will be taking a closer look at, you did finally give us a couple of the key -- a couple of the numbers that we need to cross the finish line on this one. We saw some of these critical flows that we need to understand for both Crowsnest River and Blairmore Creek. We -- I'll point out, and this was explained --

MR. O'GORMAN: If we want to scroll up a bit,

please, Zoom Host, so we show -- it was IR 7.3. Just go to the beginning of our ask where we -- just, you know, scroll up pages. Yeah. And there, if you go a bit farther up, you'll see where the IR itself begins. Go up one more page. Okay. That's where your response begins, so that's fine.

Actually, leave it on -- that's -- that's good.

Q MR. O'GORMAN: So there are a couple of different approaches that one could take to identify the critical flows and the release requirements. We discussed several of them, and when we issued this IR, we provided some detailed calculation guidelines to attempt to steer you in the direction of producing the numbers that we need.

You, in your response -- which I won't show on the screen right now -- but you adopted essentially an approach in which you tied the critical flows to be based on avoiding a greater than 10 percent loss in area-weighted suitability habitat in Blairmore and Gold Creeks, and that includes maintaining certain minimum monthly discharges for key bio periods. You fleshed that it in your response. I'm sure you remember that, Mr. Houston.

I'm going to point out that when, Mr. Houston, you and I spoke, what -- what feels like a year ago in the climate change section of questions, and I pointed --

you know, we had some -- I think "disagreement" is too strong a word, but we had a different interpretation, maybe, of what we had asked you in this IR; and in rereading it, it seems that you, Benga, interpreted the IR to really focus on the scenario we proposed in here about a shutdown of the SBZ.

And in your response -- so to be clear, we put the scenario of the shutdown in the SBZ to motivate you to why we needed the numbers for Blairmore Creek. The Gold Creek request in here had nothing to do with a shutdown in the SBZ. So when you responded, No flow augmentation to Gold Creek will be undertaken, we were -- interpreted that as, oh, you're not -- you're not augmenting Gold Creek, and you were -- I think were saying you're not augmenting Gold Creek just because there's an SBZ shutdown. That explains our -- you're nodding your head so I see you're --

A MR. HOUSTON: Yeah. I agree. I remember the discussion. And you can imagine immediately after that, during a break I went back and read the entire IR, so I'm -- I'm with you.

Q Okay. Okay. So that's my preamble. Let's begin. In your IR response that we're looking at, you did provide us with a flow-mitigation plan. I don't think we need to look at a particular -- we can go to PDF 30 in here, five pages later, please, near the bottom of the page.

Okay. So in the proposed mitigation plan that you provided us, you did provide a rationale for explaining: (as read)

> Where project impacts on fish habitat in Blairmore Creek would be more than 10 percent if flows were below .07 cubic metres per second from August to April and .19 cubic metres per second from May to July.

You -- does that make -- do you remember that? You see those numbers?

A Yes. Yes, I'm following.

Q Okay. Okay. You proposed that you would supplement flows to Blairmore Creek by up to .07 cubic metres per second from sediment ponds and pit seepage. This is described over the next couple of pages. Does that sound right still?

A Yes.

Q Okay. So let's scroll up, please, to PDF 26, four pages before this one. Okay. And if we scan down. Scan down. Where did we say this? If I scan down a little bit farther, please. I did write -- oh, second paragraph from the bottom. EBFs using -- there we go. The final sentence in that paragraph, second paragraph from the bottom, that says that: (as read)

> The EBF [environmental base flow] minimum release rate will likely be required to be

proportional to the project footprint in each creek's watershed as illustrated in sample calculations that we'll give a little bit later.

So I want to clarify something with you, please. In your response here, and going forward, are you committing that you, Benga, will supplement the full flow shortfall below -- in -- in Blairmore Creek below the critical thresholds of .07, .19 cubic metres per seconds irrespective of the magnitude and duration of that shortfall.

A Give us a minute, Mr. O'Gorman, to formulate a good answer.

Q Sure. By all means.

A DR. BEWLEY: Hi, Mr. O'Gorman. This is Dan Bewley. Nice to meet you.

Q Hi, Mr. Bewley.

A How are you doing?

Q Good. How are you this morning?

A Good. I've only had one coffee, so I'm still waking up. I --

Q I've had five.

A You are far ahead of me, sir.

Okay. So I was involved in this particular response from a point of view of instream flow needs in some of the calculations that you see here. It's --

it's definitely an important question. If we get into kind of questions related to mitigation scenarios and kind of water volumes in those different scenarios, I may divert to someone else, but I can just talk from a kind of instream flow needs as a protection level for the fish aspect on this.

I'm going to try a slightly unusual tactic here to begin. I just want to -- a minute or two for some preamble.

Zoom Host, can we bring up CIAR 543, page 141.

And I should just kind of add some context here. Myself and Mr. Bettles were responsible for writing the instream flow assessment, and this instream flow assessment was critically reviewed by Mr. Allan Locke. And just for context, Mr. Allan Locke was one of the -- the authors of the Alberta desktop method, and I really appreciate his contributions to the review and the discussion that we're having today.

Once we get there, we'll kind of home in on one of his recommendations, and I fully agree with this recommendation. So this is CIAR 553 and -- 553, page 141. That's right. Top paragraph.

So just for some context, when we -- when we deal with instream flow needs, there's various ways of doing this. There is a coarse level way of doing it, just on a desktop basis. There's no fieldwork involved. There

is also a very detailed way of doing it with field measurements, and that's the route that we ultimately went down.

In terms of a coarse level assessment, there's various thresholds out there. Mr. O'Gorman, you introduced one this morning, a 10 percent significant loss of habitat over a particular period. There are other thresholds out there at various jurisdictions. So one is the -- the federal threshold, and it's -- it's in much of the documentation. The federal -- DFO threshold is essentially once you go below the 30 percent mean annual discharge level, then essentially any project-related impacts have to be mitigated for.

There is also the provincial level -- environmental base-flow cutoff level, which basically is -- originates from the Alberta desktop method. And basically what the Alberta desktop method says is in your driest 20 percent of conditions for any given week or year, if there are project impacts on flow in that driest 20 percent of the year, then those losses due to the project must be mitigated. Okay? There's -- there's all these various different thresholds.

And Mr. Locke's good recommendation is that we need to -- we need to have a discussion on what is that best or most optimal environmental base flow or cutoff

for this project, given that there are different jurisdictions and they each have their own protection level at that very low-flow level.

The one -- the one reason why we did a detailed assessment is because, you know, these -- these desktop methods are great if you don't have much data. But if we're dealing with something of high significance -- in our case, the trout -- then we really need to dial into a detailed flow assessment. Right? And just really get the most amount of information as to what the flows are and all the different reaches and what are the life stages and the fish suitability for those life stages.

So our scope was to identify the residual impacts on each life stage of the trout for each reach, and you see that in some of the calculations. That supersedes any kind of desktop-level method that we're dealing with. So where -- we want to be careful when we're, you know, saying that we're -- we're using these coarse-level desktop methods in this discussion.

I should also note that Mr. Locke -- also , one of his great recommendations was to point us to an updated version of the Alberta desktop method that has just come out in the last 12 months. I believe it's called the Alberta Water Directive Guidelines. So sorry for the long preamble. Just to kind of add that to the -- the discussion, Mr. O'Gorman.

So I guess just to kind of carry the question on. Yeah. So there is the scenario that the SBZ shuts down and our calculations were to, you know, figure out using these coarse-level thresholds that we believe should be improved using our detailed method, yes, essentially, the -- the folks here at Benga crunched the maths and they basically said there's this water available in the ponds that, you know, over a given amount of time -- I think it's -- it's 50-something days maximum period worst case ever that this saturated backfill zone may shut down and flows in Blairmore Creek need to be supplemented, that they would meet that 30 percent MAD level in Blairmore to satisfy the -- the base component of the instream flow needs using that desktop method that we think should be updated with our detailed assessment. Okay?

Q Okay.

A Yeah. Do you want to guide me on to ...

Q Well, I mean I'll take you back to the question. In the IR response -- and so first I'll acknowledge everything that you just said are things that have been discussed on the record. We understand there are desktop methods. We understand, instead, you're proposing something based on your instream flow assessment. I'm not really at this point challenging you on that. We acknowledge those are different

approaches that -- we've said you've proposed that approach, so I'm just going with that approach.

And in the -- in the response that you gave us you did say that you would supplement flows up to the .07 and .19 metres cubed per second. And I just wanted to confirm, are you committing to doing that irrespective of the magnitude of duration, or are you not?

A MR. HOUSTON: So the answer's: Yes, Mr. O'Gorman, we are committing to do that. We -- of course, if the saturated backfill zone isn't shut down, we need to recognize that that is in respect of Blairmore Creek.

Q Yes.

A That saturated backfill zone is a huge water storage element in the water management plan and -- and so one can draw that down. It -- if it's out of service, then I -- I think the -- the limitations on how long one can tolerate that -- that situation are -- are limited, but we would commit to providing the .07 flow rate during that time.

Q Okay. Thank you, Mr. Houston.

And the higher value at the different times of the year, which was .19, as I recall?

A It -- yes, I'm -- I'm sorry. We would -- we would meet the requirements.

Q Okay.

A Yeah.

Q Okay. Thanks, Mr. Houston.

Let's move on to a slightly different aspect of this question. So as I think I alluded to in my long preamble, we still need -- I think I said we were two-thirds of the way home. We had critical flows for Crowsnest, and there just was a lot of conservation objective there that you addressed. We had -- now had critical flows for Blairmore, but we still don't have this critical flow information we need for Gold Creek. In fact, we interpreted your response as saying you weren't going to augment flows to Gold Creek as -- that you didn't have that for us.

So I did note, Mr. Houston, several times, and I'm not going to try and -- and I won't try and find the transcript references, but you have spoke through this process about your plans -- small 'P' plans, not capital 'P' plans -- but your plans, your ability to augment flows from the sedimentation ponds into Gold Creek at times when flows were low. So you've spoken to that in a general sense, but what we need to understand is for -- again, motivated by your use of these water transfers, what the critical flows are and the potential flow augmentation that you will do into Gold Creek, and we actually need some detailed -- a sense of how you're going to do that.

So if I scan down in my notes -- sorry. I have a lot of notes on this.

MR. O'GORMAN: Let's call up, please, Zoom Host, CIAR 44, which is -- and we're going to look at your instream flow assessment. We're going to go to PDF page 84. That's several pages nearby. Great. If you can just expand just as an illustration that graph -- that figure at the bottom.

Q MR. O'GORMAN: We won't look at this other series of tables here. Actually, it's Dr. Bewley; is that right?

A DR. BEWLEY: Sure. Or Mr., whichever you prefer.

Q Okay. Did you prepare these?

A Yes.

Q Okay. Great.

So we have a series of figures that relate the AWS habitat to flow for different life stages of the westslope cutthroat trout. We have five different figures, one for a bunch -- you know, five different reaches on Gold Creek. We won't look at the others.

I will note that in the response you gave us to IR 73 -- 7.3 that we've been talking about earlier, you did illustrate one or two of these diagrams for the -- relating the AWS habitat to flow for Blairmore Creek. So that would -- this was -- this type of figure is an

important motivator, I think, in your -- your proposed approach.

And we're going -- so knowing that these exist, we're going to -- now go to, in the same document, PDF 252, please. Table A1.

So if we look at -- I think we wanted to look at GC-09.

MR. O'GORMAN: And blow it up a little bit, please, Zoom Host.

Q MR. O'GORMAN: So GC-09 -- and this is a projection you gave us for the maximum percent change in flow forecasted due to the project -- no, that's not -- not -- there. During operations.

MR. O'GORMAN: That's good. That's good, Zoom Host. Stay there.

Q MR. O'GORMAN: So you projected during operations at GC-09 the biggest percent change flow would be a decrease of 9 percent at -- at that station in Gold Creek. Is that right, Mr. Bewley? I think -- and I understand that that is in Reach 7, GC-09.

A DR. BEWLEY: Sorry. Which -- which page is this of this document?

Q It's PDF 252.

A I believe this is in the water temperature section. We have -- we have predicted changes in stream flow, and they show in page 26 of this PDF, I believe.

Q Let's take a look.
A So, yes, this shows the changes on Gold Creek at those various nodes. This is in average hydrological conditions, I believe. There's a corresponding table for dry hydrological conditions. But, yes, this is the -- kind of changes in flow predicted --
Q Okay.
A -- along Gold Creek.
MR. O'GORMAN: Can we scan down a little bit, Zoom Host, please, to see the time frame we're looking at here? This -- so -- you see -- okay. That's fine.
Q MR. O'GORMAN: So this starts in 2017 and goes to 2041, and then you see those sorts of fluctuations.
I'll -- I'll tell you what I'm getting at, Mr. Bewley, is what we wanted to see were actual numbers -- this figure, of course, we'd have to eyeball and guess what the number is. Actual numbers for your projected mean reduction in flow in Gold Creek. You -- in that table we looked at a minute ago -- and I recognize we were looking at the dry year column. But I think the normal year column on the other side of it also will show the same maximum reduction in flow at that station in Reach 7 in Gold Creek.
But we wanted to know what your mean percent change in reduction and flow due to the project is

during operations. And if I look at this figure, what I interpret you're saying, it decreases --

A DR. BEWLEY: Sure.

Q -- on a pretty steady path down to, actually, dropping the flow to more than 10 percent reduction at that --

A Yeah.

Q -- station, which is CO2?

A Essentially, you know, through operations as -- as the mine develops, water is increasingly lost through to the end of operations and then into this kind of two-year window of decommissioning in the early to mid-2040s, and then we get into that kind of closure phase thereon.

So, yeah, like, part of my discussion with Mr. Sawyer is getting into the -- the losses of habitat that are predicted based on these flow changes and the relationship of that to the kind of baseline amount of habitat available.

Q Right. And, of course, that's what we are interested in for this calculation as well. So that's interesting, but do you -- do you have -- do you have a table of numbers that would support this ?

A Of these flow values?

Q Yes.

A So this was obtained from SRK, and I would defer to Mr. Jensen to -- you know, if these values are

tabulated.
Q Mr. Jensen?
A MR. JENSEN: Yes. Hello, Mr. O'Gorman.
Q Hello.
A I'm trying to -- I'm trying recall if we did tabulate these, and I would probably say no. I -- I don't recall tabulating these numbers. I -- I think all we did was show them in an illustration like this.
Q Okay. Well, I'll pull back from looking at these specific numbers. Although I will ask -- maybe what we should do is --
MR. O'GORMAN: Let's go back to the AWS curve again, which is page 84, PDF 84, Zoom Host.
Q MR. O'GORMAN: So here what we're really looking for -- what we would like is for each reach to understand --
MR. O'GORMAN: Scan down a little bit, please, Zoom Host.
Q MR. O'GORMAN: What we would like to do is understand for each reach on Gold Creek what the percentage change in flow is that we can expect due to the project and, you know, a -- a graph that we have to eyeball where it -- the points might line up over on the -- on the y-axis makes that a challenge for our hydrologists.
When you gave us your response to IR 7.3, you did

sort of demonstrate that you do have a good sense through your -- your modelling and your instream flow assessment how habitat varies with flow for the different reaches and for different life stages. So this is what I'm going to ask you whether you can provide: If you can provide it -- I expect it would require an undertaking -- but I expect you're going to need to think, you know, is this something that you are able to provide for us? 'Cause this is the information that we need.

Can you please -- I'll read it out to be -- make sure I don't get -- get it wrong. Can you please provide for each reach and life stage during operations what is the flow below which the predicted change in flow due to your project will reduce habitat by more than 10 percent? And if you like, I can actually offer you a suggested formula for that calculation to guide your work. But the idea is here if you know what the average flows are and you know on average how your project is going to impact those flows, how -- at what point in reducing those flows from -- due to your project are you impacting the AWS habitat for the different reaches and bio periods to a degree that's greater than 10 percent. And that would be fundamentally, I think, related to this question I want to know of what is the critical flow?

A DR. BEWLEY: Okay. So I think I understand the question. Just to -- let's try this. Can we go to page 94, please, of this document. There we go. Okay. Let's just scroll along to the operations phase.

So what I think you're asking, Mr. O'Gorman, is we have columns in there that say "mean percent AWS", okay, and anything negative means that there is a residual impact on habitat due to the flow losses that have been predicted.

What I think you're asking is what are the flows that would cause those numbers that you see there, like negative 2 percent, 2 percent, 2 percent, 1 percent, 1 percent, what would be those change in flows that bring us to that 10 percent significance level. Okay? Is that the question?

Q I believe that it is. I do want to make sure my hydrologists agree with me, so they will get back to me, but I -- yeah, I mean, the whole point is at what point are you reducing the flows so you -- is your project reducing the flows so the AWS decreases by this critical -- as you've suggested, is the critical amount of loss of 10 percent. So, yes, we think that what you just said would get us to where we -- we need to be to come up with the critical flow.

A Okay. So I think we're on the same page. Just give me one moment, please.

A MR. HOUSTON: So -- so, Mr. O'Gorman, we're just discussing what we think you're asking for, and we're -- we're thinking this may be a -- a couple of days of work to -- to get back to you on this.

Is this fundamental for ongoing questions or --

Q Yeah. I'll jump in and respond to that, Mr. Houston. So, yes, this will require an undertaking. It would require some number crunching but not sort of months or weeks of remodelling or anything like that. It would just take some -- we think some elbow grease from your experts. It is not information I need to ask you more questions about.

So as -- if we could get this -- you know, like the other information request I had, I did want to ask you more questions about. This is just information that we are going to need going forward in the future to be able to evaluate if we have enough information about your flow augmentation strategy.

So if you could be -- put some folks to try and -- to work it out and submit it before the close of the evidentiary period, I think that would be sufficient for our purposes.

A I -- I think we can commit to that. I'm just going to check with Dr. Bewley to make sure that he's crystal clear on the request.

Q Well, I could -- I could clarify a bit more.

A Okay.
Q Let me -- let me just try and clarify again. I'll give it to you a couple ways.

In Gold Creek for each reach and life stage -- so those are, you know, broken down in those categories for everything they say -- we want to understand -- here's a couple of ways you could think about it. Given an 'X' percentage change in flow due to the project under what flows -- so below what flows, then, are the project impacts more than 10 percent impact to the AWS habitat?

A DR. BEWLEY: Just to be clear, Mr. O'Gorman, you're referring to the mean bio period that we see in the columns here, or do you mean the one-month maximum? They're slightly different.
Q Can we scan over to -- a bit, please, to the left side so I can see.
A I can -- I can clarify what that difference is, if you want me to.
Q Please do.

Yeah. So we were looking for each bio period -- each region bio period.

A So can we just --
Q On the bio stage.
A Yeah. Can we just scroll over to the decommission? And this is the easiest one to explain. Sorry,

decommission. That's right.

So there's -- there's two thresholds or metrics that we've used. There's a mean, and there's a one-month maximum. Mean is the more chronic, kind of long term, and the one-month maximum is more acute. So decommissioning 2043 to 2044.

And let's just take spawning as an example. Spawning occurs in May, June, July; okay? So that means that in May, June, and July of 2043 and 2044, we are calculating the habitat reductions in each of those six months, and we're calculating the mean in the mean column that you see here. The one-month maximum basically means in those six months of calculations, what is the one month with the highest loss of habitat; right? As an acute level of habitat -- residual habitat impact. So it's -- for this particular window, it's the one-month value versus, in this case, six months of values that are averaged, which you see in that mean column.

So, yeah, it's over to you whether you -- which -- which metric would you like?

Q The metric we'd like you to apply, Mr. Bewley, to the AWS figures is not the column we're looking at there, but the mean impacts on flow from the project during operations.

A Okay. So it's the -- the flow reduction that brings

you to the 10 percent level of mean habitat reduction. Okay.

And it's going to be five numbers per reach that we see here. I guess five flow reduction numbers per reach that give you that 10 percent.

Q Yeah, we want it by reach and by -- and by -- by life stage, yes.

A Okay.

Q So, yeah. That -- that would work for us.

And because this is obviously a confusing and technical calculation for all involved, we would like you, please, to be very explicit in explaining to us the methodology you use in coming up with these numbers and make sure -- I suppose it's obvious -- that you use real data with numbers as opposed to a -- a figure that we have to try and interpret.

A Okay. And the last question I have is: You indicated you had a formula that was available to help in these calculations?

Q Well, we sort of had a general sort of formula. Why don't I, you know, share the one I suggested to you?

A Sure.

Q Unless my hydrologist says not to. Okay. I'm going to go the -- if it helps to clarify, the idea we're thinking of -- and, obviously, I'm going to have to say this out, so -- I can't show it to you. But we're

talking about a percent reduction in habitat, right, for reduction in flow due to the project.

So if we think about the numerator of that equation for -- in the percent reduction, your AWS curves show a habitat -- you know, a habitat amount as a function of 'Q', as a function of the flow?

A Yeah.

Q So if you have your 'H' as a function of 'Q', where 'H' is habitat area and 'Q' is flow, and you subtract 'H' -- I'm from Newfoundland, and so I call it as "haitch" [phonetic], you'll have to forgive me -- 'H' is a function of 'Q' to the 1 minus 'K', where 'K' is the reduction in flow due to your project. Right?

So what's the -- what's the delta between the habitat number as a function of 'Q', subtract the habitat number as a function of the reduction in 'Q' due to your project, divide that by your denominator of the habitat as a function of 'Q', and you get the percent reduction in 'H' that we're looking for? And where does that take us to exceed 10 percent? And that will tell us something interesting, we think, about the critical flows in Gold Creek.

A Okay. Yeah. I will look into that and get some numbers.

A MR. HOUSTON: Okay. Well -- so am I correct that we're looking for delta 'Q' for the --

Q Delta 'H'.
A Delta 'Q' or delta 'H'?
Q Delta 'H' is a function of the change in 'Q'.
A DR. BEWLEY: So you're after the delta 'Q', I'm understanding?
Q Well, we do -- we want it for the two different 'Q's. We've got 'H' of Q1 and 'H' of Q2; right? Where Q1, right, is the -- the -- the flow, and Q2 is the reduction in flow the -- the reduced flow due to your project. That delta divided by your starting point, your 'H' of Q1.
A MR. HOUSTON: Okay.
Q We want to know, most importantly, obviously, when does the result of that calculation take you to greater than a 10 percent loss in 'H', or "haitch" as I call it?
A 'H' or "haitch"?
Q Either one will work.
A Okay.
Q But I'm the -- I'm the only person that will understand if you call it "haitch".
A Okay. I used to have a calculus professor who called it "haitch" too, so I'm used to that.

But I'm looking over at Dan here to see if 'H' is a characteristic of the reach, or is that something that varies on a smaller scale? 'Q' is a function of reach; I can understand that.

A DR. BEWLEY: Habitat varies between all the individual means or habitats, and this -- this approach basically uses sampling at a number of those representative meso habitats; okay?

These -- these calculations that you see here are essentially averaged over the -- the reach, but they -- they're weighted for the proportion of meso habitats. So if you have a riffle-dominated reach, then the loss of habitat will -- will essentially be weighted by what is the loss of habitat at our riffle-specific transects in a given reach; okay?

So -- but the numbers you see here are averaged over the reach, but they -- they weight what the reach looks like in terms of meso habitat composition.

Q Well, Mr. Bewley, we might need you to, you know, unaggre -- disaggregate them to do that calculation, so that's why we're hoping -- it'll take a little bit of elbow grease, we acknowledge, from you folks, but it is information that our hydrologists have been trying to understand for some time. And here we are at the hearing. We don't need to ask more questions about it, but we would appreciate it.

And, Mr. Houston, I'll ask you to confirm if you can commit to an undertaking to submit these numbers before the end of the evidentiary portion?

A MR. HOUSTON: I --

A DR. BEWLEY: Sorry. From a nonlegal background, what is that date, actually?
A MR. HOUSTON: The end of the month, roughly.
A DR. BEWLEY: That, I think, we can make work, yeah.
A MR. HOUSTON: Okay. We'll commit to that, Mr. O'Gorman, and we'll try to exceed your expectations, just in case there is some tweaking to the tables that is required.
Q That's great.
MR. O'GORMAN: Mr. Chair?
THE CHAIR: Okay. Can we get an undertaking number?
MS. UTTING: Mr. Chair, Tracy Utting, Panel manager. That would be CI -- oh, sorry. Undertaking Number 22.
THE CHAIR: Thank you.
Q MR. O'GORMAN: I'm going to -- I mean, I'm going to just incorporate in that, please, a detailed explanation of your calculation methodology.
A DR. BEWLEY: Sure. Yeah.
Q Okay. Okay. Thank you for that, Mr. Bewley and Mr. Houston.

So let's carry on with some more hydrology questions, but those -- that should be the -- that was the most number-intensive one.

MR. O'GORMAN: Okay. Can we please take this down, Zoom Host, and call up -- and we will go back to in -- a lot of these questions. Go back to CIAR 360. It's Addendum 12, and PDF page 36. We're still in the information request response to information -- IR 7.3. Yeah. That's good. Right there in the middle.

Q MR. O'GORMAN: The Crowsnest Pass -- the Crowsnest River water conservation objective.

So in this IR response, in this part, you did provide a minimal release rate of 500 -- about 500 cubic metres per day from the site to help satisfy the water conservation objective for the Crowsnest River. However, in this response, you didn't provide us with a mention of how this was going to be handled during the winter period when the water -- the WSC hydrometrics station, affectionally known as "05AA008", and that information is in here somewhere. Those in the know know that station. It does not, in the winter, have near real-team data, so it's not reporting flow data in here real time, which is a familiar concept, I think, to Alberta hydrologists.

So I will ask you a question: Can you tell me how you're going to monitor the water conservation objective in Crowsnest River at the Frank -- at the Frank station during the winter when that Water Survey of Canada station does not report on a near real-time

basis?

A MR. HOUSTON: That -- that's a good question, Mr. O'Gorman. I'm wondering because that -- the issue must be live today with or without this.

Are you on mute?

Must be live today with -- without our project, and -- and so I'm wondering how that is done today and -- and, you know, how -- how is that managed today. That -- that's what's going through my head. This is an issue with or without the project is, I guess, what I'm thinking.

Q I do know the answer to your question, Mr. Houston, but I'm not, I don't think, allowed to answer it for you.

A Okay.

Q So I'm wondering whether you might turn to your colleagues.

So as a starting point, you folks have not explicitly thought through -- you may -- you did commit to meeting that WCO objective in the Crowsnest River, and you have to, because you're -- if you -- if you are successful in getting the transfers you've asked for, for the Crown in particular -- licence in particular, but during the winter when there's no real-time data to evaluate it, we need to know how you plan or -- to -- to meet that WCO during the winter in the Crowsnest River.

A DR. BEWLEY: Hi, Mr. O'Gorman. Sorry for the wait.

Yes. What we can offer, I think, is to begin winter sampling on the Crowsnest to fill in the data that the Water Survey of Canada collects at the same station through the open-water months.

We -- we do have experience of this for a similar kind of -- similar kind of analyses that are called for in terms of -- the water survey have their seasonal gauges, but we need year-round data. And this is important data for any kind of hydrological annual statistics; right? In this case, it's to assess whether the flows on the Crowsnest are above or below a certain threshold, as you indicated.

So what this would entail is, essentially, I think, offering staff to conduct winter streamflow measurements on the Crowsnest at this station. That basically gives us streamflow measurements that are then used to calibrate continuous estimates of streamflow which you get from, like, the pressure transducers.

You do need these streamflow measurements because they're -- they're a complicated -- the reason why you cannot use stage discharge curves in winter is because ice is a source of backwater, which basically means that you have -- you have more water depth than you

should for a given discharge because everything is backed up. So those stage discharge curves that Water Survey develop and refine over time, they are not applicable in winter. That's where the streamflow measurements come in to help calibrate those continuous winter estimates.

So just talking with Mr. Houston, I think we're -- we can commit to essentially conducting those streamflow measurements on the Crowsnest in the winter to kind of calibrate those -- those winter estimates, subject to, of course, risks associated with winter sampling on the river, ice safety, all that kind of stuff; right?

Q Sure. Okay. Thanks, Mr. Bewley. I have one follow-up on this. So that's -- that's your proposal.

Let me throw an alternative sort of assumption at you. Let's say, for whatever reason, you have challenges in identifying the real-time flows to know if, on a particular day during the winter, when this is mostly an issue, the Crowsnest has fallen below the rate at which you need to assure you are putting at least 500 cubic metres a day into the system. Would you be willing to commit that when you don't have the data, you would commit to maintaining throughout that entire period, presumably during the winter, when you don't have data, that you would return the 500 cubic

metres per day to the Crowsnest, obviously via Blair [sic] or Gold, to make sure that you were satisfying this objective?

A MR. HOUSTON: Yes, that -- that's a fairly small number compared to what we're -- we're planning to put back in the system on a daily basis, so we -- we could commit to that.

Q Okay. Thank you, Mr. Houston. Let's move on. And thank you, Mr. Bewley.

Good. Good. Good. Good. Another question related -- two more questions related to monitoring of flows. Okay. This -- my initial preamble we've already covered a number of times. So we've talked about you've agreed to return water -- "return" during operations when flows are below the critical thresholds. You've proposed a monitoring plan.

MR. O'GORMAN: If we could haul up CIAR, Zoom Host, please, Number 44. Excuse me. And look at -- in CIAR 44, PDF 77.

Q MR. O'GORMAN: Right. So I won't ask you to go through this, but you may remember this document -- it came from your materials some time ago -- which had a monitoring plan for how you would be monitoring for -- for -- for these flows. I just wanted to illustrate that we had seen it.

Separately from this -- that's it --

MR. O'GORMAN: You can take it down, Zoom Host.

Q MR. O'GORMAN: Separately you've also provided us with critical thresholds for Blairmore Creek in Addendum 12. We don't need to haul those up. Those are the numbers we've been discussing. And you are going to produce, as a result of the undertaking, the threshold -- the thresholds we need to see for Gold Creek.

So if we can -- do I actually need to haul up this document? Hmm. Yes. So let's go -- open up again Addendum 12, CIAR 360, and go to PDF 27.

MR. O'GORMAN: 27. Good. Let's scan down to the bottom of that page, please. Okay. Good. Actually scan down a little bit more, just to the very bottom of the page.

Q MR. O'GORMAN: I'm wondering if we show -- oh, looks like we define those terms at the top of the next page, the 'Q's and the 'A's that you see on this page.

Okay. So in this document what we did was we presented you with a set of equations as a method to compute what the minimum operational release rates to Blairmore and Gold Creeks would be when flows are below the critical thresholds. We've focused a lot so far on the critical thresholds, but it's a separate question

as to how much water you would need to release if the flows fall below there.

And I -- to be -- so I guess what we want to know is whether you'll be able to follow this method to compute the minimum operational release rates. And I should be a little more clear with that. We want to know operationally how you're going to be able to tell every day, while you're at work mining for coal, whether or not you need to release extra water into Blairmore and Gold Creek; and if so, how much?

A DR. BEWLEY: Sorry. Just one moment, Mr. O'Gorman. Thank you.

Q Yeah.

A Thanks for waiting, Mr. O'Gorman.

So we do have some experience with this essentially with projects that need to, you know, maintain certain flows or water levels under certain permit conditions.

So what I think we can offer here is, as -- as we have discussed this last week, we do have hydrometric stations in Gold and Blairmore Creek as we stand.

The one thing that I think is important here is, I think we're -- the need in this particular question is for real time or near real-time data in terms of water levels, water temperatures, and essentially estimated flows in a real-time basis. That we can do if we set

up our hydrometric stations with the ability to have telemetry on those sensors in the hardware, and basically what that means is through the telemetry, the data calls into a server or a database however -- how -- how regularly we want it. So often we -- we collect near real-time data from the last day based on, you know, the data in the last day, and that goes through the telemetry systems.

So what I think we're offering here is the -- the ability to add that telemetry option to our hydrometric gauges to call in with the latest data and essentially characterize the flows on a near real-time basis, and that then gets fed into your calculations that I believe you're talking about.

Q Okay. And you would monitor on the mine site as well to estimate, you know, the mine flow?

A MR. HOUSTON: So, yes, Mr. O'Gorman, we -- we could have that data available and use operating parameters to set alarms and -- and reaction points where we would -- we would take, you know, a -- action to correct a -- a low-flow situation.

Q Okay. Okay. Follow-ups. So what we're describing and, Mr. Bewley, what you just sort of talked out is the sort of "return strategy" and the monitoring to support a return strategy that our hydrologists have been seeking. So is your plan that you would prepare a

detailed plan that describes a return strategy and submit it at some point? If it'll be part of the plan, you know, what -- when would we see that or some future regulator see that? What else would that plan include?

A So, Mr. O'Gorman -- yeah. I'm not on mute.

Mr. O'Gorman, we -- we have submitted a draft aquatics monitoring plan, and I believe these would be details that we could add to that aquatics monitoring plan to be more specific about the timing of data retrieval and -- and operating characteristics. So our -- our -- our understanding has always been that we will finalize that aquatics monitoring plan with the -- with the regulator post this -- this process.

Q Okay. Final question on this theme.

Sorry. I have construction taking place outside. I don't know if people can hear that.

Just can you elaborate a little bit more about whether you have a plan about where you would install the type of equipment that Mr. Bewley was just talking about?

A It -- it would be associated with the existing hydrometric stations that we have on -- on the creeks, Mr. O'Gorman.

Q Okay.

A And -- and I should add, and -- and potentially at any outfall location that we -- we choose, you know, that

we create.
Q Okay. So by -- Mr. Houston, by tying your response to the -- to the -- which plan did you just say?
A Aquatics monitoring or --
Q Aquatics monitoring plan?
A Aquatics monitoring plan, yeah.
Q So you're not saying you would prepare a separate piece which would be a water management plan?
A No. The -- the aquatics monitoring plan includes a broad range of monitoring programs, from quantity to quality to biological monitoring. So it's a fairly comprehensive plan, and we would try to keep it all in one document.
Q Okay. Thank you.

Let's move on. This last --

THE CHAIR: Mr. O'Gorman.

MR. O'GORMAN: Yeah.

THE CHAIR: Yeah. I'm just going to suggest, if you are about to change topic areas, we're going to be looking for a break soon, so you can either do it now or after your next set of questions.

MR. O'GORMAN: Actually, I'm not -- this is the final one that's sort of related to hydrology and monitoring, so let me do this question, and then I'll take a break, Mr. Chair.

THE CHAIR: Okay.

MR. O'GORMAN: And thank you for --
THE CHAIR: Sounds good.
MR. O'GORMAN: And this is, actually, I think, a fairly brief question.
Q MR. O'GORMAN: So, Mr. Houston, I don't need to haul the document up again. All of this is related to your response to IR 7.3. You did indicate in there -- if you need me to point you to it, I can -- that you would augment the creek flows by pumping stored water from the selected sedimentation ponds.
During operations -- and, to some extent, we touched on this, but just to make sure we're clear -- how will you monitor to ensure that the release of water from your site is the correct volume or flow rate needed to satisfy that water return?
A MR. HOUSTON: I don't think we've finalized how we're going to monitor the flow rates out of the various ponds. There are various methods -- you know, using shaped weirs, for example -- to -- to gauge the -- the flow rates, or we could just do a -- you know, a -- a level metring on the pond. So I -- I think it's going to depend a little bit on the -- on the final design of the ponds.
Q Okay.
A Yeah.
Q Do you have a sense of what kind of structure you're

going to need to ensure that you've got the return volume and rates?

A Yeah. Typically you would -- you would use a -- a shaped outlet from the pond that -- and that -- where you could measure the -- the height of water flowing through -- flowing over a weir, and use that as a -- a measure of the quantity of water that -- and -- and the rate of water that's flowing out of the pond. That -- that would be my sense. It -- it's a little bit going to depend on the -- well, I -- I think that would be the primary method of managing water-flow quantities.

Q Okay. Mr. Houston, I'll accept that as an answer, and let's say that wraps up that set of questions. Thank you.

MR. O'GORMAN: Mr. Chair, I think this would be a good time for a break.

THE CHAIR: Okay. Thank you.

It's 10:30-ish, so we'll resume at 10:45. Thank you.

(ADJOURNMENT)

THE CHAIR: Okay, Mr. O'Gorman. Whenever you're ready to continue.

MR. O'GORMAN: Okay. Thank you, Mr. Chair.

Okay. Zoom Host, can we please call up CIAR 42, Section C, and we're going to go to PDF 117.

Okay. Yeah. The surge pond. That's good right

there.

Q MR. O'GORMAN: So, Mr. Houston, this document we're looking at does indicate the dam crest heights for the southeast surge pond as 1,509.2 metres above sea level, and the raw water pond as being 1,503 metres above sea level. Do you agree with that?

A Yes.

Q Okay. Great.

MR. O'GORMAN: So, Zoom Host, in this document can we scan down, please, to PDF 193? And scan down on that page a bit, please. And zoom in at the -- sort of the bottom half of the page. Scan down. Just -- no. The bottom half of the page. Okay. And can we -- a little bit lower now. And can we zoom in one more time maybe? And maybe one more zoom. One more magnification, Zoom Host, please. Okay. That should work.

Q MR. O'GORMAN: Mr. Houston, here we see the location --

MR. O'GORMAN: Oh, that's good. Thank you Zoom Host.

Q MR. O'GORMAN: We see the location of the southeast surge pond and the raw water pond.

MR. O'GORMAN: Oh, no, we've lost it, Zoom Host. I need both of those ponds to be showing, please. Can you roll back down on the page? Just

scroll down the page a little bit so we can see both of the ponds, Zoom Host. Good. Thank you.

Q MR. O'GORMAN: Okay. So here we see the southeast surge pond and the raw water pond is. There's an interconnecting water pipeline in pink, and we also see the surface contours on the map for the area between those two ponds.

Now, it looks like we have the height of the land between the two peaking at about an elevation of 1,570 metres above sea level, which would be more than 50 metres higher than the southeast surge pond. Does that look right to you, Mr. Houston?

A MR. HOUSTON: That -- that is what I'm reading off the map as well. Do you have a question you're going to follow on with?

Q Yeah.

A 'Cause I was going to ask Mr. Youl to --

Q Yeah.

A -- to weigh in on this.

Q It might be Mr. Youl. And we're going to actually call up later, just shortly, some conversation that Mr. Youl engaged in relating to this topic, but I was going to do that in a minute or two.

So leaving this picture up, I guess as our first question: Can you explain how under normal operations water is going to be moved from the southeast surge

pond -- surge pond to the raw water pond? And I can -- you know, while you're thinking about that specifically, we're wondering about will this proposed pipeline be underground? What -- would it be a -- what would be its size? What would be the flow capacity of the pipeline? Is water going to flow by gravity or require pumping? So those kinds of questions.

A MR. YOUL: Want me to jump in?

A MR. HOUSTON: Yes, please.

A MR. YOUL: Okay. Yeah, Mr. O'Gorman, you're right. The peak of the natural ground surface between those two ponds is significantly higher in each pond, so the water will be pumped from the southeast surge pond to the raw water pond. So this is all contact water which eventually will require pumping into the saturated backfill zones.

The design of that pipeline, I -- I do recall we have stated that somewhere in the documents. I can't recall which page, but we talked to the diameter and the -- the flow rates, from memory. Whether that pipeline is on the surface or buried is still to be determined and whether it -- or be on the surface; it'll need to be heat traced. So that's still to be designed in the -- the actual material of the pipeline. But the -- the general theory is that that pipeline will move water back to the raw water pond for

processed water as well as going to the saturated backfill zone.

Q Okay. Thanks, Mr. Youl.

And, yeah, to clarify, by "underground", we weren't really asking whether it would be on top of the surface or a foot below surface. I guess we were wondering was there some plan to drill through that mountain to run your -- your pipeline?

A No. No. We'd smooth the surface to avoid any sort of undulations in the pipeline to give the water a clear path and minimize resistance to maximize the pumping efficiencies. But by and large, it will follow the -- the natural ground surface.

Q Okay. Thank you.

And it will be pumped because --

A Yeah.

Q -- those ponds are both at essentially the same elevation; right?

A Correct.

Q Crests. Okay.

Okay. We're going to look at a couple of transcripts, please.

MR. O'GORMAN: Zoom Host, can you please call up the -- I think it's the November 6th transcript, which I think is CIAR 799.

And we're going to -- right. So page 2171. I

recognize that -- yeah, the page numbers in these transcripts, sometimes they're PDF numbers and sometimes they're page numbers. I can't keep them straight myself.

If we look at 2171 and we scan down -- actually, one full page to line -- starting at line 13, displaying down from there. So this was a converse --

MR. O'GORMAN: Okay. That's good. That'll be fine. Thank you, Zoom Host. That's good.

Q MR. O'GORMAN: So this was a conversation that I was engaged in with you, Mr. Houston, when I was asking about potential failures of that southeast surge pond which, as we've acknowledged, has contact water in it.

And I think, if we look at the response that we had from you, you indicated that one type of failure that the -- that pond or the dam -- we were talking about dams at the time -- might experience would be water coming in too fast to treat.

I assume you didn't really mean treat 'cause no treatment is taking place in that pond; right, Mr. Houston?

A MR. HOUSTON: That's correct. Although, if it's -- if there is an emergency situation and -- and were not able to accommodate in the raw water pond and the saturated backfill zone, then there -- you know,

with a high quantity of water to deal with, we could run into a situation where -- through the whole system that there's an inability to treat at that -- at that quantity. Like, we -- we're not treating in this -- in the -- in the surge pond, yes.

Q Right. That's all I was asking. Sorry. I mean, that's fine.

A Yeah.

Q That was a simple misstatement using the word "treat"?

A Yeah.

Q But more so the issue is how I seem to be interpreting your answer is water is coming in too fast to the southeast surge pond, and in that case, the discharge would be through the raw water pond, and then would flow out towards Blairmore Creek. Is that -- that's what you said there; right?

A Yeah. And to be clear, that -- that would be through that pipeline that we were just talking about.

Q Okay. And that's -- okay. Fair enough.

MR. O'GORMAN: Can we please call up, Zoom Host, CIAR 42, Section C -- actually, while you're -- while you're hauling that up ...

Q MR. O'GORMAN: I just want to be clear, Mr. Houston. So I just want to make sure I understand how if the -- if the southeast surge pond has water coming into it too fast, you get it over the top of

that 15-plus-metre crest to get discharged over to the raw water pond, like, your pumping capacity will be able to handle that and that pipeline?

A MR. HOUSTON: So maybe I should ask Mr. Youl to -- to provide additional details.

A MR. YOUL: Yeah. The -- the pumping capacity that southeast surge pond is designed to -- it's a matter of days to empty that pond. I can't recall the exact number. And I wasn't involved in -- in this work, so I'm just trying to recall that from memory.

But in theory, we're looking to keep that southeast surge pond at a lower level. The raw water pond will be the main pond where we maintain operational water levels, and the intention is with that pipeline and pumping system, we'd continue to top up the raw water pond from the southeast surge pond and keep that southeast surge pond at a -- at a typically lower level. It's a buffer pond, if you like. So we're not intending to store contact water there for long periods of time.

But the raw water pond will be the main pond, which will have its operational limits designed into it. There will be a lower limit. There's a buffer capacity for maintaining some supply at the processing plant, particularly during the -- the low runoff

season, and then an upper limit, and then above the upper limit there's the flood mitigation limit, and then you have your freeboard, and then you top through the spillway.

Q Okay. Thank you, Mr. Youl.

MR. O'GORMAN: Zoom Host, can we look at -- back to CIAR 42, Section C, and look at PDF 116, please. Yeah. That's -- that's what we want.

Q MR. O'GORMAN: So is it -- it is on that table. The inflow design flood is there. Yeah.

So this -- this table above does include the inflow design flood for the surge ponds and for the -- actually, maybe it is --

MR. O'GORMAN: If you scan down a bit. I'm looking for the southeast surge pond. Table 556. Yeah, it's the one on the bottom of that page. Sorry. So if we just blow up the bottom of that page, please, Zoom Host, and scan down. Right. Good. Good. Thank you.

Q MR. O'GORMAN: So we see down here we've got the preliminary dam specification and inflow design floods for the different surge ponds.

The southeast surge pond is shown as being, for the inflow design flood, two-thirds between a thousand -- a thousand-year and the probable maximum flood; is that right?

A MR. HOUSTON: That's correct. Yes.
Q Okay. Thanks.
MR. O'GORMAN: And if we scroll down to the next page, please, Zoom Host, PDF 117, but it's just the next page. We're looking at Table 5-8 -- 5.5-8 now. So scan down a bit.
Q MR. O'GORMAN: Again, southeast surge pond at the bottom is the one that we're interested in. But this table shows us details on the surge pond emergency overflow spillways. For the "SESP", let's call it, it does indicate an inflow design flood of 21 cubic metres per second; correct?
A MR. HOUSTON: Yes.
Q It's in the first column of numbers. And a 140-metre discharge channel; is that right?
A Yes.
Q Okay. So in the circumstance for the emergency overflow spillway, can you just clarify where that discharge channel will be directed?
A I -- I believe that would lead over to Gold Creek.
Q Right. Okay.
A Mr. O'Gorman, I think it's important to understand the purpose of the surge pond. We're -- we're -- we're using this as a place to put the contact water, and the contact water would come from the ex-pit dumps, percolate through and be picked up in -- in toe drains.

Any -- the catchment basin, if you will -- if you're thinking about a rainfall event, the -- the surge pond in -- in fact, we're -- we're going to arrange surface flow so that it doesn't go into the surge pond, again, with the idea of keeping clean water clean. And -- and so I -- I just wanted to make sure we're all thinking about this the same way, that this -- this is not a pond that's catching rainwater and -- and dealing -- dealing with a high-precipitation event. In fact, we would design this pond to not have that surface flow -- the clean water arrive in the pond.

Q Okay. Thank you, Mr. Houston.

MR. O'GORMAN: We're going to call up a different document, please, Zoom Host. I, unfortunately, don't have the CIAR number, but it was a transcript. The transcript from November 18th, two days ago. I did indicate to you folks -- you kind, Zoom Master folks, that I'd be asking for it, but I don't think I have the CIAR number. And -- great. Thank you. We're going to scan down, please, to page 3673. And going to go down to the bottom of that page. Starting at line 24. So let's show the bottom of the page, please. Great. Thank you.

Q MR. O'GORMAN: So this, Mr. Youl, you'll remember -- it was only two days ago -- you were

speaking with Mr. Rennie this week. There was -- if we -- if we look at -- there's -- we -- you were discussing spillways applying to engineered channels that would flow to -- in particular, we were interested in a gully that existed between Grassy Mountain and Bluff Mountain.

If we take a look at -- starting at line 24 here, and then we'll scroll through the next page, I -- I think you said -- actually, why don't I ask you if you wanted to repeat, starting at line 24, and we'll go to the next page.

Could you read that for me, please, Mr. Youl?

A MR. YOUL: Yes. (as read)

The surge pond that will feed any emergency overflow water will flow over a spillway. [And this is the raw water pond, not the southeast surge pond, just to be clear.] It will be an engineered designed spillway based on the Canadian Dam Association guidelines; and that will flow down the spillway, over the dam wall, and down into an engineered channel that will, by gravity, discharge eventually into Blairmore Creek.

Q Okay. So you were talking here about the raw water pond, not the southeast surge pond?

A That's correct.

Q Okay. So there's no gully that exists, that you know of, between the southeast surge pond and the raw water pond; right? We didn't miss this in your diagrams?
A No. No. The gully -- there may be a better description for it, but it's a topographic low, an actual low that sits between Bluff Mountain and Grassy Mountain. And that ridge we talked about before on that plan which was -- I don't know -- 1,570, thereabouts, that's the high point; and then from there to the west towards the raw water pond, the elevation decreases all the way down to -- to Blairmore Creek.
Q Okay. Okay. That's -- that's good, Mr. Youl. Thank you.
A MR. HOUSTON: Mr. O'Gorman?
Q Yes.
A I've been discussing with my colleague Mr. Jensen on the answer I gave just a few minutes ago about the purpose of the surge pond, and he would like to clarify the -- the different kinds of events that -- that we could see at that surge pond. So if you don't mind, just to make sure that the record is -- is perfectly clear.
Q Yeah. Please proceed. That's fine with me.
A MR. JENSEN: Thank you, Mr. O'Gorman.
When we look at -- at different types of events for -- I should preface this by saying I'm not a -- I'm

speaking as a -- as a water management professional and not as a geotechnical engineer. But generally we're dealing with two distinct type of -- types of events. One is the EDF, which is the environmental design flood; and the other one is the IDF, which is the -- is the inflow design flood.

The EDF is the -- is the event that you expected to contain so -- so that there is no -- no uncontrolled release into an environment. And, you know, the -- we -- it's project dependent and situation dependent what you define the EDF as. I don't know if it's been finally established what the -- what the EDF would be for this. I know for some of the channels we're talking about a 1-in-200-year event is -- is not untypical for EDFs; whereas for IDFs, you know, the guidance listed in the -- in the CDA guidelines, the Canadian Dam Association guidelines, apply.

So what -- what we've been talking about here is the IDF. And the IDF -- the intent of the IDF is to protect structures. So you want to make sure that you can either contain or you have a spill where they can convey that maximum event you designed for. And -- and it's great. So that maximum design event would indeed -- you know, if we were in a PMF-type situation or two-thirds between of a 1-in- -- in-1,000 and a PDF, that would indeed be -- likely be released into a --

into Gold Creek.

What -- what would be contained and would be managed is anything up to the EDF. So the EDF we haven't -- I don't know if -- if it's been defined yet on the record. It's typically a detailed design consideration. I know we looked at -- at different -- at the hydrotechnical considerations around routing. But -- but the clarification I wanted to make is that EDF is the event that would be contained, just -- just so it's clear.

Q Okay. Thank you, Mr. Jensen. Jensen; right?

A Yes.

Q Yeah. Thank you.

Okay. We'll -- that -- that clarified some things for us.

MR. O'GORMAN: Zoom Host, could you take this down, please. Actually, no -- yeah. Take down the transcript. And we're going back to Registry Doc 42, Section C, and this time, we're going to look at PDF 113. Okay. PDF 113. At the bottom, Table 5.5-2. Okay. Thank you.

Q MR. O'GORMAN: We saw this a moment ago, Mr. Houston, or whoever wants to answer it. But you did provide preliminary dam classification with inflow design floods for the sediment ponds and the surge ponds. And this table actually had the sediment ponds.

And if we jump forward -- I don't think we even really need to. I -- I think we -- 'cause we saw it a minute ago, Table 5.5-6 showed the same. Actually, let's go ahead and show it.

MR. O'GORMAN: Jump forward to PDF 116, please, Zoom Host, a few pages down.

Q MR. O'GORMAN: And on that page at the bottom we'll see you provided preliminary dam classifications and IDFs for the surge ponds and the raw water pond, which also contains selenium. Sorry.

So I want to just confirm if it's correct, and I'm not going to show them, but I -- I think you'll be able to confirm without me showing as an exhibit that the categories listed under the classification based on incremental losses was based on the Canadian Dam Association consequence classification rating systems for dams?

A MR. HOUSTON: I -- I believe at the time this was written out, that was the document we used.

Q Okay. And no one else would disagree with that?

A Mr. O'Gorman, we -- we talk about preliminary ratings of dams. Obviously there's a lot of work to -- to be done. We would follow the Alberta Dam Safety Guidelines in -- in terms of final designs for these dams, and that would include things like inundation studies during the -- during the detailed design phase

that would, you know, solidify these classifications of the various water storage structures.

Q Okay. Okay. Thank you, Mr. Houston.

So -- right. I just want to clarify it's correct to assume that, looking at some of these categories that you've assigned here, the ratings -- the consequence ratings in the middle column of environmental and cultural, those are primarily driven by environmental considerations for these dams in -- the surge pond dams in particular; is that right?

A That -- that's correct.

Q Okay. So I wonder if you could just, for the record, tell us, you know, briefly why the ponds that we see on the Gold Creek side, so the east -- northeast sediment ponds and the southeast surge pond, were rated as -- so we see the southeast surge pond on this -- the table. We can go back and look at the other table, if you need to.

But I wonder if you can just quickly tell us why those ponds and their -- their dams on the east side of the project all were rated as "very high" under the "Environmental Consequence" category?

A It -- at this stage of the design, Mr. O'Gorman, the ratings are based on an appreciation for the size of the structure, the -- the -- the type of consequence that -- that could be expected. And -- and, again,

we're -- we're talking about worst-case consequences, so what could be expected, and -- and then using professional judgment, deciding whether that's high, low, or very high.

That needs to be confirmed through -- through the inundation studies that I was talking about and some discussion with the -- the regulator, in this case, AER, to -- to assign a final rating.

Q Okay. Thank you, Mr. Houston.

So your -- an element, I think I heard you say, in your response of that rating is related to, would you agree, the sensitivity of the potential receptors in the case of something bad happening?

A That -- that's -- that's correct. And that combined with the potential volume of water and -- and, you know, some professional judgment to assess what the -- what the consequences of that could be.

Q Okay. So I actually want to ask you about the ponds and their dams on the -- on the west side of the project where the environmental and cultural ratings were much lower. Your southwest surge pond you rated as being -- classified as being of "low consequence". And if we go back a few pages, we would also see smaller ratings. Smaller, you know, not -- not very high ratings for the other dams and ponds on the -- on the west side of the project that would -- let's call

it the "Blairmore Creek side of the project".

I wonder if you could just explain your basis for -- for those ratings?

A And it -- it's the same process, Mr. O'Gorman, assessing the receiving environment, looking at the quantity of water in -- in the ponds -- specific ponds, and using professional judgment to assess what the impacts would be. Again, all that needs to be verified through a -- an inundation study.

The -- the point of -- of this level of assessment is really to take a first crack at what the structure itself might look like, what -- what footprint it might need to take up on the -- on the -- on the plan. And -- and so that -- that's the basis for assigning these classifications at -- at this stage and -- and -- and, you know, go -- going to this depth, is -- is more or less to have a preliminary assessment of how big these ponds need to be, how high, and what size that would look like on the footprint.

Q Okay. I'm trying to think about what I heard you say.

So was the potential sensitivity of the receptors in Blairmore Creek, in the event of, as I call it, something bad happening, was that a factor in these rankings?

A Yes, and that will continue to be a factor as we go through the more -- more detailed studies. Yes.

Q Okay. But I would point out that there are still near-pure westslope cutthroat trout in Blairmore Creek. You would agree with that; correct?
A Up -- upstream of a point on the creek, yes, I would agree with that.
Q Okay. Okay. And one last question on this topic, although I might need to go back and clarify one thing.
MR. O'GORMAN: I will ask -- I submitted an aid to questioning, and I don't have the CIAR number, but I did tell you kind Zoom host folks that it was coming. It was the AEP Dam Consequence Classification System.
MS. ARRUDA: Mr. O'Gorman, it's AQ Number 1.
MR. O'GORMAN: Right, AQ Number 1. And I think, Ms. Arruda, you told me that the page number was 48 in that document, if I remember correctly?
MS. ARRUDA: I believe so.
Q MR. O'GORMAN: Okay. And it spans over the next couple of pages.
And I just want -- Mr. Houston, you -- you may have even sort of answered this, so just to -- for completeness, these are the Alberta Environment and Parks dam consequence classification system, and we wanted to confirm that you would expect to update or revisit your classification for your different dams

according to this document?

A MR. HOUSTON: Absolutely. And based on -- based on the further engineering work that -- and investigation that we're going to do. Yes.

Q Okay. Thank you.

Before we leave this topic, I do want to come back to you, Mr. Youl. I have -- we remembered your conversation with Mr. Rennie, I think, potentially differently than you indicated a minute ago. I don't know if we need to go back through the transcript, but we did -- we can haul it up, if you'd like.

We certainly had the impression that when you made those comments -- or maybe Mr. Rennie or you, at least one of you was talking about the southeast surge pond. So I wonder if you wanted to clarify if what you said this morning was a correction, or if you genuinely -- we can -- I'll let you look at the transcript, and then maybe you can tell me whether you were correcting something that was said or if you stand by that, please.

A MR. YOUL: Okay. Just while you're bringing it up, I -- I definitely recall referring to discharge to Blairmore Creek, not Gold Creek.

Q M-hm. Right. No. We agree with that.

A Yeah. Was there any other clarification you were seeking?

Q Okay. I don't think it's that important to pursue.
A Okay.
Q So let's -- let's move on from there, 'cause I think we understand what you're saying this morning, so -- and we -- we heard some useful information there. So thank you both very much. That's it for that question.

And for the topic of hydrology until -- one future hydrology question to come.

Okay. 11:21. We're going to change gears and talk about geology and geochemistry, gentlemen and ladies. So I'm going to ask -- I think that I -- probably all a little bit surprised that a week into a discussion about water for, I think, a mine -- a proposed mining project, I'm not sure there's been any reference to acid rock drainage yet, so we might actually touch upon that a little bit in these questions to come.

MR. O'GORMAN: I'm going to ask, Zoom Host, please, that we call up CIAR 42, Appendix 10, and PDF 134. And we're in the geochemistry reports here in Appendix 10. PDF 134. Right. Okay.

Q MR. O'GORMAN: So, gentlemen, metal aging potential was evaluated by SRK, by conducting humidity cell tests and comparing shale samples to the average crustal abundance for shale, graph of humidity cell -- I don't think this is -- I don't think I have asked you

for the right page 'cause I thought I was going to be looking at -- yeah. That's the wrong reference maybe.

MR. O'GORMAN: Are you showing me Appendix 10 from CIAR 42? Yeah. It looks like it. I expected to see a different figure. A little help here. Just one second, folks. Geochemistry reports. Let's go down to PDF 134. Yeah, this is the one. Okay.

Q MR. O'GORMAN: So I'm not sure what the first problem was. But there it is.

So we're looking at arsenic here and some tests that you folks did -- that SRK did. So if we look at this, the graph of humidity cell data does indicate that over .2 milligrams per litre of arsenic would be released from the Adanac and the Cadomin found -- formations or members, combined that is, within a week, you know, with the majority of that from the Cadomin but also a contribution from the Adanac. See the Cadomin numbers in green at the top and Adanac starts a little bit lower.

We do see that after, you know, 20 weeks or so, you get up to -- this is a logarithmic scale on our left-hand side, so we get back to that .2 milligrams per litre of arsenic release indicated in this test.

You agree with that? I'm not sure which of your experts will speak to this. It might be Mr. -- well, I'll let you tell me, Mr. Houston.

A MR. HOUSTON: Yeah. Mr. Day, are you able to answer?

A MR. DAY: Yes. For sure, yeah.

Yeah. You're correct, Mr. O'Gorman, yeah.

Q Okay. Thank you. Okay. So that's one.

MR. O'GORMAN: Can we next haul up on the same document at 'P' -- Zoom Host, most of -- we're going to use this document for most of this round of questioning. Let's go to PDF page 68, please.

Q MR. O'GORMAN: Here's a -- we wanted you to know we -- and by "we", I mean our geochemistry experts -- did look at the X-ray diffraction results you submitted, and I wonder if you could say whether this figure does confirm the presence of sulphides in the Adanac and the Cadomin?

A MR. DAY: Yeah. Mr. O'Gorman, I -- I don't know which rock types these refer to in particular, but there are definitely sulphides in those -- those units. I can confirm that, yeah.

Q Yeah, we can sort of see them if we dig through.

A Yeah. The blue -- the blue, pyrites.

(INDISCERNIBLE - OVERLAPPING SPEAKERS)

Q MR. O'GORMAN: Exactly. Yeah.

A MR. DAY: Yeah. Yeah.

Q The pyrites --

THE COURT REPORTER: Excuse me, gentlemen.

A MR. DAY: Yeah. For sure.
THE COURT REPORTER: Excuse me. I can't understand you both at the same time. The last thing I heard was -- clearly was something about "the blue".
MR. O'GORMAN: That's my fault. That's my fault, Zoom Host [sic]. I -- I shouldn't have spoke over you.
Q MR. O'GORMAN: I apologize, sir.
Okay. I appreciate that. So dum de dum de dum.
A MR. DAY: Recorder [sic], do you need to clarify that point, or are you -- are you okay with it?
THE COURT REPORTER: That's up to the questioner.
Q MR. O'GORMAN: Yeah. Why don't you -- why don't we try that again.
Can you confirm that this suggests the presence of sulphides?
A Yes, I confirm. The -- the label -- the legend there shows pyrites.
Q Right.
A And that is the most common sulphide in these -- in these rocks.
Q Okay. Thank you.
MR. O'GORMAN: Okay. So we're going to haul up another reference now, please, Zoom Host. We're going to go to -- this time it will be a different document, so I lied a couple of minutes ago. We're

looking at Addendum 10, so Registry 251, Package 5, and we're going to, within there once it -- once you get it open, jump to PDF 32 and scan down, please. A bit lower. Right. To the bottom. All the way to the bottom of that page, Zoom Host, please. Okay. That's good.

Q MR. O'GORMAN: So here was an information response request. You indicated that in an effort to evaluate long-term treatment of selenium and nitrates, the column testing is ongoing to simulate in the lab the mobility of selenium for mine waters. And the column tests involve, if you'll agree with me, the measurement of selenium and nitrate under various conditions; correct?

A MR. HOUSTON: That -- that's correct, Mr. O'Gorman.

Q Okay. It's unclear whether or not other analytes like arsenic, which we looked at a second ago, are also being measured in your column tests. Can you clarify that?

A No. No, they are not, Mr. O'Gorman. This was specifically focusing on nitrates and -- and selenium.

Q Okay, Mr. Houston or whoever. Actually, this question is not for you, Mr. Houston.

A I'm afraid that these column tests were not conducted by SRK, and so I'm worried about asking Mr. Day to --

to comment on them. That's all.
Q Okay. Well, okay. No. I'm not going to get into exploring the column tests too much, actually. They might be slightly more general questions.
So if you remember the first figure that I showed, Mr. Day, we showed leach rates for arsenic of up to .2 milligrams per litre. I wonder if, in your professional opinion, that would be considered high?
A MR. DAY: I'm talking to myself here. Apologies.
Yes, definitely that would be considered high. I agree. Yeah.
Q Okay. And can you confirm for me where -- which mineral phases you understand to house the arsenic?
A Most likely it's in the pyrite.
Q In the pyrite, so sulphides?
A Yes. Correct, yeah.
Q Correct. Okay. Thank you.
A I -- I -- do you mind if I -- I -- I mean, I think to -- you've asked about whether those are high, but I think it should be clarified the situation in those tests under which those arsenic concentrations came out. Do you mind if I do that?
Q I do not mind, sir.
A Okay. Could the -- Zoom Host, could you go back to that? I can't -- I can't recall what the page number

was for the arsenic.
Q I can tell you.
A Yeah. That would be good. Thank you.
Q The very first figure we looked at was, in the geochemistry reports, PDF 134.
A Do you -- could you bring that up, please?
Q Yeah.
MR. O'GORMAN: Zoom Host, sorry. Right.
A MR. DAY: Okay. So I would like you to go up to PDF page 118 in the same document.
And what I want to point out here is those high arsenic concentrations are associated with low pHs. So you can see those -- see those symbols there at the bottom there, the brown -- the brown squares and the green circles? So those high arsenic concentrations are associated with very low pHs.
And maybe you're going to ask more questions about that, but I wanted to -- to be clear on that because you asked me about whether they were high arsenic concentrations, and that is due to the low pHs.
Q MR. O'GORMAN: Okay. Sure. Thank you, Mr. Day.
So just to clarify, we talked about sulphides and the pyrite. Are there mineral phases other than sulphides that you might expect to house arsenic?
A In the -- yes. In the weathered materials you can

expect that the weathering of pyrites will convert to iron oxides, and it's very likely that the arsenic would be sequestered with the iron oxides.

Q Okay. We're wondering how the potential release of arsenic from these phases might be -- is going to be tested, or will you?

A What additional testing are you thinking of? Or you've done the -- the desalt testing. Are you thinking of -- okay. I'll let you answer that question.

Q Sorry. I'm curious whether you have any plan to testing, like column tests, for example, which is the reason why I took you to the column tests as a part of the preamble.

A MR. JENSEN: Steve, perhaps I can --

A MR. DAY: Sure. Go ahead, Soren.

A MR. JENSEN: -- jump in here?

A MR. DAY: Yeah.

A MR. JENSEN: Yes. Mr. O'Gorman, so -- yes. So one of the primary purposes of the -- scale of tests we have proposed for -- specifically for the saturated backfills and -- well, in general for the -- you know, along the similar lines of what the intended purposes of the column tests were is to precisely look at -- and I believe I testified to this previously a couple of days ago -- is the one thing we are, let's say, unsure about and we want to test through on-site testing is

this potential for -- you know, we do see reductive dissolution of not just arsenic but manganese and iron. Those are typically the ones we're worried about. So one thing we specifically want to look at through that ongoing test work is to what extent we might see manganese, iron, arsenic, and -- and potentially other constituents be released as part of that process.

So it's one reason we did propose -- I did advise Benga to plan for -- for post treatment of SRF effluent is precisely for that reason, because we can't categorically say that this won't be an issue, and so we wanted to have mitigation in place to accommodate that.

But until we do actual on -- on-site tests with the material that we -- that will be exposed to these reducing conditions, we can't say for sure, but the mitigation is there to -- to address it.

Q That mitigation being?

A That -- that mitigation being -- being lime treatment.

Q Right.

A And -- and -- and -- and specifically to address arsenic, it is possible to remove arsenic in that same process but it may require the addition of -- of a ferric coagulant.

Q Okay. Thank you, Mr. Jensen.

And you anticipated, I think, my next question to

some extent. I'll ask it anyway. But considering that we saw what might be considered high levels of leaching of arsenic in the humidity cell tests, and also, I think, people won't disagree with me that arsenic can have high mobility under anoxic or suboxic conditions, we are curious about your views on the potential for arsenic to be mobilized from the mine waste; and if that happens, how it would be attenuated which ...

A Yes. That's right. And -- and, you know, we absolutely share that -- that concern. It's something that absolutely needs to be addressed. It's a lot of -- for lack of a better way of thinking about it, it's the obvious concern that would be associated with something like this. So it's very much at the forefront of our thinking, and -- and, like I said, I mean -- you know, we suggested to Benga that this mitigation needs to be anticipated.

Q Only lime treatment? Are there other mitigation measures you might consider?

A Yeah. I mean, you can consider if arsenic turns out to be -- to be, like, the issue that will be concerned with, it may be necessary to implement a different -- you know, use ferric -- ferric co-precipitation is typically the -- the approach that you take to -- for removing arsenic. But it is -- like I said, other (INDISCERNIBLE), molybdenum, or antimony are -- you

know, they -- they require lower pHs for effective removal. Arsenic you can remove at higher pH as part of a lime treatment system, but like I said, it does require the addition of a ferric coagulant unless, of course, we also see -- you know, we see parallel mobilization of iron at the same time, then the effluent may just come with iron we need to remove arsenic. But either way it's -- we need that co-precipitation step. That's what would be required.

Q Okay. Thanks.

What about the weathering of the pit walls, might that be a source for arsenic?

A MR. DAY: Can I can I speak to that?

Q Yes, by all means.

A Okay. Sure. Yes, you're correct, Mr. O'Gorman. The -- there are sections of the pit walls which could -- and under those circumstances it would be acid generation which would mobilize arsenic, as shown in the humidity cell tests. There is a plan to -- to mitigate that through -- through covering the pit walls with -- with the non-acid-generating materials to -- to try and mitigate that.

Q Okay. Thank you, Mr. Day.

Can you confirm the measures you will put in place to monitor for arsenic levels -- arsenic levels, sorry, and the runoff and/or the oxygenation of the blended

mine waste, especially considering arsenic can be highly mobile?

A You're referring to the -- the -- the -- waste rock dumps?

Q I'm sorry. Out of the -- yes.

A Yeah. I mean, that'll be --

Q I'm sorry. The waste rock dumps and/or the SBZs?

A Yeah. So that would be a normal part of water -- water monitoring. You'd normally monitor for -- for both parameters that are of interest to help you understand that parameter -- like arsenic itself, but also the pH, the ORP, the other parameters that would be involved, like iron.

Q Okay. Great.

Can you tell me whether or not your water column studies have revealed sulphide oxidation via nitrate in the absence of oxygen?

A MR. HOUSTON: So, again, SRK wasn't involved in those column studies, and -- and I'd -- just not being an expert in that field, I would have to say that's not something we were specifically designing those column studies for, Mr. O'Gorman.

Q Okay.

A Steve -- Mr. Day, can you add to that or ...

A MR. DAY: Yeah. Mr. O'Gorman, it's a very good question. It's something that -- you know,

that we do think about. So it's just to clarify your -- your questions around -- normally pyrite is oxidized by oxygen, but you're asking whether nitrate can actually function as an oxidant of -- of pyrite. That's really what you're asking there, isn't it?

Q Yeah, it is.

A Yeah. I --

Q And so -- yes, I was asking whether you had seen it. Recognizing or acknowledging you didn't do this test, at least weigh in on the potential that that might happen, and whether that's something to be concerned about?

A Yeah. I -- I can -- I -- I haven't looked at those -- that column data. And as has been mentioned, we weren't involved in the test work. I mean, I can -- I can help with the question in generalities. It's something that I've -- I've actually taken a hard look at for some other coal projects. So I'm -- I have had -- had to think about it quite a bit.

And I think, you know, in general, you know, what you're talking about here is that you're -- denitrifying nitrates to -- in order to -- to -- for it to function as an oxidant in those conditions. And -- and it -- and it -- definitely in theory can be an oxidant for iron -- for iron sulphide. There's no question about that. But it's -- the circumstances

under which that must occur are low oxygen by definition, and so its potential to do that chemically exists, but it's -- whether it's a significant process is another matter. And the conclusion is really that it -- that it wouldn't -- that it isn't significant compared to oxygen as an oxidant. That's about as far as I can take you, though.

Q Okay. That's fine.

So in the presence of nitrate in the saturated backfill zones, is that something that causes you -- gives you pause on the arsenic front?

A On the arsenic front, you're -- you're thinking of whether it would release more arsenic from the -- from the pyrite; is that the --

Q M-hm. Yes.

A I -- I -- professionally I -- I don't think that's a significant issue. I just don't -- I just don't think it's -- it would be a source of arsenic, no, I don't, but we don't have the data but -- specifically for this project to say that, and I think that's something that would be looked at logically through those -- through the current testing that -- that Mr. Jensen was talking about.

Q Okay. So last -- I think my last arsenic question.

And, Mr. Jensen, you did sort of get at it a little bit. I guess to bring this to a close, this --

this thread, I think I heard you say, Mr. Jensen, that you would start monitoring for this once you have a real waste rock to monitor and test. You are not planning testing in advance of actual construction with the rock from the -- from the mine area to -- to know whether or not you expect arsenic to be a big problem; is that right? You'll monitor once you get going with the mine, or am I getting that wrong?

A MR. HOUSTON: So, Mr. O'Gorman, if -- if I can step in here. The pilot testing that we're talking about would be started at the same time as construction, and so there would be a -- a pilot-scale test of the saturated backfill zone process using on-site materials that would commence with the start of construction. So we're hoping that that would give us some data that would help guide our next steps, and -- and then certainly through the operation we will be monitoring and, you know, looking -- looking for trends from -- from the -- in -- in terms of arsenic. I'd -- I'd --

Q Okay. So you --

A Yeah. Just speaking --

Q You are committing to that plan? Okay.

A Yeah. Yes, we have committed to it. We are committing to it, yes.

Q Okay. And I guess you -- can you tell me at this point

what results from monitoring triggered Benga to decide, We are going to build a metals treatment plant, a lime treatment, a -- something to -- to mitigate the release of arsenic?

A Just give me a moment, Mr. O'Gorman.

So, Mr. O'Gorman, I don't have a specific answer to what would trigger a specific number. Again, we -- we think that a pilot-scale test on-site at a -- at a scale that is significant is necessary to, you know, have a better handle on -- on this. We -- we would monitor. We would expect that any indications of arsenic or -- or other metals of concern that would need treatment would develop gradually. Basically these -- these issues arise from the gradual deposit of waste rock external to the pit and subsequently to water percolating through those waste rock dumps.

So that volume of water and, more importantly, the amount of elements or chemicals that would leach out of the rock is going to develop gradually with the project. So our expectation is that monitoring the trends would provide a significant -- sufficient advanced warning of the need to implement a metals treatment plant. But I -- it's difficult to provide an exact number as a -- as a trigger point.

Q Okay. Thank you.

All right. Let's haul up a different document,

please. Actually, not a different document. We're all in the geochemistry document here. Let's look at PDF 163, please. Great.

Now we're looking at uranium. I think you'd agree, Mr. Day, or Jensen, perhaps, that if we look at this, we do see data that indicates uranium leach rates of up to .1 milligrams per litre in the Cadomin in that first week?

A MR. DAY: Yeah, that's correct. Again, I'd just like to point out that these are the acidic -- those tests that were highly acidic, so they're not representative of -- in general of these materials.

Q Okay. Fair enough.

MR. O'GORMAN: Zoom Host, we're going to haul up something different to show, please. It's Registry Document 555. And PDF 233. This was the submission by CPAWS. 233, please. Good. Yeah. If we scan down a little bit and -- no. Zoom in. I did want to be able to see it.

Q MR. O'GORMAN: So we see a couple of the lower -- little pink blobs, refer to the microbial "Shewanellaceae" -- maybe is how that's pronounced. We actually see high proportions of Pseudomonas as well. The Pseudomonas is over 20 percent, and also there's -- yes, the Shewanellaceae is a smaller amount. You see that and agree with that, Mr. Day?

A I certainly see it, but this is not my -- my area, so I think you're going to have --
Q Oh.
A -- to be talking to other people about this one.
Q Okay. I'm not sure who to speak to.

Is there -- who -- who -- who would be able to comment? Here's my question. About the fact that you do have not insignificant potential for leaching of uranium based on the test that we looked at a minute ago, and whether the fact that you have these bacterial communities -- not bacterial. Yeah, microbial communities in your -- in your rock, whether that might cause a concern that -- the interaction with uranium and why or why not?

A MR. HOUSTON: I don't believe we have anybody on the panel who can address this specific question, Mr. O'Gorman. We -- we'd probably have to go back to the author of this report to -- to get a specific answer to a specific question.
Q Okay. If you can't answer, that's fine. I mean -- okay. I was going to ask you some questions. I mean, CPAWS brought this up in their written submission that these sometimes can be of concern, but we'll -- we'll leave that thread of questions, and I'll jump forward.

MR. O'GORMAN: Okay. We can take that down, please, Zoom Host, and let's go back to the

geochemistry reports, Document 42, Appendix 10, and look at PDF 42.

Okay. And we are on 42. Could you zoom out to see the full page, please, Zoom Host.

Q MR. O'GORMAN: Okay. We're talking about acid rock drainage, or let's call it "ARD". So in this document, we see primary mitigation. This is just an example, I think, of this one page, but I think you will know that you have proposed your primary mitigation measures for ARD to be blending and subaqueous disposal by backfilling, which obviously is also a selenium mitigation measure for your project.

You've indicated that in situ performance monitoring with groundwater wells and -- will be conducted as part of the project. However, you've not provided us with action levels for -- in an aquatics -- aquatic effects response plan to give us the triggers at which you would take some actions to -- if acid rock drainage was detected and what those actions would be. It's also unclear how long-term monitoring would be conducted and for how long.

So having put those statements to you, here's my question: So with regards to ARD and metal leaching, can you give us an overview, please, of your sampling schedule and your -- and locations, what analytes you'll be measuring and the thresholds for those

analytes which would trigger an investigation and an actionable response during operations?

A MR. HOUSTON: Could we just take a little moment to conference here, Mr. O'Gorman?

Q Certainly.

A I believe Mr. Day will -- will be able to speak to this, Mr. O'Gorman.

A MR. DAY: Mr. O'Gorman, I think -- and what you're -- what you're really -- you're asking is you -- you want to understand if ARD is detected, what would be the response? What I'd like to do is --

Q Well -- well, actually, no, Mr. Day.

A Okay.

Q We want to make sure -- first of all, to know how you're checking for detecting ARD, and then after that, what you would do about it if you detect it.

A Okay. Well, the normal detection for ARD would be to look for acid general -- acidity in your -- in your monitoring points, but is that -- is that helpful?

I mean, what I was -- what I was actually going to help you understand is I've been working on this -- on this similar approach with other mining companies for a number of years, and what I wanted to point out is that you do not -- you don't want to get yourself to the point where you are actually wanting to pick up whether ARD is being produced. You want to make sure that the

mitigation measure's working well first.

And in the case of blending, as you're -- as you're actually doing the blending, there should be a monitoring plan in place actually at the point of deposition to make sure that that's -- that's actually happening, and that's your -- that's the first thing you want to be doing, rather than monitoring the -- you know, your -- your kind of water points.

Q Okay. So you will develop a standard ARD monitoring plan, let's call it that, and implement it on-site?

A Yes. That should be done. Yes.

Q But at this point, you don't have an answer to what are the trigger levels -- if there is a problem, what you would do about it, or do you?

A Well, I would recommend that -- that -- that there be -- you know, would be -- there would be water monitoring. I think that would be your -- what you would do. But I think that should be developed as part of the overall ARD management approach.

I mean, there are -- there are things you can look for that -- I mean, obviously pH is one, but you're really looking for early -- early indications of -- of -- of accelerated leaching as well, which comes before pH decreases. So there are -- there are parameters you can look for, but I think those details will need to be developed.

Q Okay. Okay. That's fair, Mr. Day. Thank you.
You have described to us what you -- how you plan to manage your -- your PAG rock, your potentially acid-generating rock, in terms of the -- the layering in the SBZs; right? That's the blending, sorry, that's described in your materials?
A Yes, that's right.
Q Yes. All right. Is there -- do you have any concerns into the long lifetime that those SBZs need to operate, that is said to be -- could start to be generated in there; and if so, how might that happen?
A As long as they are kept saturated, then they will -- I mean, this is a very standard measure for controlling acid rock drainage, which has been around for decades. As long as you have underwater conditions, then -- then that will be prevented. Acid generation will be prevented.
Q Would have to stay suboxic; right?
A Correct. That's right. Saturated, yeah.
Q Okay. How long do you expect you might need to monitor for ARD after closure, given that it can sometimes take many years to manifest?
A MR. HOUSTON: So, Mr. O'Gorman, I think we'd look for a -- in terms of long-term management and keeping the AR -- the -- the acid rock in -- in a submerged environment, we -- we would look for

self-sustaining water levels in the SBZs, and we would want to set up the entire water management system from the end-pit lake through the SBZs to the outfall in a state that would maintain a water level in the SBZ that would keep that acid-generating rock in a submerged situation. So that would be -- that, you know, engineering the outfall so that it maintained a minimum level of water in those structures.

Q Okay. Thank you, Mr. Houston.

I'm going to stay on this theme, but I'd like --

MR. O'GORMAN: Zoom Host, could we look at -- I've forgotten if we're on Appendix 10 of Document 42. If we are, that's what I want. And look at PDF 42. Is that 42? Okay. Similar on there -- if we maybe scan down, we'll see these ratios. I don't see them. Mixing ratios.

Q MR. O'GORMAN: Okay. We're not going to waste time finding them on the page. Hopefully you will remember that this is part of your materials.

So in addition to the subaqueous disposal in the SBZs, you're dealing with the PAG rock by blending. You're going to be mixing PAG rock with non-PAG rock, nonpotentially acid generating, to neutralize the acid-generating potential.

Similar in there -- unfortunately, it didn't seem to be on that page I showed us -- you suggested the

ratios -- mixing ratios that you would have necessary for the blending were 50-50 for the -- let's -- and the Moose Mountain members and 75 to 25, or 3 to 1 as some of us say, for the Cadomin formation and the Adanac numbers. Do those numbers sound right?

A MR. DAY: Mr. O'Gorman, I think you're looking for PDF 45. So we can go there if you're -- oh, yes, there it is right there.

Q Okay.

A Yeah. Yeah, it's correct, yeah.

Yeah, these are -- these are some calculations to -- to just check what mixing ratios you might need. They're kind of considered, you know -- like, kind of low targets. Like, you'd want to be higher, but yeah.

Q Okay. And I guess, you know, those -- those blending ratios do -- you know, you're an expert, Mr. Day. Do you -- do they seem high to you?

A When -- when you say "high", what do you mean? That they're -- that they're -- it's a lot of PAG rock, or is that what you're --

Q Yes, exactly. The amount of non-PAG rock you need to blend with it to get it to be neutral?

A They're not -- I wouldn't say they're -- they're -- yeah, I'm not really sure what you're -- what you're asking. I mean, they're -- like, I'm -- I've been working with, as I said, a number of -- a number of

mining companies with this over the years, and they're -- they're not -- they're not unusual. I mean, these are -- they -- they're pretty typical for these types of rocks.

Q Okay. All right. That's fine, then.

And we just want to clarify, do you plan to have any PAG rock not stored subaqueously?

A Well, some of it will be blended. I think that's ...

Q Blended in the pits, but will it also be blended, for example, in the rock dumps?

A External rock dumps. Maybe I should ask Mike -- Mike Youl to -- to respond on that.

A MR. YOUL: Look, in the early years before the end-pit dumping begins, yes, there'll be -- all the waste will go to outer-pit dumps, so I guess, by extension, we will need to work on the blending and -- and containment of the PAG material within that waste dump.

Q Okay. Okay. Thank you, Mr. Youl.

MR. O'GORMAN: We touched on this a second ago. I will point out to my colleague, Mr. Chair, that I would like to finish the geochemistry questions before we break for lunch, and I can see that happening over the next, hopefully, 15 minutes or so, if that works for you, sir?

THE CHAIR: Yeah, that sounds fine.

Thanks.

Q MR. O'GORMAN: Okay. Yes. Mr. Day, we alluded a minute ago to, do you consider there to be the potential for oxygen infiltration into the pits; for example, snow melt, rainfall? And if so, how do you plan to manage or limit that?

A MR. DAY: Sorry. Is the question whether there will be oxygen transported with -- with water coming in; is that -- that --

Q Yes.

A And -- and -- and is the question related to functioning of the saturated backfill zone? Is that the ...

Q Yes. Both for selenium, but in this case, we're talking -- well, we might talk about that more in the selenium questions. I'm thinking of it now from an ARD perspective.

A The amount --

Q Maintaining the suboxic nature of the saturated backfill zone is what I'm asking.

A Yeah, I understand you're -- the question's around whether there's no oxygen coming in with the water to be -- to significantly -- to result in significant oxidation, really, that's the -- I think that's what you're asking?

Q That's what I'm asking.

A Yeah. I mean, there's been a lot of experience with this over the years that the water covers are very effective because the amount of oxygen that can dissolve in the water is -- is so low relative to the amount of oxygen that's in the -- that's in air. And so, I mean, yes, some -- certainly there's going to be oxygen that comes in in that form, but it'll be -- it gets used up very quickly and consumed, and it's -- I mean, that's the foundation for -- for some increased disposal being good, is that you -- you have such low oxygen coming by that route.

Q Okay. Did you say that there would be -- described the cover over the saturated backfill zone? Did you say there would be some sort of cover that prevents penetration of oxygen, for example, with snow melt?

A No. I -- I didn't say that, no. And I don't -- I wouldn't see the need for it.

Q Okay. All right.

A MR. HOUSTON: To be clear, though, Mr. O'Gorman, we will be -- or putting topsoil and revegetating the -- over the saturated backfill zones like the rest of the -- the project, so there will be that vegetative cover.

Q Okay. Thank you.

Can you confirm -- I think you said you will be monitoring to ensure that no acid is being generated

by -- in the SBZs?

A MR. DAY: That would be a normal part of the monitoring, yeah.

Q Okay. You're dumping the PAG and non-PAG rock down into the pit in layers. Would it be more effective for you to crush and mix those layers to create a homogenous blend at predisposal?

A Yeah, that -- sorry.

A MR. HOUSTON: Sorry. Go ahead, Steve.

A MR. DAY: I don't believe -- I don't think that's necessary. You know, the -- and crushing creates more surface area, which makes more reactivity, so I wouldn't -- I wouldn't recommend that.

The experience I've had with implementing a similar approach elsewhere -- not me personally, but working with companies that have done it -- we don't find that's necessary that the -- that -- that by end-dumping over high enough faces you get sufficient mixing on the face to -- to result in this kind of -- this blending process. So I don't -- I don't -- I wouldn't recommend crushing. I don't -- I don't see it as necessary.

Q Okay. Last question in this group, and then I'll ask a couple of more.

MR. O'GORMAN: Just really quickly on page 47, Zoom Host, a couple of pages later, there's a

diagram.

Q MR. O'GORMAN: And we are wondering whether it would make more sense to dump a non-PAG layer at the base. Do you think that it matters?

A MR. DAY: It -- it doesn't matter. If you -- like, if -- if the concept of an un-PAG layer at the base is to -- is to neutralize acid produced above it, it wouldn't be effective. The key point about this diagram is not to illustrate an actual dumping sequence but to -- really to show that by having thin enough PAG layers that you effectively result in an un-PAG mixture -- functioning as just an un-PAG, and so what -- what's on the bottom really -- really doesn't make any difference. The intent is that the whole thing behaves as a nonacid-generating sequence.

Q There you go. Our confusion was thinking this presented your proposed --

A No. No. No. This is a demonstration of a theory.

Q Fair enough.

Okay. So the last group of questions in this theme. Can we please see, same document, let's just jump ahead a few pages to page 51, PDF 51, please.

So now we're talking about the derivation of the source terms. There's a line in here about how the results -- the input rates from the -- determined from the humidity cell -- I'm not going to find it on the

page. I'll ask you to believe that it's there. The input rates for the water quality model were determined from the humidity cell tests that were scaled to field commissions based on laboratory-to-field scaling factors determined for coal mine wastes in the Elk Valley.

We have here inputs that are given, and it's down on this page, but I'm pressed for time and I do want to move. We've got inputs that were given for elements that are controlled by pH and for selenium and sulphate.

We noted that the Fernie and Gladstone formations were not included in humidity cell testing or in the pit wall runoff calculations. Does that make -- does that make -- sound right to people, that you did not include the Fernie and Gladstone formations in --

A MR. DAY: Yeah. At the time of the testing we didn't have samples of Fernie to test, so that -- that does make sense. I'm not sure about Gladstone. I'd have to -- I'd have to check back on that.

Q Okay. Yeah, we did notice if we called up a different document -- so it's Registry 42, Section B this time. And we looked at PDF 96. If I wrote this down correctly. 96. That, yeah, on this graph -- graph. Sorry.

On this figure, the -- the Fernie is the big purple bit, and the pink line, I think, indicates the pit bottom; right? And there being -- if we see near the top of that central figure a fair chunk of the Fernie would be -- would be mined; does that make sense? Am I interpreting that figure correctly?

A I think it would help -- I think -- I think you're right, Mr. O'Gorman, but I probably should ask Mike Youl just to confirm that.

A MR. YOUL: Yeah, that's correct. The Fernie sits below the base of the lower seam, so in some areas we'll be excavating through that for foot wall stability and also for ramp access.

Q Okay. Great. I think we're on page 96, and if we scroll back to 94 in this document. It looks to me, and to us, like the Fernie formation would be exposed frequently along the pit boundary in some of these cross-sections. Do you agree with that?

A That's correct, yeah. In some of the final high walls it will be exposed and then backfilled.

Q Okay. Okay. Thank you for confirming that, Mr. Youl.

Okay. We'll go back to Appendix 10 again, and we'll go to Document 42, Appendix 10, the geochemistry reports, and we'll -- right. Go to page PDF 51. Oh, we're there. And this is the second paragraph from the bottom. If we'd scroll to the bottom of the page,

please.

It's a sentence that begins "the input rates" -- I found it earlier. Right, right there. Right there. (as read)

The input rates were determined from humidity cell tests which were scaled to field conditions.

And I mentioned that earlier.

So can you briefly explain this -- the laboratory field-scaling factors that you're referring to to help our geochemists understand that translation you made?

A MR. DAY: Yeah. I'll explain that. So this is a standard thing that needs to be done to to use laboratory testing. The tests are performed under room temperature conditions, under finely crushed materials relative to -- to site scale and under fully oxygenated conditions. And it's necessary to -- to address all of those factors which tend to make weathering faster under laboratory conditions than they are at field scale. And we do this using scaling factors which translate the rates of -- for -- at least measured in the tests to -- to field scale.

Q Right. But what sort of -- are those scaling factors standard that one would look up in a textbook, or what -- like, what are the scaling factors?

A Well, yes, the scaling factors -- if you scroll down,

the actual scaling factors are shown in Figure 10, which I believe is on the next page of the document. There we go. Thank you.

I mean, these are -- they're not standardized because they're -- you need to consider site-specific conditions. But in order to develop these scaling factors for the Grassy Mountain Project, we referred to a paper that was referenced on a previous page which I was the co-author of, and a study that I designed, to look at scaling factors in the Elk Valley, and that was how we -- we used the same scaling factors because the rocks are very similar. The climatic conditions are similar enough for geochemical purposes to -- to come up with the scaling factors which are shown in that first row there in -- in Table 10.

There is a -- there's quite a bit of experience on this topic around the -- you know, in the -- particularly in Western Canada, and these -- these are not unusual scaling factors. They're -- they're fairly typical. I mean, there's no -- there's no textbook you can go to look them up, but they're -- they're fairly typical.

Q Okay. That's fine. That's the methodology question I was really trying to get at, so thank you.

If we cut now in this document, please, to page 15. And we're going to have to find something --

right there. Right. Other formations will be mined. It's the final paragraph above where -- Section 2.4.

So I'll let you read that. We don't need to read it out. You can skim it.

We do want to know -- so you didn't have fresh samples of the Fernie formation when you did your testing. Is that what you said?

A Yeah. That's correct. Yeah.

Q Okay. I guess we did wonder, and I'm -- whether any of the drill holes that you drilled might have provided a sample from the Fernie that you could have tested?

A At the time there were not samples available for the Fernie formation. We did subsequently get samples from a part of the project area to look at Fernie, and I believed there are -- there have been samples that have come available subsequently, so there -- there are materials available that can be tested.

I would just like to say that -- I mean, from my experience working with these rocks throughout the region, the Fernie formation is not a -- is not a potentially acid-generating unit, so it's -- it's not a concern from that standpoint. And -- and generally the volume of rock is -- as Mr. Youl described, is relatively small, although most figures it looks like it's big. It's more of a -- it is a small part of it because they're -- they're really trying to avoid

having to mine much of it. It's really just to access where the coal is and for stabilization reasons.

Q Fernie has shales; right?

A The Fernie is a -- it's a sandstone -- it -- it has sandstone units, it has siltstone -- siltstones and shales, yeah.

Q Okay. So those shales wouldn't be expected to contain pyrite?

A Yeah, they do contain pyrite. That's the regional finding on the Fernie. They do contain pyrite, but they also contain -- tend to be quite calciurias, meaning a lot of carbonate, and so we -- we aren't concerned about acid generation from the Fernie in general.

Q Okay. Okay. So nearly there.

MR. O'GORMAN: If we can haul up, please -- this time we're going to a different document, Zoom Host.

Q MR. O'GORMAN: And I'll ask for the document, and I'll throw one final question at you while -- while they're searching for it.

Now we're looking at Registry Doc 42, Consultant Report 3, and while that's coming up, just to wrap up my last question. So you aren't -- Mr. Day, you're not concerned about ARD from the Fernie. What about metal leaching?

A MR. DAY: Yeah. The -- the geochemical characteristics of the Fernie are quite similar to the -- this mountain formation. It can have -- it can have higher sulphide content. But the element content of the Fernie tends to be similar.

So I'm not in general -- I'm not in general concerned about it, just because it's not -- it's not -- not a particularly unusual unit, and it does tend to be a relatively low proportion of the overall waste that's produced.

Q Okay. Okay. That's fine. Thank you.

So in this document --

MR. O'GORMAN: Zoom Host, PDF 85, please. So where is the figure that we want to see? Scan down a bit. What we're concerned about -- maybe you need to scan -- actually, you are going to need to scan it. And let's look at the legend.

Q MR. O'GORMAN: I think if we find -- when I looked at this earlier, if you blow up the -- zoom in on the legend a bit, you will see that the Fernie on here is indicated -- as I recall, they were in blues, but I'll admit I can't -- I'll admit I can't read it. But if we think about the overlay of your project design, we -- in looking at this figure, can you confirm that it seems the raw water pond is placed where the Fernie is at surface?

A MR. HOUSTON: It -- it appears to be, Mr. O'Gorman.
Q Okay. Now, Mr. Day, I acknowledge what you just said about your views on the Fernie formation. But the raw water pond, it will not be a suboxic environment; right?
A MR. DAY: I -- I can't speak to the design of the raw water pond. If somebody else could. I mean, I -- maybe Gary -- Mr. Houston.
A MR. HOUSTON: Yeah. No, it -- it -- it won't be suboxic. There'll be exchange of water through there, and -- and so it will be oxygenated.
Q Okay. So I guess we just were -- wanted to understand whether you would be checking for or monitoring whether you had concerns about the fact that the potential -- that some of the sulphides in the Fernie formation might be exposed during the excavation of the raw water pond and be -- you know, release trace metals or cause ARD.
A MR. DAY: Yeah. My -- my advice to -- whenever excavations are made at mine sites is that there is -- is at least a geologist checking to see what the rock looks like and, if necessary, geochemical testing done, but I think that would be normally part of a -- an MLA or ARD management plan that's developed.
Q Okay. Mr. Houston or Mr. Youl, can you remind us

whether you have planned to put a liner at the bottom of your raw water pond and particularly -- you'll understand, I think, where I'm going with this -- the potential for elements in the Fernie formation to be liberated into the raw water pond?

A MR. HOUSTON: So I'll let Mr. Youl add to this, but we have not committed to lining the raw water pond. We will do additional investigation and -- for a number of issues, including the -- the quality of the rock, and we -- we could do something to line the raw water pond if those -- subsequent investigations at the time of construction indicated that there was reason for a -- a concern.

Mr. Youl, do you -- do you want to add anything to that?

A MR. YOUL: Thanks, Mr. Houston.

No. You've covered that pretty well. I don't have much more to add, other than, you know, we are considering liners; not yet committed. One of the concerns with a liner is upward hydraulic pressure pushing up the liner from underneath and -- and whether by installing one we're creating other problems. So we're still looking at all the potential solutions.

A MR. HOUSTON: And just finally, Mr. O'Gorman, I think we're talking about a fairly small surface area compared to the rest of the -- the

project. So, you know, we -- we would anticipate that any -- any issues related to ARD are -- are relatively small in -- in the scheme of things from the raw water pond.

Q Would you plan to conduct humidity-style tests and maybe X-ray defraction on Fernie samples before putting in the raw water pond, or are you really just not concerned about it?

A One minute, please.

So, Mr. Day, can you -- can you speak to that?

A MR. DAY: Yeah, I'm happy to.

No. I would -- I would -- like, for something that's, you know, relatively small in the -- the, you know, context of the whole site, normally what I would recommend is that a geologist or somebody just take a look at the rock as part of the other investigations that are done to design the pond. I wouldn't see the need for a -- for -- for testing beyond that unless -- unless that -- that geological look came up with something.

Q Okay. We're really close to the end. I was going to draw you to some things that you had said, but to -- to abbreviate it, cut to the -- cut to the chase, you haven't tested the Fernie formation, and we don't think -- we haven't discussed it, but we're not -- we don't think you've tested leaching potential from the

Gladstone formation either. Both of those might be in the rock that you dig up, and so we do wonder whether you think that estimated seepage from the waste rock for concentrations for dissolved metals, like cobalt and zinc, might be higher if you were to add a -- potential leaching from the Fernie and the Gladstone formations. And to be fair, I haven't asked you about the Gladstone, so we can focus on the Fernie.

A I'll answer that, Mr. O'Gorman. I -- I really don't think that the -- the Fernie formation would have a significant influence on those -- those -- those predictions. I mean, they're -- we've based those source temp predictions on the bulk of the waste rock, and they also consider the influence of some of the units that are noted in the humidity cells that do react rapidly. So I'm -- I'm not concerned about the Fernie.

I -- I mean, I think it would be prudent to -- to -- to be -- to be looking at the Fernie to -- as I've talked about, from the geological standpoint and confirming its geochemical characteristics, but I don't -- I don't think it really has an influence on the water chemistry predictions, not a -- not a significant influence anyway.

Q To clarify, there are no tests on the record to confirm that, though; correct?

A Definitely not for humidity cells. That's correct, yeah.

Q Okay. I think we're good. Thank you, gentlemen. That gets us through our section on geochemistry. Thank you for your -- for your responses.

And, Mr. Chair, I propose it's a good time for us to break for lunch.

THE CHAIR: Okay. Thank you, Mr. O'Gorman.

It's 12:30, so let's resume at 1:15, and Mr. O'Gorman will continue with his questions.

MR. SAWYER: Mr. Chairman --

THE CHAIR: Yeah.

MR. SAWYER: Mike Sawyer here.

THE CHAIR: Yeah.

MR. SAWYER: My apologies for interrupting, sir, but Timberwolf has reviewed Undertaking Number 19 that was provided to us today, and I would like the opportunity to have a very brief redirect on the information that was provided in that undertaking, sir.

THE CHAIR: Okay. Okay. Mr. O'Gorman, would you mind if I provide that opportunity to Mr. Sawyer right after the lunch break before you resume?

MR. O'GORMAN: That's completely fine with me, sir.

THE CHAIR: Is that okay with you, Mr. Sawyer?

MR. SAWYER: Yes, sir. I think I'll be less than 15 minutes.

THE CHAIR: Okay. Thank you.

Okay. We'll see everyone at 1:15.

PROCEEDINGS ADJOURNED UNTIL 1:15 PM

Proceedings Taken via Remote Video

November 20, 2020 Afternoon Session

A. Bolton	The Chair
D. O'Gorman	Hearing Commissioner
H. Matthews	Hearing Commissioner
M. LaCasse	AER Counsel
B. Kapel Holden	AER Counsel
K. Lambrecht, QC	Joint Review Panel Secretariat Counsel
T. Utting	IAAC Staff
E. Arruda	AER Staff
D. Campbell	AER Staff
T. Turner	AER Staff
T. Wheaton	AER Staff
A. Shukalkina	AER Staff
M. Ignasiak C. Brinker	For Benga Mining Limited
R. Warden T. Howard	For Ktunaxa Nation

K. Poitras	For Métis Nation of Alberta Region 3
Chief B. Cote	For Shuswap Indian Band
B. Snow	For Stoney Nakoda Nations
R. Drummond S. McHugh	For Government of Canada
A. Gulamhusein	For Municipality of Crowsnest Pass
M. Niven, QC R. Barata J. Nijjer	For MD of Ranchland No. 66
B. McGillivray	For Town of Pincher Creek
D. Yewchuk	For Canadian Parks and Wilderness Society, Southern Alberta Chapter
R. Secord I. Okoye	For Coalition of Alberta Wilderness Association, Grassy Mountain Group, Berdina Farms

		Ltd., Donkersgoed Feeder Limited, Sun Cured Alfalfa Cubes Inc., and Vern Emard
	R. Cooke	For Crowsnest Conservation Society
	G. Fitch, QC C. Agudelo	For Livingstone Landowners Group
	M. Sawyer	For Timberwolf Wilderness Society and Mike Judd
	(No Counsel)	For Barbara Janusz
	(No Counsel)	For Jim Rennie
	S. Elmeligi A. Morehouse S. Milligan M. Boyce	For Alberta Chapter of the Wildlife Society and the Canadian Section of the Wilderness Society
	J. Gourlay-Vallance	For Eco-Elders for Climate Action
	L. Peterson	For Trout Unlimited Canada

R. Campbell	For Coal Association of Canada
(No Counsel)	For Alistair Des Moulins
(No Counsel)	For David McIntyre
(No Counsel)	For Fred Bradley
(No Counsel)	For Gail Des Moulins
(No Counsel)	For Ken Allred
(Not Present)	
(No Counsel)	For Monica Field
S. Frank	For Oldman Watershed Council
A. Hurly	
A. Porco, CSR(A)	Official Court Reporter

(PROCEEDINGS COMMENCED AT 1:17 PM)

Discussion

THE CHAIR: Welcome back, everybody. Just before we let Mr. Sawyer do his follow-up cross, the Panel had a discussion at lunch, and I wanted to put this to the participants. We had planned to sit

tomorrow, and the reason for that, of course, was to try and contain the water section to one week, the six days, but it's clear, based on where we're at in the schedule, that even if we sit tomorrow, I don't think we'll -- well, we won't finish the water section tomorrow.

Looking at where we're at, my best guess is we probably have two full days after today, when I look at the participant time estimates for their direct and the cross. So even if we sit tomorrow, we're not going to finish.

So I'm also aware of the fact that we used our last two flex days, which were both Saturdays, and sat those days to try and kind of keep on schedule, and I've also noticed that we've gone late a few nights beyond kind of what we said we were going to sit.

So the Panel is of the view that it might be preferable to do what we can do today and then resume Monday and not sit tomorrow, and I know that's a departure from the schedule. So before we kind of make that decision, I wanted to kind of hear from any of the participants about whether that would create any kind of unmanageable scheduling issues in terms of, you know, expert witnesses or others.

MR. SECORD: It's Richard Secord here. I actually was wanting to just raise as a preliminary

matter exactly what you've raised. Looking at the schedule, I just wanted to get your confirmation that the four expert witnesses for the Coalition would not have to be on standby today and would come in tomorrow morning.

I -- my guess is that the four witnesses would probably not be adverse to coming on Monday, but I would need to check their availability. I know that they are available tomorrow morning, but subject to their availability on Monday, certainly I would have no objection.

THE CHAIR: Okay. Mr. Secord, thanks for that.

Any other participants have comments on that?

MR. DRUMMOND: It's Robert Drummond from Justice Canada. I will just have to confirm. As you know, there are a number of federal witnesses, and I want to make sure they're all available. If the hearing goes longer than the 30th, there might be a slight question of Canada asking to go at certain times because of one witness's availability, but I think we can leave that for now.

THE CHAIR: Okay. Thank you, Mr. Drummond.

MR. FITCH: Mr. Chair, it's Gavin Fitch. Yeah, I had been thinking up until, I guess, yesterday

that we would probably be putting up Dr. McKenna tomorrow, so we're not adverse in principle to not sitting tomorrow. Far from it. But like everyone else, I'll need to just check with Dr. McKenna to see if that creates any problems with his schedule next week.

THE CHAIR: Okay. Thank you.

MR. RENNIE: This is Jim Rennie speaking.

THE CHAIR: Yes, Mr. Rennie?

MR. RENNIE: I have an appointment on Monday from the middle of the day, from about 11:30 till 12:30. Do you think that I would be giving evidence around that time or later in the afternoon?

THE CHAIR: It looks like you might be either late that day or Tuesday.

MR. RENNIE: Okay. Well, later on Monday will be all right. I just have that previous commitment in the middle of the day.

THE CHAIR: Okay. Thank you, Mr. Rennie.

MR. RENNIE: All right.

THE CHAIR: Mr. Ignasiak, any comments from Benga?

MR. IGNASIAK: Thank you, Mr. Chair. I don't think so. Not at this time. I haven't had a chance to talk to my client, so ...

THE CHAIR: Yeah. Understood.

MR. IGNASIAK: But, you know, we'll do whatever makes it easiest for the Panel to move this forward.

THE CHAIR: Okay.

MR. IGNASIAK: So we're in your hands.

THE CHAIR: Okay. Yeah. Again, sorry for the change in thought. But we're just looking at what we still have to get done this week, and it doesn't look like we'll get it done. And I think, you know, continuing to push as hard as we have been may not serve us well.

So I'll leave it for now, and maybe what I'll do is ask that if -- to the extent possible, those who have identified potential scheduling issues could try and, you know, just confirm with their clients -- or, sorry, their witnesses, depending on the case, whether moving to Monday, Tuesday to finish this session would create -- create an issue, and then maybe I'll poll people again just before the break to see if we can get some clarity.

In any event, given where we're at, the Government of Canada witness panel would not be up today, so it would be up tomorrow if we stuck to the original schedule. So I think they can certainly stand down for this afternoon. Looks like Mr. O'Gorman will probably take us to the end of the day.

MR. SECORD: And, sir, can we just send an email to Ms. Utting and Ms. Arruda to let them know that we're -- if all of my witnesses are okay for next week, would that be sufficient?

THE CHAIR: Yeah, I think that would be -- that would be probably preferred, and then we can look at that at the break and -- and confirm our kind of course of action after the break.

MR. SECORD: Thank you very much.

THE CHAIR: Okay. Any other discussion on that topic?

MR. YEWCHUK: Just one point from Mr. Yewchuk at CPAWS. Is there any chance my witness will be up today, or should I release them?

THE CHAIR: No, I see no chance, Mr. Yewchuk, given where we're at, so thanks for asking.

MR. YEWCHUK: Thank you.

THE CHAIR: Mr. Sawyer?

MR. SAWYER: Thank you, Mr. Chair. Bear with my ignorance, but this IR Response 19, has it been entered into -- as an exhibit in this proceeding; and if not, can we?

THE CHAIR: I believe it already has, but maybe staff could confirm that.

MS. UTTING: It's entered this morning as

CIAR 877, I believe.

MR. SAWYER: Thank you for that.

Zoom Master, if I could ask you to bring up CIAR 877, please, and if you could turn to PDF page 4, please.

GARY HOUSTON, DANE MCCOY, MIKE YOUL, MIKE BARTLETT, CORY BETTLES, DAVID DEFOREST, SOREN JENSEN, MARTIN DAVIES, LEIF BURGE, DAN BEWLEY, Previously Affirmed

STEPHEN DAY, NANCY GRAINGER, Previously Sworn

Mr. Sawyer Cross-examines Benga Mining Limited

Q MR. SAWYER: Good afternoon, Benga panel. How are you all today?

A MR. HOUSTON: We're fine, Mr. Sawyer. Thank you for asking.

Q Okay. I have a few questions directly out of your response. And I just want to make sure I understand your numbers.

Now, did -- Mr. Bettles, are you there?

A MR. BETTLES: Good afternoon, Mr. Sawyer. How are you today?

Q I'm good. Thank you.

Did you prepare these numbers, or did one of your team members prepare them?

A I worked with a biostatistician that works with us at Hatfield.

Q Okay.
A Then the time to get the numbers turned around.
Q Okay. So I just want to make sure I understand these numbers.
A Sure.
Q And so I'm going to look at Table U19.1 on page 4. And under the Gold Creek values, I just want to focus on Reach 9, and Reach 9's not important in one or the other. I just want to make sure I understand how you did the numbers.

So as I look at Reach 9, I see that you -- during that survey, you caught a total of 203 fish; is that correct, sir?
A That's -- that's, I believe, the number that comes from the previous tables that -- in -- no. Actually, I believe that you're correct. That's right.
Q Okay. And then you indicate a number -- a survey length in metres, and in that case it was 368 metres; correct?
A That's correct.
Q And that would have been the length of the stream channel that you surveyed using electrofishing methods?
A Just one second, please.

The -- I was -- just to clarify, the total westslope that we caught, 203, we didn't catch those. That total westslope is as an estimate.

Q Okay. So, yeah, and I stand corrected. So that is your estimate when you applied the -- the statistical method from the number you caught?
A That's correct.
Q Okay. Thank you for correcting me on that.
So back to my question. In Reach 9, the stream length that you surveyed using those methods was 368 metres; correct?
A That's correct.
Q And we look at your density number's 100 -- per-100-metres square. Although you didn't use this later on, that's simply a number of dividing the -- the number of fish you estimate by the number of square metres of wetted channel in that 368-metre length; correct?
A It's length and width 'cause you need the square metre -- you need the area.
Q Okay. And for this calculation where did you get the width from?
A We had calculated the -- the width while we were out there doing stream channel measurements. So it's not reflected in the table, but we did take width measurements.
Q Okay. So that's based on the value it derived during the time you did the survey?
A That's correct.

Q And that would be a mean -- a mean value for the entire length that you surveyed?
A It's -- it's an -- it's -- it's an approximate number, a density number for that area that we surveyed based on the mark-recapture estimate, which is referred to as the total westslope number of fish.
Q Okay. And going along on that table, we -- (UNREPORTABLE SOUND)
MR. SAWYER: My apologies, Mr. Chairman, for the ringing. I have no control over it, and it'll end shortly if it hasn't already. No.
Q MR. SAWYER: Continuing. So you surveyed 368 metres of that reach; correct?
A That's the length that we surveyed, correct.
Q And -- and in that table you say the reach length was 1,922 metres?
A Well, the -- where -- Reach 9 is comprised of 1,922 metres itself, but we only sampled 368 metres of -- survey length in there.
Q Okay. And then so if I'm correct, you -- if we look at those numbers, you would have created a ratio of how long you surveyed relative to the total reach length; correct?
A Sorry. I'm just double-checking here, looking at it. So, first of all, what we've -- what we've done is we've -- we've taken the density estimate and we've

applied a density scale factor to come up with a standard deviation of westslope cutthroat per 100 times square -- square metres.

Q I see that, sir, but that's -- that's not what I'm asking. If we look at, for example, in the -- in the right-hand block of the -- the Table 4, Reach 9, you've come up with an estimated number of westslope cutthroat trout of 1,060.2?

A It's not time -- it's not time-distanced. It's not time -- it's not time; it's distance. Sorry.

Q Okay. So just -- just let's back up here. You surveyed 368 metres of the reach; correct?

A It's a proportion of the full reach of Reach 9 that we've identified as 1,922 metres; correct.

Q Okay. And I would suggest to you if you do your arithmetic, you would see that that proportion was 5.228. So you multiplied your total estimated fish of 2,003 by 5.228 to get 1,060.2; is that not correct?

A Just one second. Bear with me. Sorry. I believe you're getting -- you're pretty much right there, I believe.

Q Mr. Bettles, I think I'm exactly right.

Okay. And you've used that same method for the calculations that you did on -- on Reach 7 angling, Reach 7 electrofishing, and Reach 8 electrofishing, as well as for all the data presented for Blairmore Creek;

correct?

A That's correct.

Q Okay. So let me ask you this question, sir: During the course of this study, have -- has the identification of the specific reaches changed during the course of the study?

A We -- we have been standardized -- we've standardized our reaches. We haven't changed them at this point. So the actual reach lengths that we've identified, we've maintained those reaches to date.

Q Okay. So what is the reach length of Reach 9, please?

A Well, in this -- based on the Table U19, we have 1,922 metres.

MR. SAWYER: Okay. Zoom Master, I wonder if you could bring up CIAR 42, Addendum 1, Appendix A1, and if you could go to page 131, please. I must have the wrong document.

Where I'm looking is CIAR 42, which -- and then Addendum 1, Appendix A1. And I believe that --

MR. IGNASIAK: Mr. Chair, I think he means CIAR 44, if he's referring to Addendum 1.

MR. SAWYER: Mr. Ignasiak, I'll take that on advice. Let's just see where it shows up.

If we go to page 131, what do we see? Should be a Table A2.1. That is correct. My apologies, Mr. Chairman, and other participants. I didn't -- I

thought I had the right number.

So I wonder if -- Zoom Master, if you could zoom in on that so we can read the numbers, just in that top portion of the -- of the -- of the paper.

Q MR. SAWYER: Now, Mr. Bettles, you're familiar with this; correct?

A MR. BETTLES: Mr. Sawyer, yes, I am. I'll let you continue on here, and I will -- I have a response, I think, already prepared, so -- but continue, please.

MR. SAWYER: So, Zoom Master, if you could scroll over so we can see the values for Reach 9.

Q MR. SAWYER: Now, Mr. Bettles, would you confirm for me that your Reach 9 length, and I'm reading this directly out of the table, is 616 metres?

A MR. BETTLES: Well, that's the -- that is the number in that -- in that table you're showing there. Correct.

Q Okay. So you've told us that there -- that the reaches as they were defined early in the study have not changed; correct?

A I'd like to clarify that I think you're -- we've done further habitat work post 2015 and into 2016 where we actually have delineated the reaches through our habitat mapping. So this was used initially to inform further analysis that we did in 2016, so we have other

figures in our -- in our technical baseline report that were used to derive the actual reach lengths, more appropriately to cover off on a bunch of different aspects of our assessment.

So I would -- I would actually argue that we did not use the data in this -- in this table for our reach delineations in our mark-recapture estimates.

Q So, then, that means that your response to my earlier question is: Have the reach definitions changed over the time of your -- that was not a correct answer?

A Well, I guess you can -- I guess -- I guess it is inaccurate, but again, if -- if you look at our documentation in our -- in our actual baseline report, we refer to the work that was done in 2015, but we really focus on the 2016 habitat mapping that we -- that we used.

So, I mean, yes, it's -- it's initially preliminary information we collected in 2015, but the -- the -- the scope of our assessment relied on the 2016 habitat mapping that we conducted.

Q Okay. So you did not answer my question accurate.

So if we were to pull up that table -- or a table that shows you what the actual reaches that you used at some point in your -- would any of those tables jive with the numbers that you have presented in your response to the undertaking?

Specifically, do you have a table that shows the estimated reach length of Reach 9 as being 1,922 metres?

A It's -- that's the reach length that we -- that -- that we identified. I'd have to go back and look in the actual document to find those numbers, Mr. Sawyer.

Q I'd like you to do that, sir.

A Just bear with me for one second.

Yes, that would -- that would be Table 4.1 in the actual document, so yes. That's where we've -- we identified it, and I can let you -- sorry. And that's in the same document that we -- CIAR 44, Addendum 1.

Q On what page, sir?

A That would be on PDF 47.

Q So you're saying this is in the same document as the one that I'm referring to, this table?

A That -- that's correct.

Q Okay. And when was this -- this document was published in 2016; correct?

A That's correct.

MR. SAWYER: Okay. And so we can just go to that Table 4.1 on page 47, Zoom Master, please.

Q MR. SAWYER: Okay. So Gold Creek -- I'm just checking some numbers here. Okay, sir. So we're going down a bit of a rabbit hole here, but I just want to check a couple things.

First of all, in your electrofishing survey, you used a reach length of 1,922 metres; correct?

A MR. BETTLES: That's what's in the table, yes.

Q Well, I'm not asking whether it's in the table. I'm saying: Did -- is that the length of reach that you used for your calculations of population sizing confidence?

A That is the number we -- that was incorporated in there, yes.

Q And so now when I looked at the earlier number for Reach 9, it said in the same document we were referring to it was 616 metres long. Now, you've told me that's not correct, that you didn't use that number. And instead, you've told me you used this number, which is 2,130, which is over a hundred metres longer than the number you used in your population estimate; correct?

A That's -- that's correct.

Q How do you explain that?

A I believe that -- that's an error.

Q Okay. Moving along. If we went down each of these reaches that -- Reach 7, 8, we would find the same error, wouldn't we, sir?

A That -- that would be -- that would be accurate.

Q Okay. Let's go back to your response to the IR, if I can, Zoom Master.

And here is -- here is what flagged this whole issue for me. The reaches as they're defined, notwithstanding our previous discussion here that you changed the reaches, the reach is the reach; correct?

A It's what we have defined it as.

Q Right. So if we look at Reach 7 under "Angling", and we go over to "Reach Length", you've defined the reach length for the purpose of that analysis as 400 metres?

A That -- that's -- that's correct.

Q And under "Electrofishing", you've defined the same reach as 2,474 metres, notwithstanding the -- the -- the built-in errors around what the actual length is, how can you have the same reach, one -- one -- in one case measuring 400 metres and in the other case measuring 2,474 metres. It's the same reach. Explain that to me.

A Sir, they get added up. Those numbers get added up. So --

Q Get added up from where?

A Just one second, please.

So in this case, Mr. Sawyer, the -- the reach length is proportionate to the angling, so you would add up the two numbers for the reach, electrofishing and angling.

Q So you're saying that the -- the reach length on 7 should be presented as 2,874?

A Well, you -- you break it out based on the method of sampling that you did in the reach. So if you combine the two together because -- and that's what we've tried to do, is because of the type of sampling that was done, each reach length is proportionate to -- to the actual amount of effort that you put in based on the method that you used.

Q And what was the reach length of 7 that you presented in Table 4.1? What's --

A It was -- we documented it as 3,183.

Q So, again, you know, we're looking at a -- over a 400-metre error in -- in what your -- the length of your reach is?

A I don't know if it's 400. I think it's less than that, Mr. Sawyer.

Q Approximately 400?

A Well, it's less than 400.

Q But it's more than 350?

A Well, it's -- it's in that range, then.

Q Okay. Would you agree, Mr. Bettles, given the errors that we've seen in your calculations here and in the errors we've seen -- or maybe more accurately, the changes that you've used in defining the length of your reach, if we embed all those errors in the calculations -- and remember, the lengths are -- there's two variables here. One is the length that you

surveyed -- no, there's three variables: the length that you surveyed, how many fish you caught, and then -- and then based on that, how many did you estimate were in that reach you survey, and then you extrapolate to the entire reach.

Would you agree with me that the embedded errors in your calculations have resulted in you overstating the number of fish and, in this case, in -- in that survey you concluded there were 613 fish in Blairmore Creek, plus or minus, plus or minus 1,128, so that's a really wide range of error.

If you redid these calculations and eliminated the error in terms of reach length, would you agree with me that these numbers significantly overstate the number of fish that you would have estimated if you'd done it correctly?

A Mr. Sawyer, I -- I can't speak whether or not the number would be up or down at this point. What I can say is that each -- each -- each reach that we analyze -- or we -- we do a population estimate for each reach, and each reach is treated as its own independent experiment. And so based on that , we standardized to try and combine together.

So if you -- if you -- if you adjust the reach lengths, accordingly again, and given the number of high abundance of fish that are in the upper reaches of

the system, it might bring the numbers down, but I can't say right now at this point what that would do to the actual numbers.

Q Okay. So if we -- if we look at a Reach 7, for example, were there high abundance of fish in Reach 7?

A There's -- yeah. I mean, all -- the upper reaches have reasonable numbers of fish. That's why we included them.

Q Okay. And with respect to the Reach 9, sir, where did that -- bear with me one second. I'm going to actually do the exact calculation.

You said the reach -- your Reach 9 was 32 what? 3,274?

A No, no. 31 -- Reach 7 was 3,183 based on Table 4.1.

Q Okay. And --

A Mr. Sawyer, if I can -- I can just clarify. If the reach numbers used are low, then the population estimate is an underestimate. So in -- in our opinion, at this point, just from a -- at a high level, we -- we -- we believe that our actual numbers could be -- could be an underestimate. We'd have to double-check the numbers, but just -- just doing some rough -- rough number crunching, it's an under -- it likely could be an underestimate.

Q Well, okay. So you're telling me that Reach 9 was -- sorry. You said 31?

A No. Reach 9 was 21 -- 2,130 in Table 4.1.
Q 2,130. Okay. Bear with me one second, sir. 2,130.
Okay. So you've got an error reporting your reaches relative to what Table 4.1 had them listed, and your -- your -- your numbers -- or your estimated numbers on fish which on Reach 9 were -- you estimated there were 203 fish in 368 metres of stream that you tested; correct?
A Our -- our -- sorry. Repeat the question, please. Wait. We have -- what we've -- sorry. We've estimated based on the mark recapture 203 fish in Reach 9, based on a survey length of 368 fish. Or, sorry, 368 metres. Apologies.
Q Okay. And then once you had that estimate, all you did was multiply that number by the length of the reach, correct, to come up with your total estimate?
A Sorry. Just double -- I'm just doing the math here. I think that's -- I think that's reasonable.
Q Okay. And so if you multiplied by a reach length that was longer than what you purport to use in this calculation, you actually would end up making the number of fish you caught higher, wouldn't you? The estimate would be higher, not lower, but higher?
A Well, that's what I said. I think I just mentioned that previously, that our numbers would likely be underestimates, then, based on going with lower reach

lengths.

So what we did is we -- we converted the total number of fish to a density -- density estimate fish per 100 square metres, and that's the number that we applied.

But it's important to point out that I know the number -- even if there's an adjustment here, the number's -- if the number is underestimated or overestimated, it's going to fall within the same confidence intervals that we've identified here too. I mean, those confidence intervals may shift slightly if you were to update the reach lengths. But ultimately, I mean, the numbers still fall within that -- the range that we've identified.

Q Two things, and then I'm going to -- first of all, you did calculate the density of fish per 100 square metres, but you did not use that -- I'm going to correct you, sir. You did not use that number, which in this case was 13.13, in the calculation of your estimate of westslope trout in Reach 9 which -- which you've already told us was a multiplication of how many fish you found times -- divided by the length of the reach. How did you use the density calculation in coming up with that number?

A We converted the fish to 100 -- the number of fish per 100 square metres and then scaled to the area of the

entire reach.
Q Well, no, no, you didn't, sir, because if we --
A That's --
Q If we --
A That's --
Q -- if we look at 1,060.2, if we -- if we divide that by the 3 -- well, if we divide the reach length by 368, which is 1,009.22 that you put in this table, it comes up with 5.22826, and then if we multiply the number of fish you found by that value, we get 1,068.2. So explain -- and that -- that calculation I just did did not include your density figure.

How does your density figure figure into that?
A Just one second, please.
Q It doesn't, does it?
A No, I asked just to give me a second, please. Thank you.

So, Mr. Sawyer, we converted fish to -- to density at 100 -- or per 100 square metres. We then scaled the area of -- of the entire reach, which is the same scaling factor of length to area. And both surveys add in total reach. If you see in the -- if you can see in the actual table, we've got a density scale factor and a reach scale factor that's been taken into account.
Q Okay. What width of wetted channel did you use in your calculation for density?

A The -- just one sec. Let me just double-check.
Mr. Sawyer, I believe we actually used the -- the widths from -- from the Table 4.1.
Q And bear with me, sir. What was the width you used for Reach 9?
A Yeah. We used the -- it's 4.2 metres av -- it's an average wetted width for the reach.
Q Okay. So -- and when you say "weighted", what do you --
A No, I said --
Q -- mean by --
A I said "average wetted width".
Q Oh, wetted. My apologies, sir.
So just one last question. If we look at the -- at the numbers you presented in the undertaking response -- and, again, we're just talking about -- no, sorry. I apologize. I have two questions.
If we're just talking about Reach 9, your estimate of -- of trout was 1,060.2; correct?
A There's no .2 of -- no .2 of a fish, but that's just the calculation we wanted to take forward, so around --
Q And --
A -- 1,060 , yes.
Q And -- and when you did your confidence interval, it's plus or minus 1,084; correct?
A That's the confidence interval that's been -- been

given, yes.
Q Okay. And if we apply that confidence interval to the -- your estimate, in our worst case, you would have minus 23 fish; correct?
A Yes. Yes. And -- and in some cases that I've seen in literature and others, sometimes in some cases you can get negative. And it -- it -- it's a -- it's a calculation. It's -- it's -- it's -- sometimes it happens, and we recognize that that number -- the lower bounds, negative would equal zero.
Q Right. So is it not true that the purpose of doing the statistical test and to create a confidence interval is to allow people reviewing your data to understand how robust your analysis is and whether they can trust it? That's the purpose of a confidence interval; correct?
A I would agree, Mr. Sawyer, but what I'm -- I -- a couple points of clarification here. I mean, there's -- there's a lot of studies that have been done out there as -- as the COSEWIC 2016 report has -- has illustrated that -- that confidence limits have not been -- been provided or been calculated.

What we've done here is we've tried to calculate confidence limits across the reaches where we actually did our surveys where -- others that we've seen in this system that we know of that relied on one, maybe two sites very broad -- broader confidence limits that

we've provided. So this is an estimate. It's not -- you know, we're not saying this is an absolute value or absolute figure that we -- we feel. That's why you put -- as you said, that's how you put the bounds around this, to -- to give the confidence about what we're seeing.

But, again, a lot of this is based on the recapture -- recaptures that you -- you -- you get from the mark-recapture study. And -- and that's one of the -- one of the challenges that you'd have with doing this sort of thing.

So I would argue, yeah, I mean, the number is what -- what the number is, and -- but that's inherently been captured, and we've tried to extrapolate and standardize the data across the system where the highest abundance of fish was seen to give us more confidence, which others have relied on much lower amounts of data.

Q Okay. Just one last question. I promise, Mr. Chairman, and -- and Benga.

If you turn back to Table 4.2, this is the -- your -- your data for fish density determined through mark and recapture. On Reach 9, you initially capture 23 fish; is that correct?

A I can't see the -- it's the wrong -- wrong document up at the moment.

Q This is your Undertaking 99?
A No, I know. I'm just -- it's -- I'm waiting for the -- the Zoom host to pull up the -- the Table 4.2.
Or are you talking 4.2 in -- in the undertaking; correct?
Q I'm talking 4.9 in the undertaking. Oh, yes. The undertaking response, Table 4.9. There we go. So if we look at Reach 9 --
A M-hm.
Q -- you only did electrofishing, and on your first pass you captured 23 fish; correct?
MR. SAWYER: No, go -- go -- go down. Go down. Down. Right there. Stay right there, Zoom Host. Thank you.
Q MR. SAWYER: Correct?
A MR. BETTLES: Sorry. In your -- which -- which column are you referring to again?
Q I'm talking about the row under Reach 9.
A Reach 9, correct. Yeah. So you're looking -- which number are you referring to now?
Q Well, 'M' -- 'M' would be the number of fish you caught --
A Yeah --
Q -- on --
A -- that's right.
Q And you marked those fish; right?

A That's correct.
Q And 'T' would be the number of fish you caught on your second pass?
A Total fish captured on the second pass; correct.
Q And 'R' would be how many of those fish on the second pass had been marked fish?
A And -- and that's one fish, and that goes to my point earlier that I had mentioned that it's -- a lot of this is driven by -- by the number of recaptures that you get and -- which is why we applied the -- the Chapman estimator, because of the low number of captures that we did encounter during the mark-recapture study.
Q Okay. I just want to point out, sir, that you didn't actually apply the Chapman estimator. We asked you to do it. Is that not correct? There's nothing in your document that showed what the confidence levels on your numbers were.
A You're talking about our technical data report?
Q I'm talking about any of your reports. Did you -- you never did present any confidence intervals. We had to ask for them. So I just -- I just say it's highly inappropriate for you to take credit for it now.
A I'm not taking credit for it now. We -- we -- we did what was asked, and we have -- we've provided that. And as I said earlier, Mr. Sawyer, there's a lot of studies that have been done out there don't apply

confidence intervals at all. So -- and that's been very -- made very clear in the COSEWIC 2016 report --

Q Sure.

A -- sharing that.

So I think, you know -- it's -- I think it's -- I think it's inappropriate -- and -- and -- to -- to -- to -- to point out that, you know, we -- just because we didn't do it that -- that that's entirely inappropriate. I -- I agree that confidence intervals are -- are -- are -- are important information, and, yes, we did not include it in our report, but we've -- we've -- we've provided it here. And what we're seeing with the estimates that we've come up with in our surveys actually somewhat align with some of the other numbers that are out there if you consider the confidence limits that have been provided.

Q So last question, sir. On the surveys you did on Reach 7 and Reach 8 and Reach 9 on Gold Creek, between your initial capture and your subsequent effort at recapturing, how much time passed?

A We -- we conducted the same -- same effort that we did through the original from the first pass -- from the first round of -- of -- of marking the fish.

Q Maybe you misunderstood my question, Mr. Bettles.

How many days, weeks, or months was there in between when the two --

A Oh --
Q -- surveys were done?
A Sorry.
MR. IGNASIAK: Mr. Chair, we are getting beyond the scope of this undertaking response here.
THE CHAIR: Yeah. We are, Mr. Sawyer. I think I've heard "last question" several times.
MR. SAWYER: Yeah. Mr. Chairman, I do apologize for that. I would say this is my last question, and I don't think it -- not -- with respect to Mr. Ignasiak's raising objection, the data that's presented here in terms of the 'M', 'T', and 'R' values -- this is the first time this data's been presented, and it's in their -- in their -- in their response -- well, regardless, it's in their response, and I promise you, Mr. Chairman, this will be my last question.
A MR. BETTLES: Can I -- can I finish answering the -- the last question? So just one point you make here, Mr. Sawyer, that that Table 4.9 that comes directly out of our -- our technical data report -- so there -- this has been presented originally. So that's -- that's the first point.
Second point is that the -- the recapture aspect of the mark recapture was done between three to four days post marking.

MR. SAWYER: Okay. Mr. Chairman, those are all my questions. Thank you.

THE CHAIR: Okay. Thank you, Mr. Sawyer.

Okay. Mr. O'Gorman, we'll turn back to you.

Alberta Energy Regulator Staff and Panel Questions

Benga Mining Limited

MR. O'GORMAN: Thank you, Mr. Chair.

I'm going to start by asking, Ms. Porco, do you notice a difference in my volume now?

Yes? I did discover that I thought I had corrected -- maximized the input volume on my mic. I had done that, and my computer adjusted it on my behalf to make me quieter than I thought I was, so my apologies to people that had a challenge with hearing me earlier. Technology.

Okay. So thank you, Mr. Chair, for throwing it back to me. Let's move on to talking about selenium, which we've heard a little bit about this week.

So, Zoom Host, if we could please start by hauling up Document 42, Appendix 10, and going to PDF 233.

Great. Thank you. That's good. That's what I wanted to see. I think it's on this -- right.

Q MR. O'GORMAN: Okay. So I'm going to start this series of questions by first acknowledging, Mr. Houston, you -- you know, we've talked about this earlier, but recognizing you have a message for us to

think about the SB -- the saturated backfill zones as producing a final effluent of 15 micrograms per litre. We did -- I think you would agree most of the information that we have -- most, if not all, of the information about this issue on the record did approach it from a 99 percent treatment efficiency perspective. You agree with that?

A MR. HOUSTON: We -- we -- Mr. Jensen can speak to this more fully, but we -- we have two limits in the model. One is the 99 percent, and the other is the 15 micrograms per litre. One -- once the -- the -- in -- input selenium concentration raises above a certain amount, the 15 micrograms per litre becomes the dominant limit in the model, but --

Q Okay.

A -- that -- I'll let you ask your further questions.

Q Sure. And, yeah, you don't need to elaborate on that, Mr. Jensen; it was really just a warm-up. I was mostly acknowledging -- we have two numbers to think about now, the 99 and the 15 milligrams [sic] per litre.

Okay. So on -- in this document, which was submitted back with your original EIS -- I think you'd agree that you did say that if the selenium concentration in the saturated backfill zone in your modelling that was done was higher than 1.5 milligrams per litre, prior to applying attenuation, the effluent

concentration was limited to a maximum concentration of .015 milligrams per litre?

A MR. JENSEN: Yeah, that's correct.

Q You agree that it says that?

And that -- so that was the modelling approach you took. To clarify, you had a water-balance model; some water flowed into the system to be treated, and if the model had a flux of water that actually exceeded 1.5 milligrams per litre, you introduced a cap to say, We're going to -- we're going to treat it as the outflow as a maximum of 15 micrograms per litre; right?

A Yes, that's correct.

Q I'm actually going to introduce one other thing I meant to say up front. I'm worried about getting us all confused and the record confused if we keep switching back and forth between milligrams and micrograms, so for the sake of this conversation -- and I'm going to beg your indulgence -- and let's try and maybe all speak in micrograms per litre. I think it might be easier. There's less decimal points involved.

Is that okay, Mr. Houston?

A MR. JENSEN: Okay. Okay. Yes, sorry.

Q No, it 's good, Mr. Jensen. Thank you.

Okay. So you did introduce that cap.

MR. O'GORMAN: Now, I want to jump, please, Zoom Host, to page 252 of this document.

Q MR. O'GORMAN: So starting on this page, I'm not going to look at specific quotes on here, but I wanted to show you, we're talking about the source terms and leaching of selenium.

Starting in this section, Benga, you did describe how the leach rates and the loadings were developed for key parameters, including selenium. And I guess that we're wondering if you can give us an overview of how you obtained this source term of 1,500 micrograms per litre as the number you're going to assume as your -- your influent -- sorry, your inflow concentration, and I'm looking for a high-level description here, please, but something that gives us a bit of clarity on where that number comes from?

A MR. JENSEN: Sorry. Mr. O'Gorman, I'm not sure I follow your logic in your question. I don't believe we stated that it will be 1,500 micrograms per litre specifically. I mean, that may be an outcome at times. But are you making the inference that the 15 micrograms per litre is -- is important because it's 1 percent of --

Q Okay. Yes, I'm working backwards from -- if you were introducing a modelling cap where the output is 15 micrograms per litre and if you had -- so any inflows even higher --

A Yeah.

Q -- then, you know, you work your way backwards, obviously, and if -- essentially from a modelling perspective, equivalent to ignoring any input concentrations that exceeded 1,500 micrograms per litre, so --

A That's correct.

Q Right. So if you can give us some sense, and if -- if you don't want to focus even on specifically that 1,500 number, but can you tell us fundamentally where that derivation comes from?

A Yes. Yeah. It's quite simple, really. It's -- so the -- you had directed our attention to Table 5-1. So the way -- and this is true both for sulphur and selenium, which is why they're listed together. We -- when we think of geochemical source terms, we think of them either as a concentration-based or as a mass-based source. And when they're mass-based, Stephen and his team will estimate the release rates from a -- either a tonnage or a volume of waste rock on an annual basis. And so what we do is we estimate the volume of water that's -- that'll percolate through a given waste rock dump or waste rock storage area. We'll then take that dry load that you see listed in this table, milligrams-per-metres cubed per year, we'll divide that by the flow, so -- which is units of, say -- yeah, say it's metres cubed per year, and that will give us a

unit of milligrams-per-metre cubed or, you know, you can do the appropriate conversions.

But essentially what we do is we take that dry load and we apply it into the water that percolates or -- or that's intercepted by that footprint. I hope that made sense. It's a very simple calculation. It's very straightforward. The -- the total runoff --

Q Okay.

A -- or total volume of water receives that load, and it's a simple division.

Q So in doing that work, did you produce in, say, Tab Number 4, perhaps project it -- concentrations of selenium coming off the waste rock dumps that would be flowing into the saturated backfill zone?

A You know what? Honestly do not recall. I have to look in the appendix, then, for that information. I wonder if you'll give me a minute to look that up.

Q Sure.

A Okay. I apologize, Mr. O'Gorman. We're scrambling a little bit here.

So if you go to page 268 of -- of the same document, Zoom Host, if you please.

So this isn't exactly the answer. These are some of the sources. So you will see what the estimated concentrations are in the surge ponds that we are pumping up to the saturated zone. So I recognize it's

not exactly the answer you're looking for, 'cause there's additional sources --

Q No.

A -- being attributed from -- from in-pit dumps that we are not --

Q No, I hear you, Mr. Jensen. That's actually a very nice figure to illustrate some of this conversation. So why don't we leave that -- why don't we leave that up.

A Okay.

Q And to be clear, this figure, this were -- these would have been your average predicted selenium concentrations in the surge ponds; right?

A Yes, sir, that's correct.

Q Not any maximum or a higher level estimate? Higher end estimate?

A Yeah.

Q Okay.

A These are -- these are -- these are based on our best estimate geochemical source terms, that's correct.

Q Okay. I'll ask you if you can explain to me -- and I will start with you, Mr. Jensen. Can you tell us about what uncertainties exist in the source term derivations that still need to be resolved through monitoring of seepage water from the waste rock piles?

A I would pass that question off, if you don't mind,

to -- to Mr. Day, my colleague.

Q Sure. That'd be great.

A MR. DAY: Yeah. I'll -- I'll try and answer that. So it -- I mean, the underlying input into this for the selenium is the rate which were in those tables that you saw earlier. And so those are -- those are scaled up from humidity cells using those scaling factors which we -- we talked about earlier. And I mean, that is -- that is the uncertainty.

I would say that the -- that that method -- the scale-up method is definitely -- definitely conservative, tending on the high side. So the monitoring will ultimately tell you what the rate is. I -- I would say that I'm pretty -- pretty confident the actual monitoring will show that the rates are lower than the -- than are used in the model, but that -- that will be the -- that will need to be determined in monitoring.

Q Okay. And what sort of tests might you need to do to resolve some of those uncertainties?

A Well, the very best way to do it is to make sure you -- that we have good monitoring at the -- at the -- the points where water is coming into those ponds through -- through water chemistry monitoring and good -- good flow monitoring. That's -- that's what we've learned elsewhere, is just that the -- the best

indication is the -- is site, and to do that early, and make sure that monitoring is set up early on as the -- the first rock is going out.

Q Okay. That's good, Mr. Day. Thanks.

Okay. So this table -- figure is -- I will pull back for one second just to make sure that -- this might even be for you, Mr. Houston, and then I will come back to you, Mr. Jensen, and -- Mr. Jensen, at least.

I did want you to confirm that you understand the exercise that this Panel has been asked to undertake and necessitates that we do take a conservative -- examine a conservative case; right? We -- when a proponent submits information in an EIS for this sort of review, we do want you not to give us your best guess but to err on the side of -- well, we do want your best guess, yes, but we want you to ensure you flesh out looking at the downsides and you give us the conservative estimate; right? On key -- on key issues of concern?

A MR. HOUSTON: Yes, we understand that, Mr. O'Gorman.

Q Okay. Thank you, Mr. Houston.

Now, recognizing, Mr. Jensen -- I'll go back to you -- you didn't -- you didn't, potentially at least, start in your modelling by thinking about the inflow.

You, instead, thought about the final result, the 15 micrograms per litre and the 99 percent treatment efficiency to get you there. We see what some of your sample inflow -- inflow concentrations to the SBZs would be on this graph. These are averages, of course.

If the inflow concentration to one of the SBZs was greater than 1,500 micrograms per litre -- so the top of this scale is 1,200 -- how reasonable would it be to expect that even greater than 99 percent attenuation in the SBZ could be achieved to get down to the 15-microgram-per-litre target?

A MR. JENSEN: I -- I think it would be quite reasonable. I mean, like I said, it -- the upper end of -- of the concentration range, when it comes to these types of removal mechanisms, it's -- it's much less relevant than the lower end. And the same goes for -- I believe I described this the other day. When it comes to things like precipitation mechanisms, it's -- let's take an example of , like, copper. If you start out with 200 micrograms of copper and -- and you -- you want to treat that, it doesn't really matter if it's 200 or 300 or 100, it -- you end up coming up against the same solubility limit.

So to be clear, this is -- these are distinctly different processes, but the analog is there to illustrate that, you know, the -- whether it's, say, a

thousand or 1,200 or 1,500, the influent concentration, it really is the same situation. You're in the same range. Where it gets interesting and where it gets tricky is when you get down to the ppb -- the low ppb level.

So I'm -- I wouldn't be terribly concerned about us being off, you know, some percentage in -- either up or down in the influent, but I would be concerned if -- if suddenly we're in a situation where we have to -- say I have to meet 5 ppb; then I would probably suggest that we put in -- you know, not to say that we can't, but to be sure we can, I probably would suggest maybe thinking about at least additional mitigation-type -- you know -- or at least, you know, some backup options. 15, I'm quite comfortable with.

Q And that --

A I hope I've answered your question.

Q It gets at answering my question.

I mean, your assertion that -- I don't want to -- you know, so you're essentially saying if the inflow concentrations are high enough, that, you know, you're talking about an entirely different -- it doesn't even really matter. I suppose at some ridiculous level you're saying it mattered, but you're saying there's not a lot of difference, from your perspective, between an inflow concentration of 1,500 versus 2,000 or

something like that. Is that what you're saying?
A Yes, that is -- that is what I'm saying.
Q Okay. Do you have any -- I don't think I've seen anything on the record to suggest that or that explains that to us. Do you -- do you want to point me to that? Or ...
A Well, I mean, we have -- so there's a couple of examples, I guess, we have listed on the record that I can point to, Mr. O'Gorman. One is -- and, you know, we quickly will get into a discussion on the applicability. I -- I don't know if we need to pull them up or if I can -- if I can speak more generally to them.
Q Let's not.
A Okay.
Q Let's not.
A Thanks. I appreciate that.

One is we -- you know, through the course of our conversations here this week, we've looked at the presentation that was given by Teck this year, last year that -- that's on the record. I think they were in the 200 ppb range, just from memory. And they --
Q M-hm.
A -- they go down to about 10.

There's another example that we provided, which is -- it dates back quite some time to the 19 -- 1999,

actually. This is for a similar treatment that was applied to the Sweetwater pit in Wyoming. They sat at about 450 ppb in the pit, and, really, the interesting -- the primary purpose of that treatment process was to remove uranium and selenium both through this anaerobic attenuation, which, as a side note, some of the uranium questions that we -- that we discussed earlier and couldn't answer necessarily right then, it -- you know, these types of treatments are quite effective for removing uranium as well.

But what they saw there is a relatively -- so they dozed, from memory, I think it's around 500 tonnes of carbon into that lake, and that's even without the benefit of having a backfill of media in there to help with absorption. Concentration went from 400 -- 450 ppb, roughly, down to 7. And I mean, I could -- I don't recall off the top of my head what other examples we have on the record, but those two I'm sure about.

And I think that's just one illustration that this idea that there's a direct correlation between influent concentrations and effluent concentrations, it -- it's just not supported by the sort of basic thermodynamic premise of what we're looking at here. And in reality, that's precisely what we see. I mean, it's -- we're not -- so, you know, maybe I'll leave it at that.

Q Sure. And, Mr. Jensen, just so you know, we're going

to come back and look at some of those examples just a little later this afternoon, including Sweetwater and others, so ...

A Okay.

Q So we'll have a chance to talk about them and their applicability.

A Perfect.

Q I want to look at this graph, though, because it, again, illustrates another point that I wanted to make. Your key result that you want to achieve is hitting 15 micrograms per litre on the effluent from the SBZs. Here's -- this is an illustration of what some of the inflow concentrations to the SBZs might be. And recognize these are average cases, not sort of -- the sort of inflow we would want to see in a conservative assessment; right? We would want to see the -- the higher end of some upper percentile, I assume, for any given one of these model results. You agree with that for a conservative assessment?

A Well, I mean, I think it depends on -- on the degree of conservatism. I think --

Q Okay.

A I think that's a -- probably a longer discussion.

Q Okay. That's fine.

I'd like to work at it from the other direction, though, in terms of thinking about 99 percent.

So if we had -- I'm going to ask you to haul your calculator out, Mr. Jensen. I assume you have one on your phone.

A Yes.

Q We all do.

So if we had an inflow of 1,500 micrograms per litre, slightly higher than your highest case here for one of the ponds, the outcome after treatment was 99 percent. That would -- that would be 1,500 micrograms per litre; right?

I'm sorry. So 99 percent treatment on 1,500 inflow would produce your desired outcome of 15; right?

A That -- that's correct.

Q Okay. What if your conservative upper case inflow was only 750 micrograms per litre? What would the final -- what would the treatment percentage in the SBZ be in that case?

A It would be 7.

Q Now, if your -- if your input was 750 --

A Oh, 750? It would be 7-and-a-half. Excuse me.

Q If your -- if your input concentration was 750 and your final concentration was 15, what would be --

A Oh.

Q -- the percentage --

A Oh, I see. I apologize.

Q -- by which 750 was reduced?
A That would be 98.
Q What if the conservative upper case inflow was 500? What would the treatment percentage efficiency be?
A 97.
Q Two more to go.
A Okay.
Q If the -- if the inflow was, for the upper case conservative input, 375, what would the treatment percent efficiency need to be?
A 4.
Q 375 should take you to 96 percent, I think; right?
A Yeah. Yeah, that's -- oh, sorry.
Q Yeah, 4. I know what you mean.
A 4 -- yeah.
Q And the final numbers, if your conservative input case for inflow to the SBZs was 300 micrograms per litre, the SBZs' treatment efficiency would be?
A 95.
Q Right. Okay. Thank you, Mr. Jensen.

I'm going to move on from that, but I did think it was interesting when I thought about these numbers.

So I'll ask: Has Benga investigated or are you investigating the possibility of treating elevated levels of selenium in the contract -- in the contact water prior to injecting it into the saturated backfill

zones? Like, not completely removing it, but doing some sort of a treatment to decrease the concentrations so the saturated backfill zones might take it down even lower, for example?

A Well -- could I --

A MR. HOUSTON: Go ahead.

A MR. JENSEN: Okay. Your -- that's -- that's an interesting question. Maybe before I answer that, I will mention that, as another level of conservatism, we treated the -- the whole backfill system as -- as a single entity, which in -- in some -- in some respects is another level of conservatism because we had a different -- you know, at least at the end of the mine life we will have three distinct zones that are connected in series. So we didn't apply, say, 99 in the first zone, then 99 percent in the second zone, and 99 percent in the third zone 'cause we -- we just had it all come through as one and then applied it at the end. So when we think about pretreatment, I mean, that would be -- that would be one consideration.

The -- the -- yeah. So, I mean, I -- I don't know to what extent it's appropriate to -- to discuss something that's not on the record. I'm a little bit hesitant to do that, but -- but I will say that it's -- it's sort of a considerable interest of -- of mine personally to -- to look at what can be done at the

base of the -- of the waste rock dumps. 'Cause we know -- you know, we know from a lot of work that was done back in the '80s -- and I think I made reference to this before too that, you know, to the extent that you can produce reducing conditions at the base of a dump -- and I think that applies particularly to the -- the south dump than central dump; there's more potential for it there -- to, effectively, make a -- a bit of a reactive barrier -- it doesn't have to be perfect, but it would have the effect of -- of reducing the load of selenium. But it -- it -- you know, it's -- you know, I -- I'm mentioning it here. It's not really part of the prior description as it stands on the record.

Q Okay. That's fine, Mr. Jensen. Thank you.

Okay. Sorry. Let's move to something slightly different.

Or, actually, I did want to clarify as well. It's sort of related. So you're not proposing a pretreatment of the water in these ponds before it goes into the SBZ; but at the end, when you take it out of the SBZ and it -- you -- you hope, is at 15 micrograms per litre or less, I just want to clarify, you're not doing anything else to the water at that point to take any more selenium out of it; correct?

A Yeah. I mean, as -- as it stands, that -- that --

that's correct. Well --
Q Pending -- pending -- I recognize --
A Yes.
Q I'm sorry. I know you've --
A You got it.
Q -- talked about the potential -- right. So --
A Right.
Q But at this point there's no plans to do anything else to that effluent which would come out at 15 micrograms per litre in your -- in your assertions?
A That's correct.
Q Okay. Okay. This might have once been a longer question but is now a much shorter one because you sort of spoke to it yesterday, and I'm not even going to call it up. But you'll remember Dr. McKenna's presentation that he presented about a variety of ways to try and improve the selenium treatment --
A M-hm. Yeah.
Q -- in this operation.

I think it's fair to say, Mr. Houston, and Mr. Youl in particular, if I -- I'm working from memory; I didn't look this up in the transcript, but I -- I think you both alluded to those were some interesting ideas and you would think about them?
A MR. HOUSTON: That's correct.
Q Okay. I do want to point out something and hear your

response.

MR. O'GORMAN: So if we could haul up, please, Zoom Host, Registry Document 69, which is Addendum 5. This one was responses to IRs that came from staff before this Panel was appointed, as I recall. And we're going to look at PDF 94, please. Scan down.

So -- right.

Q MR. O'GORMAN: So this was an IR that was asked, IR93. It extends for the next couple of pages. I don't know if you remember it, but I'll summarize that it proposes to you the idea of extra source control measures to mitigate selenium leaching. You can probably skim what's on that page. We don't need to read it out loud.

MR. O'GORMAN: You can cut to the next page, please, Zoom Host. And -- good.

Q MR. O'GORMAN: So over a series of examples -- a series of subquestions, we -- staff did put to you, Here are some ideas -- or what have you thought about some ideas about potentially adding new source controls. I mean, is it -- if you can skim your responses there, do you think it's fair to characterize what you told us, is that you'd considered a lot of these, but they weren't really applicable to this site? And if you think that's unfair, I -- please, by all

means, correct my -- correct me.

A MR. JENSEN: I -- I -- I think what we specifically spoke to in this response is the -- the idea of constructing covers, low-permeability covers, over these waste areas. And we had done some -- you know, we had -- we had taken a close look at that, and, you know, the conclusions there.

Q Yeah.

A So I don't -- I don't think we really went any, like, much further, at least in -- in this response with respect to commenting on what else could be done.

Q Yeah. To be clear, I sort of went over the two pages of responses, not just what we're seeing on the screen. There are other bullets. You'll see the next one begins talking about potentially segregating waste rock.

A Yeah.

Q We asked in Part C any other source control measures that you might consider. And if you scan down into the next page, there was -- there you -- you see there was a mention of covers.

In a nutshell, I -- I guess I'm curious to know -- a few years ago now when you responded to this -- you can -- sorry -- sort of give me a sense of were you more or less open to exploring some of the ideas for alternative selenium treatment?

A MR. HOUSTON: So if --

A MR. JENSEN: (INDISCERNIBLE - 0VERLAPPING SPEAKERS) Mike Youl.

A MR. HOUSTON: Oh, yeah, no, I -- I -- I can talk to this a bit, and then I'd invite Mr. Jensen and Mr. Youl to -- to pop in.

Absolutely, we're -- we're looking at means to reduce the source of the selenium, the ex-pit dumps and -- and the water that percolates through them, et cetera. And a lot of the ideas that have been presented the other day, were -- are -- are things that we're either considering or will consider to -- to reduce the amount of contact water.

One of the biggest opportunities we see right now -- and Mr. Youl can talk to this -- is to reduce the amount of rock in the ex-pit dumps. And as Mr. Jensen mentioned, the amount of selenium that's generated is a direct consequence of the mass of rock in the ex-pit dump. So that's -- that's something we're looking at right now.

In terms of the pretreatment, that is something we've discussed. But, as Mr. Jensen mentioned, it's not part of our application because it's more of a notion right now , but we consider that there -- there are possibilities there that are -- are worth exploring. And we continue to look into gravel bed

reactors as, you know, potentially a pretreatment as well as a post-treatment, you know, depending on, you know, what is most efficient from a water management point of view.

So, Mr. Youl, I wonder if you can just talk a little bit about the capacity to manage the ex-pit dump storage.

A MR. YOUL: Sure. Happy to.

Just to elaborate, there are probably two main areas we focus on here. One is reducing the size of the outer pit dumps, so we're treating the problem at the source, and -- and through more sophisticated, judicious scheduling of -- of the mine and thinking about the faster we start up and ramp up to full production, the more quickly our initial pits advance. The quicker we can do that, the quicker we can start in-pit dumping.

So our -- my planning team is looking at all of that as we speak to accelerate that. It's a scheduling condition or issue. And making sure the trucks don't all get compressed into too small a space. But the intention is to create that in-pit dumping space earlier in the mine schedule and minimize the amount of outer pit dumps, particularly the -- the south dump, which -- which happens from Year 1.

The second aspect is our earlier conceptual

designs of those dumps essentially had a constant, on average 23-degree slope, and a flat top that nestled into the -- the north side of Bluff Mountain and constrained by ridges on -- on each side, which helped manage the drainage down towards the raw water pond. Our thinking has advanced beyond that now to look more closely at how we build a dump that sheds water much more quickly so we don't have spaces where water can pond or pool as the dump is being built.

So you can imagine, as we're raising this dump in layers, it's changing every day, and there will be areas where parts of the dump are hard in other parts of the dump, and there will be haulers, and any precipitation that falls could conceivably be caught in those hollows and start percolating down.

So it's much more attention to, as we build the dump, we're creating an active drainage network that sheds that water down the outside of the dump and into the toe drain.

And as part of all of that, our thinking is now progressing towards building a dump in much smaller lifts, as Dr. McKenna illustrated on his artistic sort of conceptual drawing, which was very good, very interesting. But as we reduce the size of the lift, we're getting much better compaction, which is limiting the infiltration of surface water in through the dump.

And so the intention is to shed it off the top, down the sides, into the toe drains as quickly as possible.

Q Okay. Thanks, Mr. Youl.

And, in fact, that sort of takes me -- well, I'll ask you to respond to something Dr. McKenna put into his submission, where he suggested that prior to construction, you should undertake a formal options analysis. I wonder if that particular suggestion of his is one that you agree with?

A I -- I do, and, in fact, with any engineering exercise. Now, whether it's building a structure or constructing a rock dump, you do a design-basis memorandum, so to speak. So you're laying out what you want to achieve at the completion of the structure and then the operational protocols of how you get there, managing risks, managing unforeseen events, and then -- so that will all become part of our operational sort of procedures in -- in how we build these through the course of the early years of the mine.

Q Okay. Thanks.

And some of what you've said actually leads me to -- I'm about at the end of this little set of questions. But, you know, we talked about the number of 99 percent capture. So let's talk a little bit about -- I'm sorry, 99 percent treatment. Let's talk a little bit about the number of 95 percent contact water

capture.

MR. O'GORMAN: So, Zoom Host, can you please haul up on Registry 42. Appendix 10, PDF 233. Right. And is -- so there's -- we had the number down a bit, down onto the bottom of the page. Okay. It's -- right.

Q MR. O'GORMAN: So Mr. Fitch asked you about this, and I won't go into it in great depth, but I did want to, you know, reconfirm that the projected -- in all of the modelling for the results that have been presented to us, your base-case assumption was you were capturing for the south and north rock dump areas 95 percent of the contact water, and at the second line from the bottom for the central rock disposal area, the one that has runoff reported into Gold Creek, you would be capturing 98 percent of the contact water. And I just want to confirm that that's -- that's what you told us?

A MR. JENSEN: Yeah. So, I mean, I wouldn't characterize it as much of an assumption as really an output of the model. So it's more of a -- I think of it more as a design basis or a design requirement.

Q Well, Mr. Jensen, I think it was an input to the model, right, as opposed to an output? I think you told the model, through iterative modelling, to achieve the end water quality. It might have -- I think it -- yes,

actually, it -- the sentence begins at the bottom of this page: (as read)

These capture efficiencies were selected through iterative ...

MR. O'GORMAN: Please scroll down, Zoom Host. Scroll down to the next page.

Q MR. O'GORMAN: (as read)

... iterative modelling efforts to meet ...

Right, right. So -- right. You modelled back and forth, and you came up with -- those were the numbers you needed to -- to meet, so they were inputs; right?

A MR. JENSEN: Yeah, well ...

Q Depends on how you think of an input number?

A It does. I mean, the exercise is correct, the way you characterized it.

Q Okay. Thank you.

MR. O'GORMAN: So if we could look, please, at page PDF 274. That's it. So if we scroll down just a little. No, no, no, no, no. I want to see that figure. I just wanted to see the text at the bottom. Great.

Q MR. O'GORMAN: So here were the results that you submitted showing some sensitivity runs in the final selenium -- well, in the output selenium concentration in Blairmore Creek for varying capture efficiencies of the ex-pit waste rock; right ?

A MR. JENSEN: That's correct.
Q Right. Where we see the green line at the bottom at a capture -- a scenario of capture efficiency 100 percent?
A Yeah.
Q A hundred -- hundred -- okay. And then the red line in the middle, and the capture efficiency of 95 percent, and the blue line at the top, capture efficiency of 80 percent; right?
A That's correct.
Q Okay. So would you agree that reducing your estimated capture efficiency in this scenario from 95 percent -- I'm struggling -- oh, there -- the 95 percent to 80 percent results in approximately doubling the predicted selenium concentration in Blairmore ground --
A Yes. Yes, that's what -- that's precisely what the graph's intended to show.
Q Okay. Good. Thank you for that.
MR. O'GORMAN: Let's jump ahead to PDF 424, please, Zoom Host. So on this page, if we -- okay. If we maybe scroll -- show the whole page, please, Zoom Host. You don't need to zoom in on this one, although that now becomes hard to read.
I mostly wanted to point this -- maybe you can zoom in a little bit, Zoom Host, while I read my question or point out that I wanted to show this to --

Q MR. O'GORMAN: In here you broadly describe capture methods to be implemented. It suggests that -- MR. O'GORMAN: No, go up to the top of the page, please, Zoom Host. Oh, maybe it is the bottom of the page.

Q MR. O'GORMAN: But in here, you talk about collection of seepage from the toe of the waste rock dump, use of collection ditches, and the use of seepage capture wells across deeper groundwater flow paths. Does that still sound like your -- your plan on how you're going to capture contact water?

MR. O'GORMAN: Yeah, I think we might be on the wrong page.

A MR. JENSEN: I think it's one up.

MR. O'GORMAN: That's 423. I asked for 424, please, Zoom Host.

A MR. JENSEN: Oh, one down. Sorry.

Q MR. O'GORMAN: Yeah. That one, exactly.

A MR. JENSEN: Yeah. Well, so --

Q Yeah.

A I mean, in some ways -- so -- so what we -- all we really attempted to say here is that we were -- we -- I think we'd always stated it probably here that it would be accomplished by doing these things. In fact, these are intended to serve as examples of -- of things that -- that can be done.

But really, this -- this document, we never really did intend to -- to address the specifics of exactly how. We did look at -- we had another -- one of our hydrogeologists at the time, we told him to take a look at -- you know, just calculate some rough well spacings that he might -- he thought might be appropriate, but we never really did look into any of the details. That was outside of the scope of this study. These are just general examples of -- of things that can be done.

Q Okay. Let's jump, please, to a different document. Let's look at Registry 69, which is Addendum 5, and look at -- let's look at PDF 105, please.

So here we asked you a -- well, staff asked you -- these are IR responses from a few years ago. You were asked about a similar question, capture efficiency, decrease from 95 to 80 percent, results in the twofold, increase in concentration.

You indicate in your response, and I think it's on this page, about another line of interception wells that could be installed downstream of the first set. Do we see that in there? It's right -- right -- yeah. Right where the -- the hand is pointing. If you could read that and verify if that's still your view?

A Yeah. I mean -- so, again, I have to tread a little carefully here. I think this response was drafted in consultation with -- with the team, but I would say,

generally speaking, that's -- that would be true. As a nonhydrogeologist I would say that.

Q Okay. So I'm going to bring this to some questions. I just want to make sure you're not disagreeing, are you? You're agreeing that your modelling on the document we looked at a minute ago did use a 98 percent capture amount for the contact water from the central rock disposal area?

A Well, just to be precise about that. It's a 98 percent capture of loading. So that includes seepage, capture, and attenuation, but -- but --

Q Okay.

A -- generally speaking --

Q They do?

A -- you're correct.

Q Okay. Thank you.

So I would like -- I'm nearing the end. I would like, please, if we could look at a different document. Now we're going to look at Addendum 11, which is Registry 313, and look at a response you gave to a -- a Panel IR. We're going to look at PDF 332, please. And that's what we want to look at.

So this was -- Addendum 11 was submitted in March -- well, I'm not sure if it was March. In early 2020; is that right?

A MR. HOUSTON: That's correct.

Q Thank you, sir.

So what we're seeing in the response you gave us this year, earlier, were for modelled selenium levels in Gold Creek at a variety of nodes on Gold Creek; right?

A MR. JENSEN: Excuse me. Yes, that's correct.

Q Okay. And I just wanted to ask your sense of -- if we would expect this was using, presumably, the 95 and 98 percent capture rates for the different potential sources of capture that -- water that might escape into Gold Creek. And I wonder if you can give me your sense of -- if we also took the estimate of the capture rate from the proposed 95 or 98 down to, say, 80 percent, would we also expect to see those numbers approximately double for selenium in Gold Creek? Would that be -- I'm drawing the analogy to the graph we looked at for your results on Blairmore Creek.

A Yeah, I think without running the numbers, that's -- that's approximately right.

Q Yeah. Yes. And I know you haven't actually run that scenario. But we're sort of trying to draw the -- you know, if you think it's reasonable to sort of draw that inference; okay?

A Well, I mean, in -- in that sense it is. It is relatively linear. I mean, it's relatively -- so,

yeah, I think you -- I think your conceptual idea is correct.

Q Okay. Thank you.

Right. I've sort of put this to you, but just for completeness, have you -- are there any additional capture measures that you are exploring to determine if they're feasible?

A I'll hand that off to Gary. Like I said, just -- just also to be clear, the purpose of -- of this modelling -- and I think I've said it a few times, so -- but it -- it really wasn't to demonstrate the effectiveness of, say, two -- two lines of interception wells. It really was to clearly define, you know, what the design basis needs to be to stay protective, so -- but I'll hand it over to Gary -- to Mr. Houston, maybe, to comment on the design aspect.

A MR. HOUSTON: So -- so, Mr. O'Gorman, what Mr. Jensen has just stated is correct. We -- we -- we consider that the -- the groundwater capture wells combined with a -- a good design of the -- of the ex-pit rock storage areas will get us where we're going, and -- and I -- I -- I don't want to sound -- you know, I don't want to sound like I'm giving the -- the team message here, but the -- the water -- the groundwater will move very slowly towards the -- the -- the creeks and -- on -- on the order of years, to get

from -- into Gold Creek, for example, which is what we're looking at here.

So measuring the groundwater concentrations of selenium adjacent to the -- the ex-pit dumps will give us an early warning, and then I -- I think it's, you know, a matter of implementing solutions in a layered way, starting from most -- most cost-effective, like the groundwater capture wells, and -- and if needs be, going to more expensive methods to -- to achieve the objective that we set for ourselves.

Q Okay. I do have a series of questions to come back to later in my package about groundwater wells, but now is not the time for us to explore them.

So I think I'm good with this package of questions.

MR. O'GORMAN: And, Mr. Chair, looking at the time, it's, well, basically almost 3:00. This might be the good time for our afternoon break.

THE CHAIR: Okay. Thank you, Mr. O'Gorman.

It's, yeah, 3:00, so we'll break until 3:15. Thank you.

(ADJOURNMENT)

THE CHAIR: Okay. So just before we kind of get back into questions, thanks for everybody who sent emails to the secretariat staff about witness

availability and that. It doesn't appear that there's any showstoppers for not sitting tomorrow and commencing Monday, Tuesday. There is a Health Canada witness that's not available after the 25th who was going to participate in the air quality section, and I think Mr. Drummond copied the other participants on that, so I don't know if anybody had specific questions for that witness. My understanding is there will be other members of the Health Canada team on the Panel that could probably respond to most questions; but if anybody had any particular questions for that witness, we would probably need to know that in advance. Other than that, there doesn't seem to be any barriers, so unless something changes, I'm going to propose we don't sit tomorrow and we resume on Monday at 9 AM after we finish today.

MR. IGNASIAK: Mr. Chair, it's Martin Ignasiak.

THE CHAIR: Yeah.

MR. IGNASIAK: So that's fine with us, provided we -- we get through this panel today. We've got panel members here from -- from outside Calgary and so forth with travel requirements and, you know, with COVID restrictions -- so if we can get through this panel today -- we don't want them, though, to have to stick around till Monday is -- is our main concern.

And then we're fine with the rest of the water session beginning Monday; and then, over the course of the weekend, we'll take a look at what's remaining after the water session and -- and work with Mr. Drummond and others to make sure we can deal with the rest and -- and with any witness limitations that come up for the other topics.

THE CHAIR: Okay. So that might create an issue that we -- we can't resolve, because my understanding is Mr. O'Gorman still has quite a bit to do. So it's not entirely clear to me we can finish this panel today, so we might need to sit tomorrow, then, to finish the panel if that's a limitation for the Benga witness panel.

MR. IGNASIAK: Yeah. I think if we have to sit for a couple hours tomorrow to finish this witness panel, we would -- we would prefer that even if we don't continue with the rest of the hearing until Monday.

THE CHAIR: Okay. Let's --

MR. IGNASIAK: Sorry. We're not trying to be difficult.

THE CHAIR: Yeah. I understand.

MR. IGNASIAK: We've just got people from -- yeah.

THE CHAIR: Okay. So maybe we'll see

where we get to tonight, and then we'll see what's left, and, at a minimum, you know, we might need to sit tomorrow to finish off the Benga panel and then maybe not do any more than that tomorrow. So let's see where we end up today. And what we'll do is the Panel will take a quick break when Mr. O'Gorman finishes his questions. We'll see how much we have left before we all break for this evening.

MR. IGNASIAK: Yeah. And to the extent it might help, Mr. Chair, we're -- we're willing to also do part of this in writing if that's required. I leave that in our hands, but that's always another option.

THE CHAIR: Okay. Okay. Thank you.

Okay. So go ahead, Mr. O'Gorman.

MR. O'GORMAN: Thank you, Mr. Chair. Am I on? Okay. Good.

Q MR. O'GORMAN: Okay. Let's talk about the saturated backfill zones. Obviously this is a key measure you've proposed, and I don't think it's unfair of me to suggest that there have been questions raised by a number of participants through this process about the effectiveness at treating selenium. So we want to explore that a little bit, please.

We're going to start -- and, Mr. Jensen, you almost got -- took us to it, but we want to start by -- we have -- and I'll acknowledge some of these

questions -- and I'm going to try and maybe pick up my pace a bit. Some of the questions were constructed with the 99 percent treatment number in mind. I recognize you want to talk about the 15 milligrams per litre. In either case, there's a high level of treatment required from these saturated backfill zones, so if I don't adjust my language and I talk about 99 percent, I'm sure you'll know what I mean and what I'm talking about.

So you did provide in Addendums 10 and 11 some case studies and engineering descriptions that we would like to examine this supporting evidence and also clarify some other aspects of this mitigation measure.

So let's go through some of them, please, and see what we can learn. We're going to start with Registry 42, Appendix 10, which is the geochemical reports. And we're going to go to PDF page 429, and it actually spreads over to page 430. So let's scan out. I'll assume the Benga panel can read this on their own screens.

So this was an example of some case studies that you submitted in your original EIA. You provided two examples of flooded pits that were used to treat mine water. One of these was the Sweetwater pit lake in Wyoming; the other was the Anchor Hill pit lake in South Dakota. These systems were shown to -- some of

this I'm going to put to you instead of asking you to -- to -- you know, you can -- ask you if you confirm it at the end.

I think these examples were shown to remove selenium at a high rate, potentially greater than 95 percent. You did, however -- and the -- the words are on here. I'll ask you if you agree. It's actually -- if we scan down to page 430 and we see the line that begins with "Treatment of selenium in open water", if we can. Do we see that "Treatment of selenium in open water"? Supposed to be on page 430.

A MR. HOUSTON: Third -- third line from the top.

Q Right there. There it is. There it is. Right.

I'll let you read that: (as read)

Treatment of selenium in open water is more challenging.

I'll let you read the rest of the -- of the sentence.

And I guess I would ask you -- you say that treatment and flooded pits is significantly different from treatment using a saturated backfill zone.

A MR. JENSEN: It's always difficult when you use qualifiers as "significant". But I would say that the basic process is the same. So the reduction process is the exact same. The -- the difference is really when it comes to mass transfer considerations

around absorption of partially reduced selenium. So, for example, selenite would still be present as a -- as a dissolved species in open water, whereas it would tend to absorb to minimum material in -- when you have backfill present. So there -- there's some -- some definite similarities, and then on -- on other levels they're not -- they're dissimilar.

Q Fair enough on you for my use of the word "significant", especially in an environmental assessment process. That's -- I should've -- I should have screened that out. Substantive differences.

Yes, I guess you're -- you are agreeing there are some substantive differences, although the process --

A That's right.

Q -- is fundamentally the same.

Could it be that you would see even better performance in a pit -- in a lake, given that the water would mix uniformly within the lake, whereas it may not in a saturated backfill zone?

A I mean, I wouldn't have any evidence to back -- back this up, but I would say that I would find that quite unlikely. It's -- mainly because of the mass -- the mass transfer consideration I just outlined.

But, I mean -- so, again, thermodynamically, I would say that you're -- you're up against similar limits when it comes to -- to just purely the reduction

part of the process. So it's -- I apologize. It's not -- it's not easy to quantify, but my expectation would be that -- that saturated backfills would perform better because of the mass transfer consideration.

Q How about the way that the carbon source was added between your plan of a -- slow and measured quantities of methanol being injected versus in these case studies? My understanding is the carbon was dumped in all at once. Would that make a difference in performance?

A Hmm. In terms of the ultimate performance, I wouldn't be able to say. What -- what I would say, though, is that one concern I would have with -- with sort of just an open body -- treatment of an open body of water is the potential for stratification and -- and, really, mixing. So I think by dosing gradually as water is -- enters the system, it's much more akin to reactor control, if you will, where you -- you have much tighter control over the dose of your electron donor or carbon source that's added to each unit of water as it enters. So instead of having, say, if you will, a hot spot maybe in an area where your carbon source isn't mixed fully in -- into the lake, you'll -- at least in theory, you'll have a much more uniform distribution of -- of carbon when it's -- it's -- it's tightly controlled. So --

Q You think these differences, Mr. Jensen, we've talked about would make it a real challenge -- recognizing fundamentally the same process is in play, but it would make it a real challenge to predict the performance of one system by looking at the other?

A Well, I mean, yes. Well, in -- it -- keep in mind that these aren't -- the intention here really is more of circumstantial evidence. It's not so much to say, Look, this happened here; we expect the exact same performance over there. That -- that's precisely why time and time again we pointed to the need for -- for scaling up test work on-site and demonstrating site-specific performance. It -- it -- it's more of an indication that it -- that we're not -- you know, we're not completely out to lunch when we say that -- that the reduction down to these type of levels using this type of process that -- that that's within the realm of reality. That's -- that really is the context that we're -- that we are submitting these case studies. You know, too, it's -- it's circumstantial, to -- to be sure.

Q Okay. Thanks, Mr. Jensen.

So those were some old case studies you submitted. Now, let's jump forward to Addendum 10, when you were responding to Panel IRs. That's Registry Document 251, Package 5.

MR. O'GORMAN: And, Zoom Host, we're going to go to PDF 27.

Q MR. O'GORMAN: So while that's coming up -- well, let's wait till we see it. It was the response to this information request from the Panel, 5.5. If we scan down to the bottom, essentially we ask you to give us more -- yeah, examples to support this treatment approach.

We did hear about some mechanical treatment measures. So if we could jump to PDF 40. PDF 40. Good.

On this page, if we scroll out, we see some fluidized bed reactor -- actually, they started to be described back on page 38. There was also Example E, which was the Wharf Resources' mine water treatment plant in Example F. A few pages earlier we heard about fluidized bed reactors. So -- which are operated at different mines. Just wanted to remind you we had seen those.

So I'm asking you, Mr. -- Mr. Jensen, I guess these are questions for you, but I'm happy to have others weigh in.

MR. O'GORMAN: And I hope I'm not speaking too fast, Ms. Court Reporter.

Q MR. O'GORMAN: But would you agree that these mechanical treatment systems are different enough from

SBZs that their performance is -- it's very challenging to predict the performance of one on the -- to the other?

A MR. JENSEN: You mean comparing -- comparing a mechanical treatment system to a saturated --

Q M-hm.

A -- backfill system?

Q Yes.

A And -- and you mean -- by "performance", you mean the effluent concentration of selenium that you consistently can achieve?

Q The treatment, percentage, efficiency, effluent concentration, other various things we could come up with, but ...

A Yeah, I mean -- so I would say yes. I would --

Q Okay.

A -- I wouldn't want to draw a straight line from -- from one to the next.

Q Okay. That's fine.

Bioreactors. Something we heard about in this addendum. If you can look at PDF 37, please. Just a few pages back. Examples B and C from this -- if you scroll out -- maybe roll out a bit. We see some bioreactor examples. There's also one -- Example H on page 41. We don't need to bother jumping to it.

Bioreactors, my understanding, they contain an organic substrate, varying proportions of woodchips and hay, that sort of thing. In the bioreactor samples, do these organic constituents play a particularly important role in the selenium-removal process?

A Oh -- oh, yes. I mean -- so the type of bioreactor I think we are referencing here is just like you said; it's typically you add some type of solid organic material. And that -- that's absolutely key. I mean -- so the purpose of that material is to produce that reducing environment that we need for a reduction of -- of primarily selenate and selenite. So, yes, its -- its --

Q And --

A -- organic material is key.

Q Okay. And acknowledging that you do have introduced, you know, methanol into your SBZ -- but there's probably enough differences between the SBZ and the bioreactor-type examples that they're not -- at least not entirely comparable. Would you agree with that?

A Oh, yes. I mean, I think -- I think there's probably greater similarities between active water treatment and -- and SBZs than -- than bioreactors and SBZs.

Bioreactors --

Q Okay.

A -- you know, you -- you're lacking an element of

control in there that you -- that you include in the SBZ operation by -- by maintaining control over your carbon dosing. So, yeah, I would agree with that.

Q Okay. And I just want to -- okay. I'll move to the next.

If we look at page 36 and 37. You just need to scroll up one, actually. We see barrel and column studies that were suggested. You've described a couple of examples in this IR response of various barrel and column studies --

A M-hm.

Q -- Examples B and C in particular.

MR. O'GORMAN: I want to scan to the next page, Zoom Host, as well.

Q MR. O'GORMAN: Would you agree, Mr. Jensen, that these systems don't have the complexity of a full-scale saturated backfill zone? And I'll give you even -- well, actually, we'll answer that question first.

A MR. JENSEN: Oh, yeah, absolutely.

Q Right. And some of the differences, you agree, I think, would be that water would flow more evenly on a more controlled manner through a column than through a large pit filled with rocks; right?

A That's -- that, I don't know if -- if I'll agree with as readily. In fact, I mean, it's -- it's something

we've spent some time looking at, how you can design hydraulic control into -- you know, into a designed saturated backfill system. One option is, of course, to -- to -- as we've heard a few times, is to, you know, more or less blindly dump -- end dump into the pit and then deal with whatever comes out of it.

But I believe you also heard from Mr. Youl that we're considering options where there are some possibilities for -- for designing it a bit more carefully for hydraulic control. And, in my mind, this is one of the opportunities we have that's not available to operations, where they have to use what they have in terms of -- of -- of backfill dumps, that there is some opportunity here to -- to embed some hydraulic controls into a saturated backfill. You know, we haven't explored them to the -- to a full extent, but I -- I -- I really see that as a very interesting opportunity to -- to try and -- and take advantage of the fact that these things haven't been built yet. And it can -- as far as I can tell, it can all be done with mining equipment.

Q Okay. Thanks, Mr. Jensen.

So I'm going to ask you if you think -- we quickly spun through without getting into all the details of these example cases you -- you asked us to look at, but would you agree that the most relevant comparator for

the performance to expect from a saturated backfill zone would be other saturated backfill zones?

A Yes.

Q Okay. So I'm guessing you'd agree that maybe the most appropriate case studies that you submitted would be to look at the ones that are on PDF page 42, which our Zoom host will take us to.

So we see the Example A, Tumbler Ridge, and numbers from Biancan [phonetic] as I recall.

MR. O'GORMAN: And if you scroll down, Zoom Host.

Q MR. O'GORMAN: And the other one, Example B, Northern Canada, I think we -- are you able to tell us where Northern Canada is for Example B?

A MR. JENSEN: Yeah --

Q (INDISCERNIBLE - OVERLAPPING SPEAKERS) mine sites?

A Yeah. I'm just -- excuse me. I'm searching my memory here. I don't believe that this particular case study is -- I don't think I put this together. So I'm going to have to go and find the reference and see --

Q Okay. You know, we don't need you to find the reference for that one. It's not that important.

A Okay.

MR. O'GORMAN: Scroll down, though, please, Zoom Host. Keep going.

Q MR. O'GORMAN: Okay. So those are the two

examples that you gave us.

A MR. JENSEN: Yeah. Yeah.

Q So these, you would suggest, potentially the most important of the examples that were submitted; right?

A Well, I mean, if -- if we think of what's submitted as a whole, I would actually say no. The Biancan study that you're referencing there, in that particular situation, there was no attempt at all to -- as far as I recall, to add any -- any carbon. This is -- this is just what happened in the in situ environment without anyone doing anything. So -- so that was just the residual carbon that you already -- that was already present in the rock.

And so what's interesting about that is it goes to show -- and I don't want to overstate the case here or be, you know, unduly optimistic about these things, but it -- it remains true that we do see these processes occurring, not just in a setting like this, but in other settings really with or without any -- any special effort.

So what we do find is that by adding -- by taking control of the process and doing that by adding a labile carbon source, you really can achieve very good control of the systems.

So, no, I actually would not agree that these are very good reference. Again, it's -- it's -- I would

put these in the category of sort of circumstantial, you know, pieces of information that indicate that the general concept, is -- you know, it's -- it's present in -- not just in what we talk about here, but it is actually a wild -- widely recognized process.

Q Okay.

A I think that's more the --

Q So --

A -- intent.

Q Sorry. I didn't mean to cut you off. So, actually you --

A Sorry -- (INDISCERNIBLE - OVERLAPPING SPEAKERS)

Q So actually you would maybe argue that an even better comparator than these two examples would be Teck's Elkview operation as the most relevant to compare --

A I --

Q -- would you agree with that?

A I would say it's better, but I would still go back to what I've said many times, which is for these types of systems it really is necessary to -- to complete test work on-site to get a handle on exactly how your system would -- would perform.

Q Fair enough. But Teck's, of these examples, is also the one that is receiving supplementary organic carbon; right?

A Yes. Yeah.

Q Right.
A And it's --
Q Carbon dosing -- yeah.
A Yeah. It's a very -- it's a key feature of these systems.
Q Okay. So let's talk about SBZs that receive dosed -- carbon doses. Okay. So a little bit of background. Let's --
MR. O'GORMAN: Zoom Host, if you want to haul up three one -- Document 313. We've -- 313 was Addendum 11 -- or was it Addendum -- yeah, it's Addendum 11, I think. We'll go to PDF 458.
Q MR. O'GORMAN: And while she's looking that up, I guess I would say -- all right. Every saturated backfill zone you've got a large excavated pit filled with rock. To that extent, they're more similar to each other than to, for example, a large pit filled with mine water; right?
A MR. JENSEN: As a general statement, yes.
Q Okay. The two examples that you cited -- well, we already talked, really, about the -- the careful adjusted dose of carbon. I think I can jump ahead just slightly in my planned questions here. Right.
Would you say, Mr. Jensen, that in terms of designing a saturated backfill zone, including determining its dimensions -- would you say that the

example with the dosed mine water is more directly applicable to the system you've got proposed at Grassy Mountain?

A I -- I apologize, Mr. O'Gorman. You're saying the example with the dose mine water, so -- being? Being Teck or ...

Q Yes, I mean Teck.

A Yes.

Q Maybe I should have used different words.

A Okay. No, absolutely. I mean, like I said, that -- that -- that's a -- probably the key attribute to -- to look at.

Q Yeah. Okay. Okay. I think you've agreed with -- I'm just -- some of these questions you've agreed with, so now I'll jump down here to -- let's talk about Teck.

So in your submission -- this is on -- we're on 313? Yes. Let's go to 227, please. Okay. That should be good.

So at the time you submitted this, you basically told us, Sorry, but publicly available data on performances not available. Does that sound right?

A Sorry. Yes. Correct.

Q Okay. But if we go to Document 503, Registry Document 503, and that is a document that you submitted as your hearing submission, I believe; correct?

A MR. HOUSTON: Correct.

Q And we look at page 35. So this is the middle of a presentation from -- let's look at 35 for now. We'll jump around a little bit here. A presentation from Teck about its Elk View saturated backfill zone, and this actually came up earlier in this hearing. Is that right, Mr. Jensen or Mr., you know, Houston?

A MR. JENSEN: Yes, it -- it looks like that way, yeah.

Q I do notice we -- the page that we landed on contains the answer to a question that was asked of you when this study came up earlier in the -- in the process when -- I'm not -- I can't -- I'm not going to call up the transcript, but I think you were looking at a different slide that showed the treatment levels achieved from Teck's Elkview operation, and I believe you were asked what percentage removal they were achieving, and the answer was, in this deck, in that it said greater than 90 percent of selenium was out; is that right? Do you remember that conversation? I think it was you, Mr. Houston.

A MR. HOUSTON: I -- I'm failing to remember the exact conversation.

Q I don't think it's important enough to go to the transcript.

A Yeah. No, no. I -- I see the "greater than 90 percent" here.

Q Okay. So I guess greater than 90 percent could be anywhere between 90 and 100; right?
A Yes.
Q But, notably, they didn't -- they did seem to present a lower bound on this.

I'm wondering if you would say -- and, again, these questions have been about comparing performance. I wonder if you would think that this removal rate or treatment -- efficiency rate is something that would be reasonable to expect at your saturated backfill zone?
A MR. JENSEN: If you're referring to the statement greater than 90 percent, then -- then yes.
Q Could it be as low as 90 percent?
A I wouldn't expect so, but it would be a matter of -- again, like some of the field trials and whatever else we recommended, you know, you'd want to complete those to -- to confirm that. But, no, I -- I certainly wouldn't expect so.
Q All right.
A I mean, and -- and if I can add a little bit of context. What -- part of the difficulty we have in -- in discussing some of these matters is that, you know, there's a limit to -- and doesn't -- this doesn't just refer to Teck, but -- but some other material we come -- we come across in our day-to-day practice -- we are privy to a good deal of -- of, you know,

confidential information from -- at other mine sites and clients. And so part of the difficulty we have in conveying our confidence around these things is that we do see other systems' -- result of other tests that aren't public but that we are privy to, and -- and that helps -- that helps us -- it doesn't help you, but it helps us, you know, with our confidence around some of -- of what we see. So it's -- we struggle a bit in -- in these instances here where obviously it's the evidence that -- that needs to speak for -- that needs to support our statements. But I can say from a professional point of view it's -- it's -- just from what I know, it's -- it's -- yeah, I have a lot of confidence that we'll -- that -- that, you know, we're speaking around the -- the 15 ppb or micrograms per litre. Like, I'm -- I have a great deal of confidence that the effluent will be down in that range.

Q Okay.

A I'll leave it at that.

A MR. HOUSTON: Mr. O'Gorman, if I could intrude -- and this kind of goes back to the calculations you led Mr. Jensen through earlier. If we go to PDF 42 in this document, what you'll see is that the influent they were starting with was quite low in terms of concentration. And so if you think about the 15 parts per billion -- or the 15 micrograms per litre,

I'm sorry, as kind of the lower level of where we can get to with this treatment process, then the 90 -- or the greater 90 comes from -- or is -- is driven a lot by the influent concentration.

A MR. JENSEN: And if I can add, I mean, this is -- this is also an example of a system where it was installed after the fact. There was no -- you know, they recruited a historical backfill, you know, set up their -- their stations, and -- and that -- that's what happened here. There was no -- no opportunity at all for -- for managing the hydraulics or for -- it was -- it was literally just, you know, let's see what happens, more or less, you know, when it came to at least hydraulic control.

So it -- you know -- so this is where -- again, some of the difficulty I just highlighted, it's -- you know, I'd love to go into more details, but, unfortunately, I'm --

Q Yeah.

A -- I can't.

Q Okay. Thank you both for those. I mean, I do feel like I -- I should, you know, very briefly respond to that, Mr. Jensen, only to point out you were right in what you said about, we do, as a Panel, need to look at what's on the record and the evidence that's presented to us. And we do appreciate that some results that may

be out there may be confidential and not public record, but they could as easily go in either direction in terms of whether there are results that would support your proposals versus results that would not support your proposals. We really can't speculate on those as a Panel. You appreciate that; right?

A Oh, yeah. Precisely. That -- that's my comment.

Q Okay.

A But -- but it -- I guess I was trying to convey -- well, I --

Q Okay.

A I don't want to repeat myself.

Q Yeah. That's fine.

Okay. So, actually, this is a nice graph, because I do want to lead through some calculations. Calculations are my thing, as has probably become painfully apparent to this panel.

So this presentation that was included in your submission, it does -- if we need to go back and look at the number, we can. It was on page 36. But it received an inflow of 10,000 cubic metres per day of water with a maximum of .2 milligrams per litre of selenium or 200 micrograms if -- as I promised, we'll talk in micrograms today. Do you guys agree with that? Do you need to look at page 36 to confirm the 10,000 cubic metre number?

A No. That -- that's fine. Yes, that's correct.
Q So a quick calculation says to me that they were taking in a maximum load of 2 kilograms per day of selenium. Do you want to double-check that number, or do you take my word for it?
A I'll take -- I'll take your word for it, but it all sounds about right.
Q Okay. And, indeed, the figure shows over a period of some months a total amount of removal of 351 kilograms in Teck's program over, I'm thinking, 21 months, reading the graph; right?
A Correct.
Q Okay. For these next questions, we want to think about the -- what's Grassy Mountain have to deal with.

So I can draw these up or I can ask if you could just confirm without us looking for this -- for the registry documents. Do you agree that reasonable numbers to assume for the treatment that your SBZs will need to handle would be a maximum of 30,000 cubic metres per day and a median of, say, 15,000 cubic metres per day?

A Yeah. I've -- that sounds about right. So --
Q I could take you to the documents to show, if you want, but --
A Oh, I don't think you have to. It's -- it's -- it's -- yeah, I -- I would agree with that.

Q Okay. Thank you.

So if we had -- you know, the conservative case that you've presented to us would be estimating -- and then I recognize we had this conversation in the source term conversation. You didn't necessarily say you calculated a set of numbers that showed 1.5-milligrams-per-litre input, but you proposed that to us as our conservative upper case to evaluate, so we're going to evaluate that conservative upper case.

So if you had an inflowing selenium concentration of 1,500 micrograms per litre, do you want to do some quick math and give me a sense of what the resulting selenium loading will be into your backfill zones, considering both the median and the maximum flow -- expected inflow rates?

A Yeah. You bet I can do that. So let's see. 15, 2,000, 30,000 -- and you want to use 1,200 or 1,500?

Q I'd like to use 1,500. I recognize you showed us a figure that had 1,200. That wasn't a conservative 95th percentile number, and that was only one of your ponds. So let's go with the -- the -- the 1,500 that we've -- we can draw from your assertion that you had in the original documents 99 percent treatment resulting in 15 as the outflow?

A Yeah. So I have between 22-and-a-half and 45 kilos per day.

Q Right. That's what we came up with as well, so we're all good at math here.

22-and-a-half to 45 kilograms per day would be a 10-to-20-times-per-day higher selenium load than Teck's project at Elkview that they're reporting on in your figure; right?

A Yes.

Q Okay. So based on that, do you expect that the SBZ at Grassy Mountain would need to be 10 to 20 times bigger than the one at Elkview in order to remove selenium as well or better as that operation?

A No, I certainly would not. I mean, we're -- we're already talking about volumes and retention times that are orders of magnitude greater than -- than what's required to remove these loadings. So if -- just for -- as a point of comparison, if we -- if we think down to the scale of an active water treatment plant through a scale of gravel bed reactors up to a full saturated backfill, I mean, in reality -- so if we think of gravel bed reactors, which is the identical process to what we're talking about -- it really is. I mean, the -- the only difference is that you have it -- you place -- you tend to use uniform rock to get better hydraulic control. But if you look at mean retention time -- and you can factor in dead space and -- and -- and put some efficiencies into dead -- you know,

whatever you might have to subtract due to -- if there's any dead space. You know, on the order of certainly less than a week, you can get more or less complete removal in -- in those systems. Now we scale up to a system where we have several months.

I mean, the most likely outcome is that the vast majority of the treatment in these -- these systems will happen within a short distance of your injection point, and the rest of the volume of the saturated rock fill will really be more of a -- you know, unreactive volume where -- so that your -- your water takes a torturous path through the -- the media. So, no, I -- no, I -- I definitely would not agree with that statement.

Q Do you think they could be the same size as Teck's facility and achieve the same results with a 10 to 20 times higher loading of selenium?

A Yeah, I would think so. And, again, I have to be a little bit careful here. I have good reasons to -- yeah, so we're into the same problem here with -- with the -- the lack of information on the record. So I'll just leave it at that. I'll just say, yes, it's -- it is quite conceivable that the same volume could -- could handle that same load, absolutely.

A MR. HOUSTON: What -- what -- what is on the record, Mr. O'Gorman, is that Teck is planning to

double the -- the throughput in -- in the existing SRF, so -- so that is on the record.

A MR. JENSEN: Excuse me, Mr. O'Gorman, my colleague is pointing out that on page 36, if we can -- if you would, Zoom Host ...

Oh. Steve, do you want to -- do you want to speak to this? I don't really see ...

A MR. DAY: Yeah. Mr. Gorman [sic], what I -- Mr. O'Gorman, what I thought it would be useful to -- it sounds like you're sort of thinking about the scale and how much of the system you need. And -- and on what -- on what this figure shows from the Teck presentation is that they're only using a small portion of the -- the -- the backfill kind of area to -- to operate their system. So it's -- because a lot of the -- the -- a lot of the processes that -- that Mr. Jensen is speaking about occur very close to the injection points. You don't need a -- you don't need to kind of -- you don't need the full -- full extent of the -- the -- the backfill zone to -- to get anything to happen.

Q Okay. So -- thank you.

Are you saying Teck overdesigned this system?

A No. They just recognized that they could -- based on modelling that they did, that they could figure out that they needed this part -- they could use that part

of the backfill to achieve what they needed to achieve. And recall that the backfill is not a -- it's not a -- it's some legacy feature. It's not something that they -- they set out where they -- they designed the -- the well field for treatment around -- around what they needed.

Q So you believe the same size treatment facility, the volumetric elements of the SBZ are not a core component of how effectively they worked -- they work?

A Well, I think that -- sorry. Soren, did you want to -- Mr. Jensen, did you want to say something?

A MR. JENSEN: Yeah. I mean, I'd say at the magnitude of -- that we are operating within here, I would say yes, it's -- it's not a -- given the volume we have -- we have available is, you know, probably an order of magnitude higher than what we would ever conceive of -- of defining in terms of a design. So -- so, yeah, I'd -- I'd say volume -- think of it as a reactor volume is -- is the least of our concerns.

Q Okay.

A At least, you know, for long term.

Short term, like, you know, in the initial phases of the project, we might have to be a little bit more careful with how we manage that. But certainly long term, yeah, it -- it wouldn't be a serious consideration.

Q You haven't really explored that, though, and justified that in any of the materials that you've sent us; is that right?
A MR. HOUSTON: Well, we have talked about retention times, Mr. O'Gorman, and certainly as Mr. Jensen mentioned in -- in the first phase of the first backfill, retention times are in the scale of one to three months. But, again, once we get full build-out and have the entire three stages of the SBZ, the -- the retention times go up to the -- you know, in the range of a year, and that's well more than is required for the reaction.
Q Okay. And we'll -- and certainly, yeah, I -- I am aware of that, Mr. Houston. I listened to the conversation you had with Mr. Fitch about the -- the residence times issue of water flowing through the SBZ, so you -- you have? Or you have talked about that aspect of it, yes.

Okay. So you're saying you're going to get the same result for 10 to 20 times more inflow for the -- with the same size of a system. Fair enough.
A MR. JENSEN: No. No, not -- not inflow. Loading. But -- but --
Q Loading.
A -- in terms of flow, we are, you know, 15 to 30. It's, I'd say, 1-and-a-half to 3 times --

Q Right.
A -- hydraulically.
Q Yeah.
A But -- but I will say, I mean, for -- you know, when we go and design other biological treatment systems, for example, for -- let's say just for nitrate treatment or for ammonia treatment, it's not -- like, the hydraulic capacity isn't -- isn't necessarily a -- well, for the process itself, it's not really a design factor. It comes down to -- to surface area of -- like, surface reaction area.
Q Sure.
A So that -- that's the design. And -- and so if you start to back out your kinetics based on your surface reaction area, like I said, you're orders of magnitude higher than -- than anything you'd ever design for.
Q Okay.
A So it's -- it's -- so I -- I wouldn't want to leave it -- you with the impression that somehow we are trying to do ten times the amount of treatment in -- you know, it -- I think that's -- that's not a -- a fair characterization.
Q Okay. Oh, I'll kind of jump forward, then, a little bit. You know, some of the -- is it -- would you say, Mr. Jensen, that it's -- you can confirm at the very least that your system is larger than the Elkview

system, right, even if not 10 to 20 times larger?
A Hydraulically, yes, it is.
Q Okay.
A And -- and loading and (INDISCERNIBLE - OVERLAPPING SPEAKERS) --
Q So in a larger system --
A -- also.
Q Also loadings, yes. And I did misspeak myself earlier. I didn't mean 10 to 20 times the flow. I did mean the loadings, but ...

So just with it being larger, just to clarify, I mean, are there greater challenges in design complexity on this -- what I would suggest might be a key issue of ensuring that the water flows evenly, recognizing, Mr. Houston, you challenged, I think, Mr. Fitch, on him describing flows. But let's -- let's just say it using those words for now. You do need to ensure that the water flows evenly through the entirety of the larger system compared to one that is smaller. Does that introduce extra complexities?

A Well, first of all, I -- I would disagree with the notion that you have to ensure that it flows evenly. Again, with this massive excess of -- of reaction volume that we have in the surface area that we have, we don't have to control that particularly tightly 'cause it's -- again, the -- it's -- it's so

overdesigned -- not overdesigned, but back to the same point I made earlier. That said, I think it is imminently desirable to -- you know, now that we have the opportunity to -- to think about the hydraulics and how hydraulically the system will operate -- and, you know, my expectation is that some thought and effort will be put in to design the hydraulics around this. I mean, that's -- it's really a luxury we have of a system that hasn't been built yet. So, you know, you can think of -- of hydraulic design at different scales. I wouldn't say complexity increases at a greater scale. You know, you can have very large settling ponds, and they're, you know, roughly speaking, not much more complex than a small settling pond. It's -- I think it's a matter of, you know, putting the right design parameters together and -- and then see what you can do -- how you can work with the -- the mining material to -- to improve hydraulic performance. But on that one point that -- there's -- there's definitely no need to be too precise or too perfect on that.

Q Okay. The spread of the methanol through the system adds a little bit of extra complexity or no?

A I mean, if you compare the -- if you compare to any other type of -- or reactor -- reactor op -- operation and dosing system, it's very -- I mean, it really is

one of the attractive features about this system, which -- you know, I see it as far more attractive than -- than, say, a mechanical treatment plant because it is -- it's quite robust to even fluctuations in -- in methanol addition, and it -- it's got inertia in the system. And it's -- if you see examples of -- of the gravel bed systems that -- I'm having a -- what are they called -- the -- Geosyntec -- thank you -- that they put together, I mean, they're -- they're really simple systems. You have a methanol tank and a metering pump, and then you have a couple of feed-forward control systems. It's -- from a reactor point of view and from a control point of view, this is a -- it's -- certainly is not complex.

Q Okay. There's some other differences that you've got to factor in when you're trying to consider your designs, and I'm thinking about things like composition of the mine water, climatic differences, that sort of thing. And will they have a -- have an impact on the transferability from the one to the other -- one system to the other?

A Sorry. I'm -- I'm not trying to be difficult. I just want to make sure I understand. When you say one system to another, you mean (INDISCERNIBLE - OVERLAPPING SPEAKERS) --

Q From Teck to Grassy Mountain. From Teck to Grassy

Mountain.

A I mean, they're very similar climatic systems, and they're, you know, within -- and -- and what we tend to see in -- in large reservoirs like this is that the swings in terms of temperature and -- and other factors -- and -- and not only that, the range within -- so if we look at the stoichiometry of dosing carbon -- so that's one -- one of the things we looked at in these barrel tests; it was one of the -- the primary goals of that test. We know that there -- there's quite a range of -- you know, again, we don't have to be surgically precise about any of this. Not -- not that -- not that we couldn't try to be. But it -- it -- it's a fairly forgiving system when it comes to all of the factors you just listed as far as we can tell.

Q Okay. So comparability of Teck's results from Elkview to Grassy Mountain, are you comfortable -- what's your degree of comfort that they are highly comparable and transferable versus there are a number of unsig -- you know, important uncertainties in being able to make that comparison of the performance of the one versus the other system?

A I would say both. I would say that in terms of -- of the performance when it comes to selenium removal, I mean, quite honestly, my expectation is that the

Teck -- the Grassy system would be better 'cause you can design it from the ground up. So some of the -- I don't know how much they speak to some of the -- the challenges they had to overcome at -- at Teck, but -- but, you know, it's -- it's -- again, that's the benefit of starting from scratch.

On the other hand, there are certainly uncertainties that we want to address. We discussed some earlier today, the potential to mobilize metals from materials at -- at Grassy. That's an important one. What else can we point to?

I mean, no, there -- there's -- there's no question there's site-specific questions that have to be answered and addressed on-site, but when I -- but on the particular point of selenium and nitrate removal, for that matter, I would -- I would express a high degree of confidence.

Q A high degree of confidence in what?

A In the performance of removing selenium and nitrate.

Q To achieve 99 percent removal? Do you have high degree of confidence in that?

A Yeah. Or to achieve 15 micrograms per litre of selenium in the effluent and less than 1 milligram per litre of nitrate nitrogen in the effluent, yes.

Q Okay. Thank you, Mr. Jensen.

You put it at high, not even moderate?

A No. I -- I put it at high.
Q Okay. Scanning down.
Okay. The gravel bed reactors that were discussed in your proposal -- sorry, in some of your materials -- and I'm not going to haul it up -- you agree that the materials suggested gravel bed reactors would be a -- a consideration for the project?
A MR. HOUSTON: I guess -- I guess I'll jump in here. Mr. Jensen and Mr. Day didn't work on that. The -- the basic work for the gravel bed reactors was done by another -- another consultant. But, yes, certainly it's a -- it's an alternative we've put forward, either as an add-on or to -- to bolster the -- the performance of the -- the SBZ.
Q Okay. But it's -- sorry. It's getting late in the day. You're not committing to do -- to building one; right --
A We have --
Q -- or are you?
A We -- we have committed to building one if the SBZ doesn't perform as we have expected. So, yes, we have committed to either a gravel bed reactor or, you know, a -- a mechanized treatment facility if -- if the SBZ doesn't perform as we expect it will.
Q Okay. Let's say if you get to a point where you don't have one of those backup systems in place and you have

effluent coming out of your saturated backfill zones that is not meeting your desired performance target of having a -- 15 microgram per litre of selenium. What do you do?

A Well, first of all, there will be an array of monitoring wells through the SBZ that will be looking at the -- the parameters, the selenium content, the oxygen content, the nitrate content at various points in the SBZ.

As Mr. Jensen mentioned, we expect the bulk of the reaction to happen very close to the inlet, and we're -- we would expect to see somewhere in the SBZ that the water quality has reached a level that is -- is -- is appropriate for discharge into the environment.

So this wouldn't happen as a surprise. It would be something that we would see coming. We have talked about diverting water that is off spec to the raw water pond and eventually recycling through the -- the SBZ, you know, if -- if need be.

Q Okay. Any chance that you would have to stop operations if you weren't meeting -- you know, I'm asking you to -- you discovered the selenium is coming out too high, and you didn't act in time to get your treatment plant built?

A I guess in the -- in the worst case, Mr. O'Gorman,

that's where we could end up. But stopping operations wouldn't necessarily stop the -- the selenium from coming into the system; it's -- it's separate from the actual coal mining. And so we -- we would need to -- and -- and I -- I think one of the important things here is that these things are -- are developing slowly. We're -- we're not going to have all of the mine -- or the ex-pit dumps formed in the first few years, and so the -- the selenium content in the influent water is going to develop slowly. The -- the SBZ has some inertia to it, as Mr. Jensen pointed out. So there are time -- time elements here that kind of mitigate against suddenly waking up one day and finding out you've -- you've got an issue.

But I -- I think that watching those trends develop, we would have to make a decision at some point to implement a gravel bed reactor or to take steps to bring in a -- a -- you know, a box treatment plant such as one that Teck has installed at the West Line Creek.

Q Okay. I did want to bring up one specific number in your analysis and ask you to speak about it. And it is on page -- just one second. Okay. It is on -- this document -- sorry. Let's go to 251, CIAR 251, and page 43. That -- that -- that figure is good.

So one of the two saturated backfill zone examples you gave us -- this was the Biancan study -- you gave

us some projected selenium removal rates in that system. Does that look right to you? And you can see the numbers?

A MR. HOUSTON: Yes.

A MR. JENSEN: Yes. Oh, sorry.

Q I'm curious if -- if you can tell us if those look like reasonable comparisons to transfer over to what you would expect to see?

A Mr. O'Gorman, no, not at all. I mean, these -- again, these are removal rates from a system where you added nothing. You -- it -- it's just passive attenuation, if you will. It's -- it's -- there's no attempt to add any kind of accelerant into the system, and, you know, the second you start to do that, these removals rates, they go up by orders of magnitude. So, no, I would not say so.

Q What value did you use --

A Well, one -- we didn't use --

Q -- for projected removal rates?

A One of the difficulties in -- isn't -- in calculating the -- the expected rates is precisely that -- we probably have to look to the -- the Geosyntec work to see what they expect. That's probably the best source of information we can point to when it comes to the kinetics and removal 'cause it -- you know, we -- like I said before, these reactions tend to go to completion

within a relatively small subset of the -- of the volume of the -- of the saturated backfill. So it's a long response to say I can't give you an exact number. We'd have to go and calculate it and -- or maybe derive it from some of Geosyntec's work.

Q Would it be --

THE COURT REPORTER: I'm sorry. Whose work?

MR. O'GORMAN: Geosyntec, he said.

A MR. JENSEN: Geosyntec. Yeah. I apologize. I was mumbling.

Q MR. O'GORMAN: Okay. But it would be fair, I think, to get a comparable value from a large-scale, real-life-type system to compare; right?

A Well, so, yes, I mean, that -- that would be another purpose of -- of running field-scale tests at Grassy. But I -- I will say in the same breath that -- that the -- the particular kinetics of reducing selenium -- again, I mean, on the list of things we worry about, that's not really on that list 'cause it's -- again, because of this order of magnitude consideration in terms of how much available reactor volume we have it -- compared to what we need. So it's -- it -- it's not something we're horribly concerned with, but it -- it's -- it's certainly something that will be calculated as part of the development.

Q Okay. I'll move on from there.

Let's go to asking you about research and development. First of all, do you want to summarize for us again the R&D plan that you have to get you to this desired level of treatment that you want to see your system produce?

A MR. HOUSTON: So we've -- we've talked about the column tests and the barrel tests, and -- and we may -- we may extend some of that laboratory-scale work even further. But the next scale up would be to do a -- a field-scale pilot test on-site, and this -- this would be at a scale where we could start to understand a little bit better some of the -- the parameters that we've been discussing, you know, the arsenic, the -- the rate of reaction in -- in an in situ situation. So those -- that would be the -- the next significant step. And -- and I think after that we -- we would move to the actual Phase 1 of the SBZ, and -- and as we implement that, of course, we're going to build in the information that we gather from the pilot scale. But I -- I think we would look at that initial phase as an opportunity to build in some optionality in terms of inlet and outlet parameters and other design features if there -- if there remains some uncertainty about what might be required and to allow ourselves in the implementation of that Phase 1 -- and, remember, we're still -- we're not up to the -- the maximum flow rates

or the maximum loading rates because the ex-pit dumps are still being formed and -- and the -- the massive rock and the surface area to get those maximum loadings aren't there.

But -- so in that first phase of the first SBZ, we could build in some redundancy or optionality to continue to test the process as we operate that first full-scale SBZ, and that would help to drive engineering decisions that we could implement on the subsequent phases of -- of the SBZ.

Q Okay. And you planned for the first SBZ to start operating when?

A I believe it's -- it's going to be ready for operation after four years of mining. Yeah, Year 4 of mining. Yeah.

Q Year 4 of mining. A couple of years of construction time --

A M-hm.

Q -- post approval?

A It's ...

Q Okay.

A Yeah.

Q Okay. I just wanted to wrap up on this sort of theme. So just if you -- if something happened -- let's say partway through mine life, you -- market conditions change with your project, and someone decides, I think

we're about done mining coal on Grassy Mountain. You are -- you know, you've been proceeding to develop according to your mine plan, you have a partially constructed -- depends on the year this hypothetical event happened, obviously. You have a partially constructed saturated backfill zone treatment system that was predicated maybe on mining continuing. What happens? What happens with the selenium and the continued operation of that saturated backfill zone?

A My lawyer told me never to answer hypothetical questions, Mr. O'Gorman, but as a -- as a thought experiment. Yeah. No. We -- we would --

MR. IGNASIAK: I'm not objecting.

A MR. HOUSTON: Obviously a lot depends on at what stage everything is at and what -- what are the long-term requirements. As we go through, though, and -- and as we're doing our annual reclamation estimates for the MFSP program, part of that -- part of that estimate is the -- the estimate of costs for long-term management, maintenance of -- of an SBZ and -- and the selenium treatment process. So -- so there -- there would be -- you know, there -- there would be some allowance for that in our -- in our annual planning, and that would be part of the reclamation liability.

Q MR. O'GORMAN: Okay. Fair enough. One

second. I'm scanning down here. Right.

I sort of asked this. I -- but I do need to come back just to make sure. Well, no, I did actually -- I put this question to you out of order 'cause it sort of seemed to come up. But it is -- you know, the follow-up to that and my hypothetical, as you say, about a partially completed saturated backfill zone, does a partially saturated backfill zone produce 15 microgram-per-litre effluent, or do you need the full meal deal for it to produce those kinds of results?

A Yeah. So you -- you would need to -- I -- I don't know what you mean by "partially completed", but obviously you need the methanol injection, the pumping, the pipes, injection wells, extraction wells, so you would need to complete at least a -- a cell of the SBZ to have a -- a reactor and a process that you can manage.

Q Okay. Can I ask you a few questions, please, about your pilot scale -- your pilot treatment that you are pursuing? You have a column test study; right? Are they ongoing?

A The -- the exact study that we had commissioned is -- is completed, and the report is written, so that -- that is -- that is completed, but there -- there are other parameters that we may wish to continue to examine through additional column tests.

Q Okay. And you -- you -- you are going to proceed with a field scale -- a field-scale study; is that right?
A Yes.
Q Okay. When do you see that beginning?
A It would begin with the start of construction, so we -- we need to, you know, have equipment on -- on-site, roads built, things like that, and then we would proceed directly to that field-scale trial.
Q How long does a field-scale trial need to run to reduce [sic] results that you're confident to let you inform the design of the -- the full system?
A MR. JENSEN: Excuse me. I would say that, at a minimum, you'd -- you'd want to run it for -- for a year, but I would also say, after a year, you would have a pretty good sense of -- of -- you'd have a -- at least a decent answer to most of the questions you're hoping to -- to answer at least initially.
Q Okay. So at the end of that year of your pilot study, do you have results that suggest, yes, we're confident that we can achieve 15 micrograms per litre, or would you be able at that point to have a result that convinced you you have been overly optimistic and potentially make a decision, We've got to go another direction here and ask for approval to build a treatment plant of some sort? Does it -- does -- does your one-year field-scale study up front answer that

question for you, or is it only a -- you know, you decide that later?

A No. That would be my expectation. After a year, I think you -- well, I mean, also I have an expectation that -- that -- that that study would replicate, really, what we've seen in many other settings. So it's -- so I would say after a year, you would -- well, you always have to be careful when you're talking absolutes; right? It's -- on the balance of probability, I would say, yes, after a year, you would have enough information to -- to make that decision on the balance of probability. Just, as an engineer, I don't -- I never want to talk in absolutes.

Q Okay. There is one thing that's interesting that came up during the hearing I wanted to ask about.
Mr. Houston, you talked a number of times about one of the ways you could tweak and refine the operation, not the SBZ -- well, that you could tweak and refine the operation, adjust it. For example -- I think this -- this came up as an example -- you could potentially change the amount of methanol dosed into the system. Does that sound familiar?

A MR. HOUSTON: I -- I think we've written about that in -- in a few IRs about some of the levers we have to pull in -- in managing the operation, yes.

Q Okay. So, Mr. Jensen, I wanted to get your sense of

how much flexibility there is in your SBZ and the operation of it after it's constructed as far as significant changes one way or the other in the amount of methanol dosing you might apply to tweak the results in performance.

A MR. JENSEN: Well, I think that's one of the interesting things about -- I mean, again, if -- if we think of an -- an SBZ as a -- as a reactor -- which it is; it's a reactor -- there's a couple of -- of control approaches that you commonly look at. One is a feed-forward control where you have some analysis of -- by the -- and, by the way, selenium isn't really an important factor when it comes to dosing. It really is nitrate that's driving 'cause nitrate and dissolved oxygen in the water are the dominant consumers of electrons.

And so what you do -- what you typically would do is have a -- a feed-forward control system so you have a measurement of nitrate -- nitrate concentrations that enters your system. That would be part of your dosing. Then you would have a secondary measurement -- well, not secondary. Then your feedback control mechanism would be a -- an -- ORP measurements, a measurement located a suitable distance from your injection site, so you can -- you can control ORP at that point. And then you would have a secondary injection -- you could

even do tertiary -- tertiary injection system that if -- if you get into a situation where your ORP -- your oxygen reduction potential, starts to increase, you could then give it a boost, if you will, downstream.

So there's all -- all kinds of -- like, the control is one of these things that -- that is really attractive about the system, is that you -- and -- and I would say as a final point of control, if you get halfway through the system and you're not satisfied with the performance, there is some ability -- some limited ability to -- to extract the water and pump it back to the beginning of your saturated zone, but in thinking about that, that would be constrained by season and other things, and we'd have to be conscious of the -- of the need to return water back to the creek, so -- but certainly in terms of control, that's -- I -- I think of it as one of the attractive part of the systems. Maybe 'cause I'm a chemical engineer turned environmental engineer, but that -- yeah, that -- anyways, I'm rambling, so --

Q Could you -- could you potentially introduce too much methanol? And by "too much", I mean taking it to a point where it would be detrimental to selenium removal.

A Oh, yeah. Absolutely. If you take it too far, you get

into the realm of -- of sulfate reduction, and at that point, it starts to produce sulfide, and, you know, now you're into a situation where you potentially would start to -- to solubilize selenium again.

But I would say that there's -- like, to get to that point, you have to overdose by quite a bit, and there's also -- there's an iron buffer in -- in there that -- that -- well, actually, no. That doesn't help you.

I will say I have a past of designing bioreactors specifically for -- for sulphur or, you know, sulphate reduction, so a much more reducing environment, and the control measures for that is -- is if we ended up with conditions that were too reducing, we would add some feragyan [phonetic] to sequester that, but it's -- it's -- it would have to be -- you know, you'd really have to -- to just really overdose the system consistently for a long period of time, and you would have to ignore some of your early warning signs and -- and some of your ORP measurements. So it's really like any -- any treatment process. You can actually overdose and get into a detrimental range. But I don't see that as -- as a particular challenge in this case.

Q Okay. I only have a couple of questions left, so -- and then I think we will be at a close. So I -- I have put you through your test, Mr. Jensen.

On this -- on this -- on this -- to wrap up the potential -- well, okay. I'll -- I'll take you -- you agreed that you could potentially introduce too much methanol.

I have one extra question on the SBZs. Mr. Youl, you described yesterday, I think it was -- I'm not going to haul up the transcript, but you described how the SBZ fills up with waste rock. I think if I could characterize it, you sort of implied that you'd have trucks of waste rock that'll tip at the edge of the pit, with larger rocks expected to go to the bottom and a finer material left higher up along the edges. Does that sound right?

A MR. YOUL: That sounds correct, yeah.

Q So can you tell me if the SRF was constructed the same way? Does anyone know?

A I may have to defer to someone else on that one.

A MR. HOUSTON: So as far as I know, Mr. O'Gorman, the SRF at Teck, it was an existing pit that had been backfilled and basically reclaimed, and then wells were drilled into it, and they began the -- the process. And that -- that's what Mr. Jensen mentioned [sic] by we have the opportunity to actually make this SBZ intentionally instead of using an existing pit.

Q Okay.

A Just -- just, Mr. Day, do you ...
A MR. DAY: No, I have nothing else to add. You covered it well.
Q Okay. My final question was actually not even about the SBZ but about your -- we've talked just a little about your fallback plan of a -- a plant -- excuse me -- a treatment plant. I did just want to -- I think you have said to us that you think you can commission, construct, and get into operation a -- a plant to treat the selenium if the SBZ doesn't work as you planned within three years. I could find that if I needed to, but does that sound like what you've told us, Mr. Houston?
A MR. HOUSTON: I -- I think that's what we've said, Mr. O'Gorman.
Q Okay. So there are some submissions on the record that suggest that's highly optimistic and that other plants took five years to get up and running, for example, and I just wonder if you can give us some sort of sense of your confidence in the three-year number?
A My understanding when you look at the five-year number that was -- was discussed, that was another operator we -- we know all too well, so I'm -- I'm going from the public documentation, but our understanding is that part of that time frame was due to a -- I guess, a need to go back to the drawing board and -- and add a --

a -- a -- another process on the back end of that plant to -- well, advance oxidation process to remove some of the other species of selenium from the water. And so I understand that that took up a year and a half or two years of that -- that time frame. So ...

Q Okay.

A Yeah.

Q And remind us: If the SBZ doesn't perform as hoped and even in your optimistic -- well, I'm sorry. I'll take that back. Even in your suggested case of three years to commission, build, and start up operating the fallback mechanism, what happens to the water that's elevated in selenium? Do you have enough storage capacity on-site to store that amount of water?

A No. And, again, I -- I think the potential to suddenly be surprised one day and -- and have to, you know, react in a short time frame is -- is not a likely scenario. As I've mentioned, the -- the selenium, the ex-pit rock dumps, the -- the loading, everything is going to build up over a period of -- long period of time. We'll be able to look at the -- the initial results to understand that, you know, we're on track or we're offtrack, and so there will be -- there will be a buildup. We won't wait till the very last minute to -- to -- to make that decision.

I -- I would also suggest that it's more likely

that the first reaction would be to put in a gravel bed reactor which would -- would, I think, be an even shorter time frame to -- to get up and running. And -- and we have had some discussions with Geosyntec on, you know, what dimensions that might be. In fact, it's in -- it's one of our IRs, what dimensions that might be and -- and how long that might take to -- to get up and running. So it -- it could be done on a shorter time frame.

Q Mr. Houston, Mr. Jensen, Mr. Day, it's been a long day. We've talked a lot in this last bit about selenium. I feel the need to end with maybe just a little bit of levity. And if our -- my -- our -- our -- our counsel doesn't shoot me for this, I will say that I shared with our subject-matter experts that in 1988, as a third-year chemistry undergrad, I wrote a paper on selenium, and I, as I recall, received an 'A' on it. So I might have started out ahead of -- chronologically I started out ahead of all of us here on selenium. I'm going to confess that I remember nothing from that paper beyond that I did well on it a lifetime ago.

With that, I do thank you all for your -- for your answers today. Much appreciated. And we'll -- I will have more questions for you. I will say that I have worked my way through some of the longest packages of questions for you. I definitely have a good 'nother

couple of hours or three hours to get through, but we can't do it today.

So, Mr. Chair, over to you.

THE CHAIR: Okay. Thank you, Mr. O'Gorman.

So the Panel's just going to take a quick break just to talk about the plan for tomorrow. It seems like what we need to do is come back tomorrow to finish the Benga panel and perhaps not go farther than that tomorrow in terms of the other participants. But I just want to confer with my colleagues briefly, and we'll be -- we'll be back in a moment.

(ADJOURNMENT)

THE CHAIR: Okay. Yeah. Apologies for the brief delay.

So we just talked about, kind of, the game plan. And I think we agree we would like to finish the Benga panel tomorrow to accommodate, you know, the travel needs of the panel. It's been a long week.

We'll propose to start at 10 rather than 9. The schedule does say 9, but we have been starting Saturdays at 10. So we don't anticipate a full day, although Mr. O'Gorman does have a few hours of questions, as he tells me. So be prepared for that.

We won't start direct from any of the other participants tomorrow. We'll just finish the Benga

panel so that we can release that panel. And so that would mean that on Monday morning, starting at 9 AM, we would start with the Government of Canada panel available -- well, both direct and available for cross, and then followed by the order that we have, which would be CPAWS after that and then the Coalition starting on Monday.

Any questions about that?

Any other business before we break?

Okay. Thank you, everyone. Have a good evening, and we'll see you again tomorrow.

PROCEEDINGS ADJOURNED UNTIL 10:00 AM, NOVEMBER 21, 2020

CERTIFICATE OF TRANSCRIPT:

I, Angela Porco, certify that the foregoing pages are a complete and accurate transcript of the proceedings, taken down by me in shorthand and transcribed from my shorthand notes to the best of my skill and ability.

Dated at the City of Calgary, Province of Alberta, this 20th day of November 2020.

<Original signed by>

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Angela Porco, CSR(A)
Official Court Reporter

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