MANITOBA CLEAN ENVIRONMENT COMMISSION

MANITOBA-MINNESOTA TRANSMISSION PROJECT

VOLUME 16

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THURSDAY, JUNE 1, 2017

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THURSDAY, JUNE 1, 2017
UPON COMMENCING AT 9:30 A.M.
THE CHAIRMAN: Good morning, everyone. Welcome back to our hearings into the Manitoba-Minnesota Transmission Project. And we're going to begin this morning with Dakota Plains Wahpeton Oyate, and Mr. Warren Mills and Mr. John Stockwell.
Do we need to do some swearing in?
MS. JOHNSON: Yes.
(Warren Mills sworn)
(John Stockwell sworn)
THE CHAIRMAN: All right. Go ahead, Mr. Mills.
MR. MILLS: Good morning, Mr. Chairman, good morning Commissioners. Chief Smoke and our project manager Craig Blacksmith, regretfully, as a result of community matters are unavailable. We have spent a considerable amount of time with them and we trust that we can provide their perspective in this regard.
John and I have been working with Dakota Plains hands on in the community three days a week for the last 16 months in some efforts to deal with some community matters, particularly

housing. And it's given us an opportunity to meet consistently with hereditary Chief Orville Smoke, his project manager Craig Blacksmith.

The community of Dakota Plains is a hereditary community and Chief Smoke sits as a hereditary chief. He doesn't like to talk about it, but my understanding is he has been the hereditary chief probably into the third decade now.

The community is small. We count between 30 and 35 habitable homes in the community, and we believe that there are slightly less than 300 band members resident in the community. The community is located -- and if I can take you to the map, John, if you can take us out to Portage la Prairie. Portage la Prairie, we all know where that is, and the red dot is Dakota Plains. It's a community of approximately one square mile. And it sits on some marshy, very low value lands.

Dakota Plains' story, and we'd like to take a few minutes to try and connect some dots for you, starts with a leader of the Lakotas by the name of Old Chief Smoke. Old Chief Smoke lived from 1774 to 1864. He was a well-respected

leader, and he took the Dakota, Lakota, Wahpeton, Sisseton tribes and bands through to the tragic Sioux Wars of post American Civil War. Chief Smoke -- the old Chief Smoke was an interesting character. He was a great horse capturer. Some of us in the room may respect his life, he held five wives over the course of his very strong, dynamic life. He clearly had a sense of humour. He named one of his sons Big Mouth. He named one of his wives Slow to Deliver, and he enjoyed the Dakota Sioux Lakota Wahpeton life of the mid 1800s. He was a fearsome man. He was over 6-foot 5, and he was well-respected. He fought off at least two coups and he remained the leader of the Dakota Sioux until his passing.

Some of his children carried his Smoke name, and our Chief Orville Smoke continues that lineage.

Old Chief Smoke was well-known for many things. He was one of the original Dakota shirt wearers. And the pride with which he wore his colourful shirt to meetings of importance was so significant to him and to his people that when he passed away, his presentation shirt was passed to the Smithsonian Institute, and his shirt, his

ribbon shirt currently resides in the Natural Museum of National History. And we note that that tradition continues today.

The Dakota and Sioux moved throughout the country. They were a very hard working, aggressive folk, who pursued the bison. And the pursuit of the bison, the buffalo, took them from Lake Superior to the Rocky Mountains, took them from we believe Central Saskatchewan down to Southern United States.

In and around 1862, as a result of blight and drought and the difficulty of following the buffalo herd, the Sioux in the Northern States at the time underwent tremendous pressures. And as the story is told, tragically one of the white settlers indicated that if they were struggling, let them eat grass. What followed is what's known today as the Sioux Wars. And history tells many stories, and I've heard a few and I've read several, but tragically that all ended in Mankato on December 26th of 1862, when 39 warriors were sentenced to be hung to death by Abraham Lincoln; 38 were hung. One was discovered to have some white blood and he was pardoned. The 38 were hung on Boxing Day 1862. Their bodies were buried in

the adjacent river.

The next morning a local doctor hired some grave robbers and the bodies were stolen, as I am told, properly boiled down and the skeletons were used as cadavers for medical discussion. That doctor was Thomas Mayo. And his family went on to develop the very successful and considered to be very honourable Mayo Clinic. The Mayo Clinic, just a few years ago, returned to the Sioux of the Northern States those parts of the skeletons that they could still find in their possession.

Following the hanging of the 38 Sioux warriors, and again this is where history has several stories, but the Sioux had been using their travel route east of the Red River into Canada for many years. We heard testimony and we have the ATK study that was prepared by Golder & Associates, which Hydro's anthropologists confirmed indicates that the Sioux had been travelling in the region of this line that we're considering now possibly back to 1200 A.D. It's a cute anecdote, but when we started to discuss this route with the Council of Elders at Dakota Plains, one of the elders observed that it's not the

Manitoba-Minnesota Transmission Project route that we're discussing, it's the Manitoba Mankato tobacco path. And they enjoyed with some delight the same acronym.

Following the Mankato tragedy, families of Sioux arrived at Lower Fort Garry. And this is probably in and around 1865, 1870. They were a hard working group, history tells us, and they went looking for good lands on which to raise their families. They discovered the crook of the river at Portage la Prairie that we know today as Koko Platz, considered one of the finest pieces of land in Portage. In 1870 and on, the Sioux, now the Dakota, enjoyed that property. And the handout we have provided you with a history of their time on that land and it tells a fascinating story. I encourage you all to read it, but I believe you'll find what I find, a story of a very proud, hard working people, the tragedy of alcohol, and a small band that provided cleanly, healthy homes and life for their families.

The Dakotas, and with the Smoke family very much involved, did a great job of converting -- I will attempt to -- that portion of the Oxbow on the southwest corner of

Portage la Prairie was known then, and the Dakotas still refer to it as the Sioux Village. On March 20th of 1911, the Town of Portage la Prairie held a town council meeting, and if you turn to the very, very last page of the handout and flip it over, the minutes of that council meeting indicated that the secretary be instructed to write the Indian agent suggesting that in the opinion of this council, it is advisable to have the Indians removed from their present location in the city. Reasons were given. The Dakota today will vehemently debate those reasons. But suffice to say the Sioux Village was picked up and relocated to swampy land that was annexed to Long Plains. And they were, as the story goes, they were walked fairly but firmly to this land, were provided with minimal support from our government, and were told that this is your new home.

The land, as many of us know, on most reserve lands was not the best of lands. And in fact, 100 years later, the Federal Government spent over $8 million installing a drainage system in an attempt to dewater the community.

John, do you have a photo of the housing?

The Dakotas exist without a Treaty. There's many stories told, and you've heard some stories told earlier. I've had very aggressive explanations that, quite simply, the Dakotas didn't hang around the fort looking for leftovers and scraps. They were out across the country, across the land, primarily hunting. And when the opportunity to sign treaties came around, some Dakota elders like to tell me that they were at work and missed that meeting. That's certainly an oversimplification of the complexity of treaties in Canada, but suffice to say the Dakotas do not exist under a Treaty and they make it clear they have never ceded or surrendered any of their lands. They certainly never ceded or surrendered the Sioux Village in Portage which they were evicted from. And they hold firm that the traditional lands of the Manitoba Mankato tobacco path has never been ceded or surrendered to the Crown for its use.

The Dakota arrived in 1911 on this raw, rough land. Nothing good comes of it. They have been chased north with the American calvary right behind them. They have attempted and have successfully, as you will read if you do take the

time to go through the history of Dakota in Portage la Prairie, they established a very healthy, very respectable community that they have once again been chased from.

I'm neither a psychologist nor an anthropologist, but a lot of pressure on some good people, and they're left from little or nothing. It doesn't go well, and history tells us that in the '70s, a group of the Dakotas living at Dakota Plains literally picked up and attempted to return to Portage la Prairie. The Federal Government promptly found land south of the Portage bypass, and the community of Dakota Tipi was established. Dakotas from the original Sioux Village in Portage have been moved to Dakota Plains but chose to split or leave, and primarily the Pashe family exists at Dakota Tipi today. Those are deep waters that I have no clear understanding or knowledge of, and I observe but I draw and offer no conclusions.

We get to where we are today with a community that receives none of the benefits or opportunities that many of the Treaty opportunities provide. The Federal Government, up until 2013, refers to the Dakota as refugees in

this land. And finally, through a long simmering claim with the Crown over some Aboriginal rights, the Dakotas have recently received the acknowledgment that they are not refugees. It's a long story and if any of you are interested in reading it, there's some good fact to the Dakotas having been of great assistance to the then British Government in the War of 1812. But the Dakotas end up today in this godforsaken piece of swamp, and they are in need of housing.

In 1942, the Rivers air base, interesting bit of Manitoba history, was home to technicians who were range finding and direction finding German U-boat signals in the North Atlantic. And some temporary homes were built for those folks. This is an example of one. They're affectionately referred to as Rivers housing. Dakota Plains, in their need for housing for their people having lost everything in their Sioux Village in Portage la Prairie, took the Federal offer and moved several of these Rivers homes to the community.

This particular home was built in 1943 of 2 by 4 construction. John and I have attempted to do some remedial and renovation work on it as

part of another project we're assisting the community with.

The walls are insulated with sawdust. The sawdust has settled halfway up the walls. And as we live and wonder and fear of the anticipated Hydro rate increases, this home currently can spend seven or $800 a month on electric heat. There is no gas distribution in the community.

The community remains a proud group, but John and I, as outsiders assisting the community, can certainly feel the occasional anger and bitterness that comes up when issues of resource development are discussed. And it was those feelings that bring us here today to participate and contribute to the Clean Environment Commission.

That's a brief history in how we get to where we are today and a thumbnail perspective of ours. We certainly don't profess to be historians and there may be holes and flaws in our description, but that's a precis of what we have had described to us and what we have pulled together.

Dakota Plains, for approximately 10 years, ran a very successful seedling nursery.

And as a result of that nursery, there was a time, probably 20 years ago, when most, if not all of the band members were working, earning a good living, and there was a brief period of prosperity and hope. And more than that, they describe it as an attachment, a reattachment to Mother Earth. Having moved through most of Western Canada, those waters run very deep but it's clear that the time that Dakota Plains spent enjoying the prosperity of their seedling nursery reconnected them to a healthier time, and also reconnected them to a very clearly hands-on connection with Mother Earth.

And it's interesting, Hydro's weather information has described the possibility of wind storm and hurricane and the risk to high voltage transmission lines. Approximately 16 years ago, one of those wind storms flattened the Dakota Plains seedling nursery, and the industry, the engine, the motivator for the community was lost to a lack of insurance. And the remains of the Dakota seedling nursery sit today on the southeast corner of the community as a sad reminder of, once again, what the community clearly feels was a terrific opportunity lost to them for reasons

outside of their control. The connection that the Dakota Plains have as a result of that nursery come to us in descriptions of Mother Earth and the land.

John and I had the opportunity to work hands on on the Bipole right-of-way clearing for one season. And we came out of that with a full and complete understanding of the damage done, arguably necessarily done to create a right-of-way.

We have watched Manitoba Hydro's presentation through the construction panels as to how that work is done, and we had been -- with respect to what we will agree is a very strong presentation and EIS that Hydro has provided us with, but we do feel that the description of the right-of-way clearing hasn't been full and complete. And we'd like to share just a little bit of our concerns with you and the reasons why, for reasons of air quality, greenhouse gas and Mother Earth, we think that there are better routes for Hydro to follow.

For some reason, we have lost our slide connections but we will attempt to get back to those.

While John works on that, there is another issue that we have an obligation to touch on. We have attended the routing panels that Manitoba Hydro has provided, and John has travelled the preferred route, both with the Hydro team and on his own time. It's interesting, but John is in fact a taxpayer along the route. And in our discussions with Chief Smoke and his Council of Elders, we initially felt that the matters of routing were not of a concern to Dakota Plains. And you may have observed, we have had literally no comment. However, John and I took it upon ourselves to attend the La Broquerie hearings of the Clean Environment Commission. In hindsight, although it was optional, it had a deep effect on us listening to the voices of families anticipating how the routing will affect them. And we had originally anticipated staying out of that issue and those matters. However, I had the opportunity to speak with Chief Smoke and Craig Blacksmith at length and describe to them what we had heard, and listened to their thoughts. And Chief Smoke has asked me to share with the Commission his thoughts with regards to the routing.

Chief Smoke indicated to me that in the limited communication he has had with Hydro staff, and he acknowledges that he has met with Hydro on, he won't say several but he won't say few, occasions, and particularly through the ATK mapping opportunities that were provided, the concerns of those affected by the routing was not part of the discussion.

And I'm attempting to honourably paraphrase the Chief's words to me. He indicated to me that had he been aware that the thoughts and concerns of his community would have an adverse effect on others, he thinks he would look at the routing in a different light. The Chief went to length to remind me that in the true spirit of reconciliation, that reconciliation must flow in both directions. He was quick to acknowledge the damages done to his people by forces outside of their control. And he asked me to advise the Commission that although Dakota Plains does not have the perspective to specifically support the change of route to have a less effect on the residents of the La Broquerie area, he would certainly support any decisions of the Commission that would reduce or further mitigate potential

harm done to any people.

The Chief wanted to be clear that he is not stating that Dakota Plains wishes the line relocated, but he wants the Commission to understand that the Dakotas do not wish upon others that which they feel has been applied to them. And he thought that it was important that that message be shared.

We have had some success with our technology, and I'll bring you back to the point at hand and what we're talking about with regards to the right-of-way.

We have heard many panels. And although John and I personally have many thoughts, we have listened clearly to our friends, we don't call them clients, to our friends at Dakota Plains, the Council of Elders. And they have encouraged us that Mother Earth is their strongest thoughts.

We like to look back to, I guess we call it lessons learned and the language that was embedded within the Bipole III transmission license number 3055 clearly flowed from the recommendations of that Clean Environment Commission. And we would anticipate that your

work will certainly consider that hard work and where it took us. The Bipole permit had language which described concerns about burning of slash and waste, and it encouraged it not to take place where it might have an adverse effect on others.

Our sense is that Manitoba Hydro has taken, or would like to take what has worked for them in northern more remote situations and bring it into southern populated situations. And we anticipate not much good coming of them being allowed to do that.

John is going to walk you through some slides. And you were shown, I believe, three photos of some beautiful mulching equipment, but you weren't shown any photos of what slash burning actually is. This is a slash pile getting started. Can we go to another one, John? This is another example of a slash pile getting started. You already have this photograph, but this is a photograph taken down a 66 metre right-of-way. This is a photo of approximately four hectares of a 66 metre right-of-way with the slash being disposed of. This is biomass. This is a pile of approximately one half hectare of right-of-way salvaged material.

Manitoba Hydro has indicated in their EIS that they will, as long as it's economically viable, that they will attempt to market this material. On the C1 section of Bipole, it was a struggle to market the material to Louisiana Pacific, a routing distance of 90 kilometres. Our research tells us that the nearest mill to the Manitoba-Minnesota Transmission Project is in Barwick, Ontario, and our Google mapping indicates that it may well be 250 kilometres.

This is a fascinating photo, and we were attempting to understand what one hectare of salvage of biomass and slash meant. So through a combination hardwood/softwood forest in Central Manitoba, we believe similar to the breakdown of the forest that Manitoba-Minnesota may well pass through, this photo represents one hectare of timber salvage and one hectare of slash. And as much as we respect Hydro's language that they will make every effort, provided it be economically viable, to harvest and use that biomass, we have fears that with the distance involved to mills that will accept that, and with the pressure on the schedule that we suspect we are placing Hydro under, that the decisions to how that harvest is

to be consumed may well fall to burning.

And in our closing, Mr. Chairman, we will attempt to describe some permit conditions that we think the Clean Environment Commission could apply to the healthy use of those types of harvests.

We observed that the Pinelands Nursery and the Providence College, both within the, almost within the footprint of Manitoba-Minnesota, both rely on biomass for heating sources. And we think that with some continued contribution of Hydro, that the biomass can be, that a healthy use of it can be arrived at.

Mr. Chairman, this is a photograph that we obtained and we're still not sure where or how it came to us at some point. But this is, I know, the Bipole III right-of-way clearing in Northern Manitoba. I believe this is on what Hydro refers to as N3. And to the right of this photo, you will see guyed transmission towers, arguably very similar to those towers which Manitoba Hydro is describing they wish to use on the route that we have under consideration.

Mr. Chairman, this is the Bipole III right-of-way and that is, I am confident, 66

metres. I am confident that the right-of-way, the existing right-of-way to the guyed towers to the right of that is less than 66 metres. I think this is a very telling photograph. We believe that the 100 metre right-of-way that Manitoba Hydro has described as being necessary for safety reasons is a red herring. And we don't understand perhaps why. We wonder if it's for concerns of EMF and perhaps other reasons, but this 66 metre wide right-of-way has been carved to accommodate a very similar tower structure to that 50 metre right-of-way. Hydro has described to us the need for the width of the right-of-way as what I believe they refer to as blow out, others have referred to conductor swing.

I am not an engineer, nor am I a mathematician, but I understand what I am looking at. And, Mr. Chairman, I'm confident that any swing in the conductors on that arguably 50 metre right-of-way would be more than accommodated on a 66 metre right-of-way. And certainly I can't understand why a right-of-way as much as 50 per cent wider, so that would take this right-of-way out to there, would be necessary for the Manitoba-Minnesota transmission project.

And, Mr. Chairman, we have scratched our heads at this. Whenever any issue is placed behind or under the concern of safety, safety in the 21st century, and certainly in Manitoba Hydro's environment, is the trump card. But then we examine that statement logically and we understand that there's a 500 kVa line that exists in Manitoba with what Manitoba Hydro, I believe, described to us as a 56 metre right-of-way. And Manitoba Hydro -- John and I went down and took a look at it -- have made no effort whatsoever to widen the apparently unsafe 56 metre right-of-way which is successfully serving an analogous 500 kVa line. But they tell us today that 100 metres is required.

We'll have more on this in our closing, Mr. Chairman, but we wanted you to clearly understand the widths of right-of-way that we're talking about, and we think this is a powerful photograph.

We also observe that there has been discussions, and I believe it was Mr. Matthewson on his closing provided us with some further assurances as to Manitoba Hydro's intent with the right-of-way. We think there are many factors

come into that discussion that you haven't heard. This is Northern Manitoba. There probably isn't anyone within 50 kilometres of this line.

But I don't think anyone would disagree with the statement that this is -- I can't imagine any more brutal approach to cutting a right-of-way through a Manitoba forest than what our Bipole licence appears to have allowed. And I heard Mr. Matthewson's assurances at the end of Hydro's presentations, but Mr. Chairman and Commissioners, I think that there are two very significant matters that this Commission can address with regards to Mother Earth in this matter.

The hard sharp edge of that right-of-way is arguably unnecessary. The clear sculpted, clearly herbicide ongoing maintenance of that right-of-way is arguably unnecessary. The even further width of that right-of-way, Mr. Chairman, and I respect that the word safety usually trumps all, but I encourage the Commission to ask themselves, if 80 and 100 metres is required for safety, where are existing right-of-ways in Manitoba not being aggressively widened by Manitoba Hydro for that very same

concern? And the description of blow out, which is conductor swing, I think most of us can imagine the conductor swing on that lesser right-of-way, apply it to this greater right-of-way, and then ask yourself why 50 per cent more is required?

We also think, Mr. Chairman, that as Manitoba Hydro has comfortably worked for most of their life on large transmission projects in Northern Manitoba, where there are fewer of us and fewer affected, the rules or the guidelines may well be different. But we believe, Commission, that you have the ability to not accept perhaps vague generalizations as to how that right-of-way will be softened, and acknowledged, and will incorporate concerns for Mother Earth, concerns for those who will use these lands, concerns for the visual matters, the aesthetics of the line.

But this result is not necessary. This result is a course engineering solution to what serves Manitoba Hydro's access and ability to construct that line. And I respect that. After all, 40 per cent of their decisions are based on cost. We have seen that value many times. But Commissioners, you have the ability to describe in very clear language that this does not occur, at

least in Southern Manitoba. And our friends at Dakota Plains, when we share this photo of them, took exception to it.

As well, Mr. Chairman, this photo -- and we're close to wrapping up -- but this photo also introduces some other matters that I think need to come to your attention. And we'd like to discuss them now.

If you go to the Conservation, now Sustainable website, and you review the post permit correspondence between Manitoba Hydro and the director, you will find a discussion that this product in one case got 7.7 kilometres off route. And in the space of I believe six days and two letters, that route revision was discussed, reviewed and approved.

We'll come back to it in closing, Mr. Chairman. But we observe in the permit a language that describes attempts to soften the right-of-way with landscape features being allowed to remain, exist within the Bipole permit. And we may be misinterpreting this particular condition, Mr. Chairman, but I'd encourage you to go to Article 50 of licence number 3055, it's page 9 of that licence. But the language is:

"The licensee shall leave wildlife trees where possible throughout the development right-of-way where they do not pose a hazard."

Now, Mr. Chairman, this right-of-way is kilometres from anyone. And we will leave you with this photo, and its very high resolution, you can zoom in on it. And if you can find the wildlife trees that the proponent has left where possible, I'd ask you to tell me where they are.

We have some concern that, as this work moves into Southern Manitoba, the level of permit oversight and the firmness of the permit language needs to be clearer and more fulsome. We look at this product, and we remember what we were assured through the Bipole Clean Environment Commission process, and we feel a very strong disconnect.

So, Mr. Chairman, we will return to these matters in closing with some recommendations as to licensing conditions that we believe you could encourage the Minister to embed into Hydro's work plan. But our client's greatest concern is to Mother Earth. Our client's concerns are to the forest. Our client's concerns are to the

right-of-way use afterwards, and we were disappointed. And if I have a harsh word to Hydro, we found it arguably disingenuous that the flyovers and photos that they provide you with don't really show you what the process may well be.

But, Mr. Chairman, we think that in 2017, you should not be one of the last constituencies that requires, or that restricts or eliminates the burning of slash on transmission right-of-ways. Newfoundland Power eliminated the burning of slash on right-of-ways in 2014. And some would say that the Newfies, you know, we laugh about them perhaps not being up to where we are. I'd suggest that they have anticipated issues that we haven't.

So, Mr. Chairman, in closing, thank you for listening to the story of the Dakotas. We will try and focus on the concerns we have discovered in our closing with some strong recommendations. But we think it's important that the Clean Environment Commission provide the licence and the permit and the process with some very firm language to respect the environment. And we think that, graphically, the status quo of

a very recent permit CEC licensing process isn't sufficient. And we're hoping that this Commission will significantly raise the bar.

In closing, we're asked what does Dakota Plains want? And we'd like to spend just a few minutes to talk about that.

The proud Dakotas of Dakota Plains describe to us that they want to be normal people. They want jobs. They want opportunity. They want housing that they can live in.

I am perhaps stepping out of my mandate, but today, Mr. Chairman, we're working on another project which is referred to within the community as Bringing the Children Home. In a community of 288 people, 10 per cent of that population has been taken from the community by Child & Family Services. And I sadly tell you that the quality of, or the lack of quality of housing is a significant issue in Chief Smoke and his elders being able to bring their children back to their community.

The opportunity that Dakota Plains had in their seedling nursery that was tragically lost to the high winds that Manitoba Hydro anticipates, kicked the crap out of the community. And we

hope, and John and I are working with the community, we hope that in anticipation of new carbon taxes and new emphasis on greenhouse gas and offsets, that a resource developer, a wise anticipatory resource developer will step forward and recognize that in the Dakota Plains tree nursery, and the knowledge that they still hold, that there's an opportunity for that community to contribute positively.

I'm sure Hydro is well aware of it, but we found it analogous and fascinating that SaskPower, at their Shand thermal station, took it upon themselves to establish a fully functioning tree nursery as part of their offset of their carbon contribution.

We do not deny, and I anticipate that Manitoba Hydro in examination will want to remind us of the healthy world that hydroelectricity leaves us in. And we accept that and we enjoy it. In fact, as a Manitoban we're proud of it. But that isn't to say that on the matter of the transmission line that connects that utility to its end user, that we can't do a better job in matters of right-of-way, greenhouse gas, air quality, and how we best work with our neighbours

and friends.

We're happy to answer any questions, Mr. Chairman. We have some latitude from our client, but there may be issues that we would have to take under advisement and get back to you with. Thank you very much.

THE CHAIRMAN: Thank you, Mr. Mills, Mr. Stockwell, and pass our thanks to the community as well for the messages they passed on through you.

Manitoba Hydro, any questions? No questions. Questions from the panel?

All right. Thanks again, Mr. Mills and Mr. Stockwell, for that presentation. We have no further questions. Thank you.

We are a little ahead of schedule. Is Manitoba Wildlands ready to go ahead with their presentation?

MR. WHELAN: We need to contact Mr. Beckwith.

THE CHAIRMAN: We'll take a break now and resume. We'll take a 15 minute break and then we'll be back here, that means we'll be back here at 20 to 11:00. Thanks.

(Recessed at 10:25 a.m. to 10:41 a.m.)

THE CHAIRMAN: Okay, we'll move now to a presentation from Manitoba Wildlands. And I'll just turn it over to you, Mr. Whelan.

MS. JOHNSON: Mr. Beckwith, can you hear us?

MR. BECKWITH: Yes, I can.

(Paul Beckwith sworn)

MR. BECKWITH: Hello everybody. So I'm Paul Beckwith, I'm with the Laboratory for paleoclimatology in the Department of Geography at the University of Ottawa. I'm also with Department of Geography and Environmental Studies at Carlton University. I teach climatology, meteorology, oceanography, and a lot of other geography courses of environmental impacts and environmental studies.

So today I'm talking about rapid climate change and the impacts from the global level to the local level, the local level being Manitoba, and even more local than that, Southern Manitoba where the Manitoba-Minnesota Transmission Project is going to be built and deployed.

So next slide, please, slide 2.

So this presentation is basically going to be an update on climate change, so

globally, and then continentally, down to the regional level in Manitoba. So what I'm basically going to show is the climate change is here now and it's affecting things on all different levels of spatial scale, and it's also happening much more rapidly than people expect.

If you want evidence of that, just Google "climate change faster than expected," and you'll find numerous things. If you Google "climate change slower than expected" or "as expected," you find almost nothing. So it's accelerating rapidly in terms of greenhouse gas levels in the atmosphere, in terms of global temperatures, in terms of the effects on extreme weather event happening more frequently, more intense and for longer duration.

So I'm going to look at abrupt climate change, abrupt or very rapid climate change or non-linear climate change. And it all comes down to the massive changes that are happening in the Arctic. So I'll look at the latest science on these greenhouse gas concentrations, temperatures, Arctic climate, the effect of the Artic climate and the redistribution of heat on the planet, on jet stream behaviour, how that relates to extreme

weather events. I'll talk about methane emissions and some of these other powerful feedbacks where we get thaw and permafrost, and we get methane going up into the atmosphere acting as a very powerful greenhouse gas. I'll talk about why the southern hemisphere is changing, experiencing extreme weather event, just as much as the northern hemisphere, even though the root cause is changes in the Arctic. I'll talk about the implications for Manitoba and the implications for any infrastructure that is being built.

We have to really think about resilience, making things much more durable than we did in the past. So in terms of the transmission systems, they have converter stations, there's substations, they are spread over a large region, they can be affected by climate change, mostly extreme weather events in many different ways. So I'll talk about how this relates to the MMTP, the environmental impact study, and what we need to do for -- how we can build a resilient system if we're going to build one.

So next slide, please.

This is just a map showing what I

think we're all familiar with here, in this room anyway, in the City of Winnipeg, the proposed route of the Manitoba-Minnesota Transmission Project.

So next slide, please.

Okay. So how climate change is really affecting weather events is via the statistics of the weather events. So this is just a bell curve. Most people are familiar with the basic bell curve or normal distribution curve. You know, when you get a grade in any class that you take in grade school or university, there's an average value, which is given by blue here in the centre of the graph, the average. And then there's people that do really well on the far right on the curve and there's people that do really poorly on the far left of the curve. If you have a large number of people, then you'll always get this type of distribution. And the idea of bell curving or mark up would be shifting this whole curve to the right to make the average of the class higher, for example.

We can have this type of graph showing counts on the vertical axis and marks on the horizontal axis, and we can talk about it for any

parameter, whether it be grades in school, temperatures, wind speeds, rainfall, humidity, any climate parameter, any weather parameter.

So the argument is that our human emissions, we change the chemistry of the atmosphere and oceans, this is leading to rapid changes in climate. And the higher you go in latitude, the faster the warming. So Canada is warming at a much faster rate than places that are closer to the equator.

Manitoba, for example, since 1950, in that 65 years since then, has warmed about 2.2 degrees Celsius on average.

Of course, there's fluctuation year to year but the trend is for warming. So the weather statistics has changed. So extreme weather events like torrential rains, wind storms, drought, et cetera, are happening more often. They are more severe, there is more energy in the atmosphere. They are also lasting longer and they are occurring in new places.

So next slide, please.

So this is showing the bell curve with our current climate being the grey curve. So you have a mean temperature in the middle. In the

left part of the curve, you have colder weather events, and in the right part of the curve you have warm weather events. And with the future climate, actually I'm arguing with the present climate, the curve, the whole curve has shifted, so the average temperatures are higher as indicated at the peak of the bell curve. And the extreme weather events, if you take the original curve and you take basically the number of events occurring all together will be the area under the curve.

So if you want to know the number of events occurring above a given temperature, you get the area of the curve above a temperature. So that's indicated by a vertical line. And what we're seeing is, because the whole curve is shifted over, the area under the curve is much larger for hot weather events and for extremely hot weather events. It's not a linear relationship. As we gain average -- as average temperature increases slightly, we get a lot more hot weather events and extremely hot weather events as indicated by this curve.

Next slide, please.

So this is some data, this is from

some work that James Hanson has done and published within the last few years.

So what we're showing is an average of the temperatures from 1951 to 1980 in the top left. And what we're looking at is, we're looking at the different decades. So 1981 to 1991, the curve has shifted to the right. 1991 to 2001, the curve shifted even more to the right. And 2001 to 2011, it's shifted even more. Remember, it's the area under the curve that is showing -- the hot events is the red and the dark red is the very, very hot events.

Now, the units on the bottom are in standard deviations. So if you go back to slide 4, what you can see is -- so we've got blue as the mean. The number of events under the curve.

So the area under the curve from up to 2 sigma on either side is 95.45 per cent of events fall in that region, according to the statistic. If you go up 3 sigma on the other side, it's 99.74 per cent. So the higher the sigma, the more unusual or infrequent the event should be.

So if you go back to slide 6, the area under the curve is showing that as we go through from decade to decade, we get a lot more extreme

hot events in the summer.

So next slide is slide 7.

Okay. So this looks complicated, but just look on the horizontal axis under each subplot is standard deviation. Okay, 1 sigma, 2 sigma, 3 sigma. So as you go to the colours on the farther right, you get more and more events that should be infrequent according to the statistics of the climate system. But what we're seeing is, if we look at the top three panels for 1955, '65 and '75, we don't see much red. Okay. And if you look at the number at the top right on a given plot, it's 0 per cent, 0 per cent, 0 per cent across the top, and that's 3 sigma event. So that's statistically, 3 sigma event, it's not happening very often. But this decade, all the plots below showing this decade, for example, in 2011, the bottom right curve, we have 8 per cent of the spatial area of the globe is seeing these 3 sigma events. And these are June, July, August, so it's 3 sigma on the hot side, 8 per cent on the cold area, 14 per cent for 2 sigma. Okay. So that's how you interpret this.

So just looking at it visually, we're getting a lot more red, we're getting a lot more

browns and dark, so we're getting a lot more extreme, late June, July, August, we're getting a lot more hot weather events as we go through the decades, which is a result of climate change.

So next slide, please.

So the statistics of weather is changing. This is very important, because when we build something we look at the frequency of extreme weather events. In the past, we could say the flood is a 1 in 100 year event, you know, wind storm above a certain level that will topple transmission towers is a 1 in 500 year event. Okay. Those numbers assume a stable climate, which we don't have. So a 1 in 500 event may now be a 1 in 50 year event, for example.

Even Justin Trudeau, when he was referring to the flooding in Ontario and Quebec recently, specifically in Ottawa, he said that what used to be a 1 in a 100 year event is now a 1 in 10 year event, or even 1 in a few years event. Now, I think he misquoted in saying 1 in a few years event, but 1 in a 10 year event is certainly there.

So, you have to remember when I talk about the climate system, you know, on human time

scales, you can see this plot I show here. So we have the atmosphere is a big component of it, right, our weather is happening in the atmosphere. We have human influences in the centre. For example, you know, we cut down a forest and we plant canola or a crop, we have changed the reflectivity of the surface, we have changed the albedo of the surface, we therefore have changed the local climate in that region.

There's other events that are happening in the lithosphere on the surface, like volcanic activity and so on. There's the biosphere is a big component. We can talk about hydrosphere, which is the lakes and oceans, and we can talk about the ice at the poles, whether ice be glacial ice or sea ice, or whether it be the ice on Greenland and Antarctica, or ice at high elevation, on the top of mountains. And of course, the sun is the input of energy into this whole system. And you change one component and you change the other component. Everything is related as a system.

So the next slide, slide 9.

Again, of the global climate system, joining the dots, are increased human fossil fuel

combustion and land use has changed the chemistry of the atmosphere. We have increased the greenhouse gas concentrations, mostly, you know, namely the important ones, CO2, methane and Nitrogen, those are the emissions. When it gets warmer, you get more evaporation, you get water vapour up, which is a very strong feedback, internal feedback.

So these parameters are increasing at basically exponential rates, very, very fast. The earth is warming, not uniformly throughout, different areas warm faster than other areas, like the far north is warming extremely rapidly. We're getting rapid decline in the Arctic sea ice and snow cover. Those are white surfaces that reflect solar radiation. As we lose Artic sea ice, there's dark ocean underneath which absorbs solar energy. As we lose the snow cover on the land, the dark permafrost is underneath and that absorbs solar energy. So we're getting a rapid Arctic temperature amplification. The warming in the Arctic is much, much faster. In fact, the number that's always quoted is 2 times or 3 times, but if you go to the high Arctic, it's more like 6 to 8 times faster.

There's periods of time when there's temperature anomalies, temperatures above normal in vast regions of the Arctic for months at a time that approach 20 degrees Celsius and more warmer than normal. So more sunlight is absorbed in the north, the Arctic is darkening, so the north is warming much faster than the global average.

So what this does, this is crucial, what happens in the Arctic doesn't stay in the Arctic, it affects the rest of the planet. Because what happens is the jet streams, which circle the globe and are very important for determining our weather patterns, are changing physical -- their physical nature is changing, their form, because of the temperature difference between the equator and the arctic. The equator is hot, the Arctic is cold. Air wants to move from hot areas to cold areas, or energy wants to move, rather, from hot areas to cold areas, but does that via the atmosphere, it does that via the ocean current. So about two-thirds of the heat is transferred in the atmosphere because the air is moving much faster. About one-third is transferred from the equator to the Arctic in the ocean current, which moves slower, but the density

of water is a thousand times that of air. They carry vast amounts of heat.

So the equator/Arctic temperature difference reduces, so there's less heat moving to the pole. So the atmosphere, the jet streams slow down and they become wavier. They often get stuck into position.

For example, over North America, we have had an omega block, if you like, the jet streams follow the letter omega, the Greek letter omega. And on the coast, we have low pressure area. We're in a jet stream trough. We've had tremendous amounts of rain in B.C., and also in Quebec and Ontario. Whereas in the middle section, which is the peak of the, or the crest of the jet stream, where the air is very hot and dry -- so look at Fort McMurray, for example, they are very worried there. You know what happened there about a year ago. Well, the forests are extremely stressed, we've got extremely warm and dry weather there, and there's a huge fire risk again this year.

So these extreme weather events are becoming more frequent. They're stronger and they last longer and they are occurring in new

locations because the jet stream behaviour is completely changing because of the temperature, because of the greatly warming Arctic.

The ocean currents, as I said, they are slowing down, they're contributing to a large sea level rise, for example, on the east coast of North America. And I'll explain a bit more of that as we get further on.

So next slide please, slide 10.

There's lots of good tools that anybody with a web connection and a laptop or a smart phone can just go and have a look. You don't have to -- everything I say, you don't have to take it at face value, you can investigate it yourself by just going to some of these sites that I'm showing you. So just Google "climate reanalyze," it's the University of Maine site. This is a screen shot I took from the site on Friday, May 19th, 2017, as indicated on the top right. So what it's showing is temperature anomaly.

So what an anomaly is -- the baseline is 1979 to 2000. So it would take the average temperature in the database at all locations on the earth, that would be the baseline, and what

it's taking is the data from May 19th, and it's subtracting the baseline. So this is the anomaly, this is the temperature difference from the normal or the long-term climate average. And what you can see is, you can see, for example, Greenland has got quite a bit of red on it, it's much warmer than normal. You can go to the scale and see that it's 10 to 20-degrees Celsius warmer than normal on that particular day. Parts of Antarctica are also very, very warm. You can see that, you know, in North America, sort of central U.S. is colder than normal, whereas the eastern part is a bit warmer than normal.

You can see how much -- and you can see this on, you can get data that is updated on certain -- this is daily data, so this is daily average anomaly, but you can get finer information every few hours sort of thing.

If you look at the numbers on the bottom, the Arctic is 1.17 degrees Celsius warmer than normal on this particular day, Antarctic is 3.22. So you can zero in on different parts of the earth, you can zoom in and get different views, different maps. But the information, this near realtime data is all there.

Next slide, please.

So from the same software, I'm just selecting in this case sea surface temperature, SST, departure from average. And you can see that there's hot areas and cold areas in the ocean water. You can look off the coast, the east coast of the U.S. and see that the water is very, very warm. You know, you can see the Gulf stream coming up and so on. We have had some really major snowfall events on the east coast of the U.S. and Canada in the last few years. And often it is early winter, and the ocean water is super warm, and the winds are blowing from the ocean onto the land. The land cools down a lot quicker than the ocean, so the water vapour is condensing giving us some of these massive snow storms. So what's happening in the ocean, of course, is very important to the climate, to what we see on land, and the ocean is the enormous storer of heat.

Okay. So next slide, please, slide 12.

So this is another software or website that is vital if you want to see what's happening in real time. It's very easy to use, it's called Earth nullschool. If you just Google it, you get

this image and there's a little icon, a little text saying earth on the bottom left. And you just click on that, it brings up all the menus.

What you can do is you can look at -- here I'm looking at the jet streams, I'm looking at the wind pattern up in the atmosphere, 250 millibar pressure, which is about the level that aircraft fly, commercial aircraft fly. We call them jets because they fly up at that level near the jet stream. So what you can see is the pink areas are very high winds. As you move away to lower winds, you get the green areas. But you can see the general pattern of these waves that are moving from west to east around the planet. And you can see in this case the jet stream wave is very loopy, it cuts back down and comes across, very, very loopy.

So what is happening is, as the Arctic is warming much faster than the equator, these jet streams which mostly ran from west to east, but some waves to the north and south are now becoming much wavier in the north and south direction. They are slowing down, and they guide storms, and in a way they separate the cold dry air in the Arctic from the warm humid air near the equator.

So if the jet stream is a trough, there's a trough in the wave, cold air can go right down as far as that trough is. And if there's a ridge, it can go right up to that area.

So we have seen the waviness go such that the crests of the waves go right up into the north pole. This is happening in the middle of winter. It's brought warm humid air from the south right up into the north pole in the middle of winter, cause some melt there. You have also seen the trough of the jet stream go as far south as the equator, actually, cross the equator and join the jet streams in the southern hemisphere. This is all new behaviour. We haven't seen this before.

Okay, the next slide 13.

This is another great site. If you just Google "Arctic Sea Ice Graphs," you can get all kinds of images and graphs of what, of the state of the Arctic sea ice.

And so the maps on the top show the sea ice concentration, this is on one given day, page 1727, seen in this case. So it's showing how much ice there is on this particular day. And if you look at the plot on the bottom left, with

Arctic sea ice extent, you can see the blue line which is 2017, how low it's tracking. So the grey line is the mean or average from 1981 to 2010. The grey area around the grey line is 2 standard deviations, 2 sigma line. So the vast majority of events, when it was 95 per cent of events is falling within that line, what we're seeing this year is we're tracking well below. We're at record low levels of ice for this time of year.

Okay. So next slide.

So a little bit about how we know -- you know, in order to find out what's happening now and what's happening in the past, we can look at the records in the ice cores.

So the record Antarctic ice core goes back about 800,000 years. And what we can see is we can see -- so this is showing, the top curve is showing methane gas, CH4 from the ice cores, and the bottom line is showing CO2. We can also plot temperature and it matches these fluctuations, so we see warm periods which are interglacials, we see cold periods which are ice ages, we see cycles of about 100,000 years are based on the orbital changes of the earth around the sun. So the amount of light hitting the earth very slightly

and there's enough feedback in the system to cause it to go, you know, change in temperature of about plus or minus 5 degrees through these cycles.

So what we have seen, we can measure the gas concentrations in the ice cores by analysing the bubbles that are frozen in the ice. We can look at oxygen ice tilts in the water, frozen water. We melt some of the water, we put it in a hydrograph, or measure the isotope information, and that allows us to determine the temperature. And if we count back, the farther down we go, the further back you go, you can get the layer data to date. So we can get these records, these proxy records.

So next slide, please.

Okay. So on more recent scale, this is the level of CO2, the top graph is a level, actual level of CO2, methane and nitrous oxide in the atmosphere, these greenhouse gases. The bottom curves show the rate of change. So it's a change in each given year. And looking at CO2, for example, you could draw a trend line going up. So we're putting more -- the CO2 growth in the atmosphere in parts per million is increasing, in general, in a trend line. Now, this goes to 2014,

2015.

What if we go to the next slide, let's look at what's happening more recently. Methane is interesting on this slide because it was actually dropping. You know, it's pretty stable and then it started increasing rapidly in 2007. And fracking is one of the big reasons for that, also there's a lot of methane coming out of wetland.

Let's go to slide 16, the next slide.

So this is showing the growth of CO2 since 2000 to present, and what really stands out, in 2016, we were 3.00 parts per million rise, and in 2015 we were 3.03. So these numbers -- so the International Energy Agency has been saying that CO2 and global emission, emissions of CO2 are stabilizing. But what's important for the climate and for changes in extreme weather are what's happening in the atmosphere, as indicated from these numbers.

Okay. So if you go to the next slide.

This is a curve showing CO2 emissions, so human emission from 1990 to almost present. And what you can see is a curve on the far right it's kind of flattening out, it's kind of

stabilizing. So I think the number in 2016 was about what the projection was, it didn't grow much from 2015, didn't grow much from 2014. So what we saw in the atmosphere was 3 PPM. We're seeing record rise in CO2 levels in the atmosphere, and yet it's plain that the CO2 emissions from humans is levelling out. So this could be very bad news if the numbers are accurate for human emission. Because it would seem to indicate that the global carbon sinks are quickly failing. So what that means is where does most of the CO2 go that is in the atmosphere? What are the dynamics in the atmosphere and oceans?

We know that forests absorb, vegetation absorbs a lot of CO2. So if we cut down forests and reduce vegetation on the planet, if we lose a lot more from forest fires, et cetera, then there's less carbon that can be absorbed from the atmosphere so the atmospheric levels go much higher.

Also the ocean is a huge part of the sink. Any phytoplankton that grow, plants on the ocean surface growing absorb huge amounts of CO2. Also water dissolves CO2. And the hotter the water, the less they dissolve. So as the oceans

are warming up, warm water floats on top of cold water, it will absorb less CO2 because it's warmer, so there's more CO2 in the atmosphere.

So these are major sinks, if you like, of carbon. And if the sinks are actually failing, then this can get out of control for humanity very, very quickly. You know, we can do all we want at Paris, and slash emission, but we'll have too much. If we start getting huge amounts coming up from sinks, then we have to take much more drastic action, which I argue that we do have to take.

Okay. So next slide, please. So what's happening in terms of temperature? So this is global mean surface temperature, just for the first half of 2016, and you can see how it spikes upward at the end.

Now the very important point is that the Paris Climate Conference, the temperature targets are 2 degrees Celsius, right. And this is about pre-industrial. Pre-industrial is 1750. Now, the baseline in this case is 1880 to 1899, so you have to add at least 0.15 degrees Celsius to this particular number in 2016 in order to get the number relative to the Paris agreement, relative

to pre-industrial. Some people say you need to add 0.3 degrees Celsius. I'm being a bit more conservative saying 0.15 here.

The next slide, please.

Okay. Let's have a look at some of the annual mean surface temperatures relative to this baseline.

So the data is always, you have to be very clear as to what the baseline is. In this case the baseline 1951 to 1980. So if you look in 2016, you see a lot of red in the Arctic, the Arctic is warming extremely fast. The global average temperature in 2016 was 0.99, as indicated in the top right just above that 2016 plot. So in order to -- so that 0.99 degrees Celsius rise relative to the average in 1951 to 1980. So let's compare it to Paris. So we need to add -- the average temperature for the range 1951 to 1980, compared to 1880 to 1910 is about 0.3 degrees. Now, the 1880 to 1910 average relative to 1750 is at 0.15. And a lot of people are saying that's more like 0.3.

So the conclusion is that 2016 is higher than the pre-industrial by 0.99, plus 0.3, plus 0.15, which is 1.44-degrees Celsius, which is

very rapidly approaching the Paris number aspiration of 1.5., right. And rapidly, you know, getting up to that, closer to that 2-degree level. So this is very, it's very important to compare to the proper baseline.

So next slide, please.

So slide 20 is February, this is the average temperature over February of 2016. This is the anomaly relative to 1951 to 1980, and it's 1.35 degrees Celsius above the long-term average in 1951 to 1980. You can see how much warming there has been in the Arctic. No wonder the jet streams are not functioning as they did before this warming has occurred. So if you add those corrections, you compare it, February 2016 was higher than pre-industrial, the year 1750, by 1.8 degrees Celsius for the entire month of February. So we're rapidly get there.

So the Paris agreement, we know what's going on in the U.S. and so on, we're heading in the completely wrong direction. And the Paris agreement is -- it's way too conservative. We have to, I really argue, I've been arguing for a long time, we're in a global climate change emergency. I'm showing evidence here as to why.

And the world really needs to wake up and get moving on various things which I'll talk about later.

So slide 21, the next slide, getting back to the Arctic, what's really important for sea ice is volume. We can easily measure area of sea ice from satellites, looking down, or we can measure something called extend, and that's defined as any area with 15 per cent or more sea ice in a particular area.

In order to get the volume, we need to multiply the area by the thickness of the ice. It's more difficult to get the thickness, but we have some good satellites, so we have some very recent thickness data. But going back even further, we need to get thickness data from other sources.

So Peter Wadhams, who wrote a book Farewell to Ice, who spent his life studying the Artic, on the ground, in submarines under the ice using sonar pointing upward to measure ice thicknesses, et cetera, he's been doing this for 40 odd years. He's published over 300 papers and multiple books on this. He thinks, looking at the volume of ice, he thinks the ice is going to be

gone certainly before 2020. Maybe there's a chance it could be gone this year in 2017, in September. Totally blue ocean, no Artic sea ice certainly before 2020.

This is much faster than any computer model will show. And I'll talk about the difference between computer models and actual on the ground observations. You know, I don't know about you, but I would look, I would believe what I see with my eyes and what is happening on the ground rather than what is on my computer screen in a model.

So this is Arctic ice volume, and 2017 is the red line, and it's much, much below long-term averages than any other year. So the ice is, the ice volume is decreasing at an extremely rapid rate.

Next slide, please.

So if you plot the ice volume in September, which is the minimum Arctic ice volume, from the beginning of the satellite era, you know, sort of which was late '70s, or this is sort of early, you know, the data starts in '79, I believe, first year we're getting satellite data, the data is the black line. You can do various

fits to try to project where it's going.

So these are different. The red line is an exponential fit through the entire curve reaching zero in the summer of 2021. That would be the red line. If you shorten your exponential projection and say that the rate of change is increasing of the ice, and starting say 2005, you can do an exponential fit down. You can do that each different year and get these different curves. So you get a whole bunch of different curves.

So the question is, you know, when will the ice vanish, go to zero, based on the Arctic ice volume? And it's very, very soon. It's a lot sooner, the data is showing it's a lot sooner than any of the computer models show. You know, the computer -- okay, so the next curve -- you know, the computer models, if you look at the IPCC report published in 2013, okay, the problem is it's old data, okay. It takes about a year to do the paper maybe, you know, a year to go through peer review. The paper has to be in the scientific literature for two years before the IPCC will consider it. So that's a four year lag.

So the 2013 IPCC report, the latest

data in that was 2009, okay. Climate change is happening much faster than our peer-review process, than what we can do.

So what do we have? We have observation. Well, you know, the observations are not what policy makers are basing policy on, they are basing it on so-called solid data, which is peer-reviewed data, but it's old data. That's the problem.

So this graph in slide 23 shows the decline of sea ice, Arctic ice volume for all of the different months of the year. So the bottom green curve is for September. And that bottom green curve matches the black curve on the previous slide.

So what we're seeing is, if we look at the months bracketing September, so August is the red-ish curve, red-pink, and the purple curve is October, those two months are bracketing September. They're also declining rapidly, as is every other month.

So when the green curve hits zero, no sea ice in September, then the other months follow quickly within several years. How quickly? Okay. Well, the next curve is slide 24, it just shows

2016 numbers, compared to the long-term average. 2012 has the lowest minimum ever in September, that's the dashed green line. 2016 was fairly close, but 2016 is now tracking much below the 2012 line.

The next slide shows this year, February to present, showing the blue curve this year, 2017, and the previous minimum is the green curve. So you can see that there's ups and downs, it depends on weather patterns in the Arctic, as to how much ice is exported out of the Arctic between, in the Fram Strait say, between Greenland and Svalbard. And other factors, how much more warm water is coming in from the Pacific at the Bering Strait, how much warm water is coming in from the Atlantic, et cetera? Those things cause fluctuations.

So next slide is 26. The key thing here the top left curve is showing the sea ice age. It's showing the ice age. So the blue is one year ice. So this ice completely vanished in the melt season of the summer and it completely reformed in the winter. The lighter blue ice survived a summer of melt. So it's 2 years old. And you can go to 3, 4, 5 plus years old. And you

can see, you know, in 2016, the configuration of the ice by age and you can see what it is in 2017. So we're getting -- the plot below shows from '84 to present day how much ice there is. So the first, we're getting each year, we're having more and more 1 year old ice and we're getting less and less of the older ice.

This is important. This is important because older ice is harder ice. Older ice is more durable, it's harder to break up. It holds together better. The reason being that in the first year ice, you get a lot of brine pockets in the sea ice. When the water freezes on the ocean surface it traps some of the salt, and over time that salty water or brine that's encapsulated within the ice, gravity pulls it down and it eventually gets out of the bottom of the ice. So the older the ice, the more pure it is, the less salt content. And the less salt content, the stronger.

So next slide, please.

Okay. So why is the ice going so quickly? I talked about temperature amplification in the Arctic, because the Arctic is getting darker. In fact, how much darker? A NASA

satellite measured a decline. The average reflectivity of the ice was 52 per cent about a decade ago, and now it's about 48 per cent. So it's lost, you know, it's lost 4 per cent, which is a huge amount actually in a short period of time. So the Arctic is darker, it's absorbing more sun a lot quicker.

So this shows the temperature anomaly of the Arctic region above latitude 80-degree north for 2016. That's the red line compared to the green line, which is the long-term average. The key thing on this, if you look at -- on the X axis, on the bottom horizontal axis is the day. So 200 would be the 200th day of the year. This is like the Julian calendar. So it goes from zero, January 1st, to 365, December 31st. What we can see in November, we can see these red spikes. Red spikes about 17-degrees Celsius above average, and then drops back, the red spikes.

So basically, it was still summer conditions essentially in the Arctic last November and December. What normally we get in the Arctic in the summer, we had in the Arctic in November and December of last year.

Okay. Next slide, please.

It's not just the Arctic that's changing, the Antarctic is changing. I won't go into details here, but if the Arctic is warming by itself, because it's getting the extra solar radiation, therefore there's less heat moving from the equator to the Artic, therefore there's more heat moving from the equator to the southern hemisphere, it gets down as far as Australia, causes heat waves there, it increases the strength of the jet streams in the southern hemisphere, and that has effects on the sea ice. If the ocean water is warming, it goes under Antarctic ice, melts the ice.

When you think about it, if Antarctic warms from the minus 45 degrees Celsius average temperature to minus 40, it doesn't cause any melting. What happens is the water underneath the ice melts the ice from below. So we can see the Antarctic sea ice, in this case it's the Antarctic sea ice extent. And we can see 2017 is much, much lower than normal. We can see that 2014 was much, much higher than normal, as in 2015. So this is part of the idea of weather whiplashing, or weather wilding, you get swings from one extreme to the other extreme.

Next slide, please.

If you add the ice from Antarctica and the Arctic together, the sea ice, the ice that is floating on the water, you know, in the Arctic Ocean or around Antarctica, then you get the red line. So the dark red line, which goes all the way across, is below the spaghetti lines above, it's much lower than normal. In fact, it's way outside, it's dropped off.

If you look at the red line in December, it's very, very low. And then that line continues to a brighter red line on the other side of the curve back in January. So that brighter red line is this year. So it's recovered a little bit, but it's still much lower than normal. So the earth is rapidly changing.

Next slide, please.

Okay. So like I said, if you go to -- if you Google "Arctic Sea Ice Graphs" you can get all kinds of data. There's some very good data from the U.S. Navy showing, you can get sea ice thickness in the top left, you can get the way the ice is moving in the top right, you can get ice concentration in the bottom half. All of this data is there. So I encourage you to have a look

at it and to see what's happening.

Next slide, please.

Okay. So how long is the ice going to stick around? So if the trend continues -- this is just data, okay -- if the observations continue, we're looking to have the first blue ocean event. No ice in the Arctic ocean in September by 2020 you say. You know, it would only take about a month. In October it would start freezing up again. But then in the next couple of years after that, one or two years after that, there would be no ice for September, for August, September, October. It would extend. And then that would extend to five months by 2023. By about 2030 or so, no ice all year round in the Arctic ocean.

And this has huge implications to the climate. Because the Arctic is the air-conditioner of our planet. Why is it the air-conditioner? The white ice reflects heat, but also it takes a lot of energy to melt ice and the temperature stays at zero.

So if you have a kilogram of ice, you put in a certain amount of energy to melt that ice, so now we have a kilogram of water. Now if

you take that same energy that melted that ice and apply it to that kilogram of water, just above freezing, you go to 80 degrees Celsius.

So, in other words, the temperature rise in the Arctic is very limited by the ice. You get rid of the ice and snow, there's nothing to keep the temperature at zero and the temperature will rise extremely rapidly.

So as large as the feedbacks have been in the Arctic, as large as the temperature rises have been in the Arctic, that's nothing compared to what we will see when there's no sea ice.

Next slide, please.

Okay. So everybody talks about sea ice in the Arctic, nobody talks about snow cover. So what this plot is showing is, it's showing data from May, June and July of snow cover over the land. That's over the dark permafrost. And what we're seeing is in May, June and July, we're seeing a huge decline in snow cover over northern regions, over northern Canada, over Siberia, Canadian Arctic. Less snow cover means dark tundra is exposed, more solar absorbed, and more heating of the Arctic, even less snow cover. As quickly as the ice is going, the ice is declining

at about 12.7 per cent rate per decade. That's the extent of the sea ice in the Arctic. Snow cover is declining about twice that rate, 22 per cent per decade.

The interesting thing is, I just got back from a road trip to the U.S. and there was a billboard in Virginia, and it said Arctic sea ice is declining 14 per cent per decade. It said that right on the roadside billboard in Virginia. I didn't get a photo of it or I would have shown it to you.

Next slide, please.

This is this year in April, and you can see the decline in April is not as steep, you know, if you compare it. So it's basically snow cover in mostly May, June and July, which is dropping more quickly than any other month, and that snow cover is making the Arctic darker just as we're going into Arctic summer. So it's having a large effect on sea ice.

Next slide, please.

Greenland is sitting, you know, massive ice sitting in the Arctic region. The plot shows that the dark line, the grey line in the graph on the top left is for 2012, and it

shows the fraction of Greenland ice that was subjected to melting, so started getting melt pools and such, approached over 90 per cent in that particular year.

What's happening is, as we get warmer and warmer Arctic, we're getting melt on the surface of the ice that forms melt pools, or pools of water on the surface of the ice. Water absorbs 90 per cent of incoming solar energy. Ice reflects up to 90 per cent. So instead of having a huge reflective surface on Greenland, it's getting darker quickly with this ice melt. This is why black carbon is important. If we cut back on our black carbon that goes up into the atmosphere, because that ends up on the ice and makes it darker and increases the melt rate.

Another factor -- okay, so how much? So basically we're seeing a large increase in the number of melting days in Greenland, and we're seeing a large darkening of the surface and, of course, any water, any ice that melts on Greenland, that water goes into the ocean and corrects to sea level rise.

Next slide, please.

So how much are we losing from

Greenland? So here's a plot from 2002 to present day, it's very interesting how they get this data. They have this -- it's from so-called GRACE, G-R-A-C-E, anomaly satellite. It's two satellites that are orbiting the earth, and the distance between satellites was measured with a laser. And when these satellites pass over say a mountain, the mountain pulls both of them closer, and the distance between the satellites decreases, and from that decrease they can figure out the mass of the melt. If it flies over Greenland, it can get the melt of the ice in Greenland. If it flies over North America we can, for example, determine groundwater depletion. If we're depleting the groundwater, there's less mass on the surface of the earth and it doesn't pull the satellites as much, and you can see a difference and measure groundwater loss. It's amazing what we can do with this satellite, you know, it's like magic.

Okay. So the monthly change in total mass of the Greenland ice is shown here. What we're seeing is the curve is increasing downwards. It's not a linear drop, it's increasing downward.

So, okay, next slide, please.

So we're losing ice from Greenland,

we're losing it from Antarctica, sea level rise is accelerating. In terms of this slide, 36, shows natural disaster trend. And what we're seeing, this is from Munich Re. data in 2015, and showed up in 2014, and it's showing an increase in the number of events that are -- the number of events of natural disaster.

So the trend rate is going rapidly upward. And the attribution is to, geophysical is red, so that's things like volcanos and stuff, not much change. Meteorological, so any weather storms and things, it's the green. Flooding and mass movement, so flooding and landslides and things like that is the blue line, an increase in that. And an increase in extreme temperature droughts and forest fires, et cetera.

We're getting more and more forest fires in the far north, in the boreal forest and the permafrost and tundra. Those forest fires produce a lot of soot and ash. That ash is carried into the Arctic and deposited on sea ice and Greenland and accelerates the melt. It's another feedback, acceleration of the melt.

Okay, so next slide, please.

So we're getting sea level increases

shown in the top left. The additional CO2 in the atmosphere shows that more CO2 is going into the oceans and the oceans are getting acidic. Okay, the ph is dropping of the ocean. So CO2 in the air plus water vapour rain, gets carbonic acid rain. They are 30 per cent more acidic than they were 30 to 40 years ago. This is a big drop.

The plot on the bottom right shows Greenland's mass loss, the Antarctic mass loss. And you can do a fit to the curve. And we talk about a doubling period, you have an exponential drop, it's a doubling period. So the rate of melt is doubling on Greenland and Antarctica roughly every seven years or so. If you take that seven year doubling, and if that continues, then we're talking about a one and a half to two metre sea level rise. We're talking about seven metres by 2070, if those doublings in fact continue. The numbers of the rate of ice mass loss from Greenland Antarctic, just about every article that comes out says it's faster than expected.

Well, if everything in the climate is faster than expected, we need to change our expectations. Right? And what I'm showing you is what we need to change our expectations to. So

the present rise, you know, sea level rise that's happening, water expands, hot water takes up more volume, glaciers melt, ice caps melt, it's rising about 3.4 millimeters per year now. The numbers, there's all kinds of different projections. Like one foot rise by 2050, this was from a few years ago.

A paper went to the California State Government saying one and a half to two metres by 2050. You know, the IPCC is still saying about a metre by 2100, but the projections since then are coming up higher and higher, one and a half metres, two metres by 2100.

James Hanson, a climate scientist, has been saying for years five metres. We know from the past record, the sea level rose 50 centimetres per decade for five straight decades. It rose two and a half metres in 50 years, it rose five centimetres metres every year. Okay. This is what the system is capable of doing.

Okay. So next slide, please.

I mentioned the albedo -- how much time do I have? I don't want to run over. Can somebody give me a time check?

MR. WHELAN: Paul, you're 50 minutes

in. Lunch here would be in 20 minutes normally.

THE CHAIRMAN: It's Serge Scrafield, Chair. Sorry, Mr. Beckwith, to intervene here. It is 25 to 12:00, we want to break for lunch at 12:30 actually. But obviously there may be some questioning and a couple of things the panel has to raise. So, yeah, if we could wrap up in about 20 minutes that would be great. Thank you.

MR. BECKWITH: Okay, no problem, 20 minutes.

Okay. So I talked about the albedo, it's just a fancy name for reflectivity. You know, you get up in the morning, go to the bathroom, you look in the mirror, brush your teeth. The albedo of that mirror is about 98 per cent, 99 per cent. It's aluminum coating on glass, it's very highly reflective.

Okay. Ice is about, if you get fresh snow on a surface, it can be 90 per cent reflective. As the snow starts to melt and refreeze and so on, and you get the ice, it lowers, it might be 80 per cent or 70 per cent reflective. If you have a dark asphalt surface on your driveway that absorbs -- that only reflects maybe 5 to 10 per cent of the light coming down.

So it absorbs all that energy -- sorry, it absorbs 90 per cent of the light coming down and only reflects about 5 to 10 per cent. So it heats up a lot. And if there's snow covering your driveway, you get a patch of black exposed, and it spreads very rapidly because it's dark.

So as the sea ice in the Arctic, the reflectivity flips from being very reflective, because it's ice covered, to lower reflectivity because it's dark. So this (inaudible), you can take this (inaudible) and project it around the planet, and what you basically see is that as the ice and snow goes in the Arctic, it warms much faster. So the rate of warming in the Artic is now about 2 degrees Celsius per decade, at least six times the global rate. That's the highest I think, 2 degrees Celsius per decade, even more than six times. So this rate will increase as the ice vanishes.

Now, there are some big severe risks in the Arctic and those are methane and CO2 that can be emitted. And on the terrestrial permafrost, for example, there's 1700 gigatons, which is a huge amount of carbon that is stored, that is in the permafrost.

So as sea permafrost thaws out, the bacteria starts to decompose it, break it down and produce CO2 if they're near the surface, because oxygen is available. If it's in a marsh or swamp and there's no oxygen available, it produces CH4, which is methane. So it's estimated that there's about 50 gigatons that are in a precarious state near the surface. If this was released, the atmospheric methane level could go up 11 times. It could cause almost immediate, very, very rapid warming. Release of only 15 gigatons over 10 years would dominate the CO2 (inaudible) There would be no chance of a 2-degree Celsius stabilization. We would be rocketing up to a much warmer world. So this is a risk that is escalating. It's getting -- we know that the ice is going, we know the Arctic is warming, we know that the methane is there in the terrestrial permafrost and in the sediment under the sea floor. So the question is, how quickly would it come up?

Next slide, please.

So this is the methane level in the atmosphere. Okay. I mentioned it's flattened, about 2007 it started going up again. Okay.

Human sources are fracking leakage. Methane is essentially -- natural gas that we use to heat our homes is essentially methane, 90 per cent is methane, there's some CO2, there's some other things in it, we put in -- we put in hydrogen sulfide to make it smell like rotten eggs, so if there's a natural gas leak, we can get out of our house quickly. But it's basically methane.

So with fracking leakage, livestock, industrial processes, if the methane could be atmospheric rather than flare, we get methane. Natural sources are wetlands, permafrost thawing, methane hydrate. Okay. The main way methane is removed from the atmosphere is water, broken down water. You take H2O, sun hits it, breaks into OH, breaks off the hydrogen, you get this ion. And it's a scavenger, it's like a scavenger for the atmosphere. It's a very reactive molecule, reacts to other things, removes them from atmosphere.

So methane lasts about 12 years in the atmosphere. It's a very strong global warming potential. So this is how much one molecule of methane will warm relative to one molecule of CO2, by a factor of 34 times if you average it over a hundred years, 86 times over 20 years, and 150

times over a few years.

So methane come up in the Arctic, first of all, it will last longer than the average lifetime because the Arctic is pretty dry, there's not much water vapour up there, so that will stick around there and not be broken down. And it has a large warming effect, 150 times on a few years time scale. So when we see these huge anomalies of 20-degrees Celsius floating around the Artic, I am very suspicious that methane could be have a role in that.

Next slide, please.

So up to now, the Arctic emissions are thought to be quite small of methane. Although there's an area on the Eastern Siberian Arctic shelf where the Russians send out ships every year and they drill into the sea floor and measure methane levels in the ocean and the atmosphere above, and they measured these plumes, these bubbles of waters, these bubbles coming from the sea floor that are as large as -- well, they were only tens of metres diameters a few years ago, they went back and they were large as a kilometre in diameter, some of these plumes of methane. And it's coming from methane clathrate, it's like fire

ice is the terms they call it. You can set this thing on fire and it will burn. It's basically frozen water surrounding a methane molecule. When the water thaws out, when the ice thaws out, the methane is released. The extension is about 160 times.

So when you have these clathrates under the ground and you thaw them, the gas, methane comes out of the gas, it's under high pressure, it pushes on the soils above and you can see these methane craters appearing in Siberia, thousands of them in fact. These vast methane craters where a chunk of the earth has been blown out, you end up with a crater and measure high levels of methane at the bottom. That's the cause of it.

Okay. So next slide, please.

So here is methane being measured in the top graph in Barrow, Alaska, and on the other side of the Artic in Scandinavia, okay. And what we see is a rise, a general rise, and we have seen some very strange large excursions of methane in the atmosphere in those regions. So this is the size of the Arctic.

Okay. Next slide.

This may look complicated but it's not too bad. What we have along the horizontal axis is 2005 to 2014, you can see a slight rise. That's a methane rise at 30 degrees south latitude. If you go back along the other axis to towards the upper left, you're going to higher and higher latitude at any given year.

So if you look at 2005, and you track across that axis, you can see how the methane level varied as we go into the northern regions.

So in the north it's much, much higher. So that, you know, that's a clear indication that the source of methane is in the north, okay, from this graph. And you can apply it back through the years and see it change.

Okay. Next slide, please.

Okay. So this is just a map showing the permafrost extent in Canada's boreal forest. We talk about permafrost melting. We talk about buildings tilting and collapsing or, you know, transmission lines, or pipelines or whatever, that have to be embedded. The pilings have to go very deep below the permafrost because the permafrost is thawing and then we get these things tilting over.

So you can see how the methane, continuous methane is always in existence, just continuous spatially. Some regions are permafrost, other regions are not, depending on the soils. And you can go down to sporadic and isolated patches and you can see how it extends down into Manitoba, as far as Lake Winnipeg pretty much.

So from a climate point of view, when the permafrost is thawing out, it's producing the CO2 and methane, so emissions are going up. From a practical local point of view, it's tilting structures, tilting forest, eroding coastline. Now, as the Arctic melts, less and less sea ice, more and more open water, waves are much higher. Waves beat against the coastline and they cause coastal erosion. And if there's sort of permafrost and clathrates and things, then those will melt very quickly and the coastline basically breaks off, and you get new coastline. There's a lot of coastal erosion.

Okay. Next slide.

So I talked about the jet streams changing. So this is an example looking -- these are looking down, if you're an eagle, or in a

satellite looking down on the north pole, this is the type of image that you see. The white line are basically the track of the jet streams, the white borderline is how the jet stream is moving around. And what we can see is a more typical configuration on the right. The Arctic is cold so the pressure is lower there. But that's a different line in the purple, that's the pressure. Plus the height, I won't worry too much, it's just low pressure area is purple, high pressure is brown, the jet stream is the white line, and you can see how it's moving around. It's not that wavy on the right curve and it's very, very wavy on the left curve. Wherever the waves move up towards the Arctic, you get hot humid air going. Wherever the waves go south, you get cold dry air going.

If the jet stream passes your particular location, say you're on the brown side of the jet stream, it's very hot and humid. And then the jet stream crosses, and now it's very cold and dry. And this switch could happen very quickly in a given region.

So you get, you know, for example, I'll give the example of 2013, March, you know, in

Ottawa, for example, we had it for a week or two, we had a heat wave, it was 20 to 25 degrees Celsius almost for a week and a half. And then it dropped back to below freezing, and it was below freezing, of course, would be normal temperatures. And this happened because of the jet stream shift.

Okay. Next slide, please.

So this is a side view of an exceptionally wavy jet stream. So in the trough of the jet stream is low pressure, stormy weather, and in the ridge of the jet stream is hot and dry. So the wavier these jet streams get, the more bizarre the temperature gets on the planet. Generally it gets colder as you go to higher latitudes. But with these jet streams being this wavy, that changes that state.

Next slide, please.

Okay. So we all know about the Calgary flooding event, the record flooding in June 2013, with insured costs exceeding 6 billion. So the white line is showing the jet stream at the time of this particular event, for Friday, June 21st. We had a persistent configuration of this jet stream in the low pressure area, the big low is a trough. We had incredibly large rains.

Those rains fell on snow in the Banff area. That flood of water moved through the river system and ended up in Calgary days later, and caused this flooding of downtown Calgary. And it was because of the jet stream pattern waving.

Next slide, please.

This is just showing some of the sections of Calgary that were flooded. And again, this is just insured losses. Okay. You know, the uninsured losses, you know, are probably double that number.

Next slide, please.

Okay. So a key point in the atmosphere is for every degrees Celsius rise in temperature, the air can hold about 7 per cent more water vapour. Water vapour is a gas. So as you get evaporation from a lake or ocean, you get the water molecules moving into the atmosphere to gas, they rise up. And as they rise up, they cool down. And then the water vapour in the gas condenses it to water droplets, and those droplets form clouds, and those droplets then combine and you can get precipitation. And the phase change from the gas, water vapour into gas form to water vapour in droplets, it releases energy and that

energy fuels storms.

So this is realtime data with the total precipitable water, and you can see these fingers that extend up into north and south, and in this particular day you can see it extending up into covering Florida and the southern part of North America. When I talked about 20-degree temperature anomalies above normal in the Arctic, multiply 20 times 7 per cent, there's 140 per cent more water vapour able to be held in the air in the Arctic in those regions. So the Arctic is becoming a much wetter place, a lot more rain events than snow events.

Next slide, please.

This is an image from Climate Reanalyzer. You can just Google it yourself and go to the particular day and look at the image of how it changed over that time. There was a long duration European heat wave that killed over 70,000 people at this time. The root cause was very wavy and stuck persistent jet stream. Okay. So this is the -- you can see the hot areas, the cold areas. Although, you know, look at Europe, those red blotches lasted, were persistent, and 70,000 people died.

Now, where are the other red blotches on this map? Well, look down to North America and you can see a red blotch there. And most of Manitoba and Saskatchewan endured a lengthy heat wave at that particular time.

Okay. Death from heat waves is something that we can minimize. It's usually older people in apartment buildings with no air conditioning, it's poorer people, it's very young, very old. They can't deal with the heat as much.

Okay, so next slide.

We just endured record rainfall in April and May. The numbers just came out for May and I believe Ottawa -- okay, so this is a climograph, the green lines are precipitation, this is the average in Ottawa, and you have red lines for temperature, number of wet days, et cetera. Just focus on the green line in April. The number in the middle is 64.8 millimeters. In May it's 76.8 millimeters. Those are the normals. And we've got 150 millimeters of rain in April, so that's about two and a half times the normal, for the normal. In the first week of May we had 117, which far exceeds what we normally get the whole month. I think the final number came in at 195.

It beat the record.

So tremendous amounts of rainfall. The river systems were inundated and floods exceeding 100 years were reached.

Now, 100 years, that's the number based on a stable climate, which I'm arguing that number is no longer valid. Even Trudeau came out and said this is more like one in 10 now, or one every few years even, but it's not -- So it peaked in Ottawa in '86, and the record water levels for Lake Ontario and the St. Lawrence River are ongoing.

Now, with flooding, with natural disasters, you have to have humans involved or we don't call it a natural disaster, so there's always a human component. So in Ottawa's case, we had all these northern reservoirs and water dumping decisions are made by humans. And I am investigating this, but it looks to me like two and a half feet of water was dumped from northern reservoir to the 70 kilometre lock, it's part of the river, a few kilometres wide, two and a half feet was dumped in about 30 hours. That flood of water came down and it reached Ottawa about May 6th, and I think it contributed, it added

about a foot to the peak of the water. I'm looking at that right now. This will be investigated, there's lots of stuff coming out on this. But that's, you know, humans have a big factor in flooding.

You have to talk about triage, for example. Now, you know about it in Winnipeg, okay. You want to save the City of Winnipeg from flooding so you divert the water onto fields, which floods out farmer's farmhouses in rural areas. You know, it takes out -- it has a much less impact on society when you think about it. Rather than flooding all of Winnipeg, you flood rural areas. So there's decisions that are made, triage. Of course, if you're in the rural area and you get flooded out, you're against that being done. Right.

The next slide shows the jet stream. It just shows the jet streams during this, on May 6, 2017. So if you -- North America is the top left of this image. And what you can see is you can see a peak, and then you see a trough, and that's over B.C. Then you see a ridge, that's over central, that's over northern, over central Canada and central North America. And then you

see another trough, that's a over the East Coast and back in Ontario. This time it's stuck for days, and we have had huge amounts of rain in those troughs, and very dry hot weather in the ridges. So this is called an omega block by meteorologists, and it contributed directly to the flooding rainfall amounts.

The next slide 52 just shows the sea level pressures, and you can see the blue or purple is low pressure, and you can see the little white circle covering the East Coast of North America. So that very slow pressure there is huge amounts of rainfall, and the same thing over B.C.

Okay. Next slide, please.

This is showing, this is showing the winds and there's all kinds of data. I'm going to skip through a few of these slides. I'll just point out that we're seeing more events like what happened in New Brunswick, we had extremely heavy wind. These weren't tornadoes, these were straight-line winds. Huge gusts knocked over transmission poles that were encased in concrete. In Moscow, a few days ago, we had extremely strong straight-lined winds.

Next slide, please.

So this is just an image showing the jet streams in the New Brunswick storms, slide 55. You know, certain gusts up to 190 kilometres were reported. This is, you know, the next slide is showing that large parts of the world are projected to get a lot drier as we move forward. Drier regions get drier, wetter regions gets wetter.

Slide 57 is showing the -- it's basically talking about things I have already discussed. It's talking about a chain of events that is very, has a very high risk or high probability of affecting our global food supply, our ability to feed the world with food, very, very soon.

Next slide.

Okay. So now I'm looking at some of the Manitoba specific things. So I have already talked about a lot of things, this is summary. So the climate history over the last century is often used as a basis for study. But we have to really look at whether those numbers are valid. The one in a 100 year flood is no longer, one in a 100 year wind event is no longer valid. These things we need to look at very carefully. The

variability is increasing, okay. We're getting weather whiplashing. A city or region can have record high temperatures, one week record low, the next week swing back to record high. So this type of weather wilding. I had mentioned the example of the heat wave in North America. This was 2012, not 2013. Okay.

Slide 59 just shows the heat wave, very unusual. It made all the buds come out in the plants, and then it got to frost after the heat wave, and Ontario lost $100 million worth of the apple crop.

Next slide.

So point 3, if we have these circulation global climate models, circulation models, we kind of downscale them to see how they are going to affect temperatures in a given region, like in Manitoba. But the problem is that the model don't model what is happening on the global level. Climate is happening much faster than the models project. Of course that's going to be the case. Models can only incorporate the physics of what we know, and there's a lot of surprises, and there's a lot of things that are happening, feedbacks that aren't in the model,

whether it be modeling sea ice or temperatures or anything else.

So there's a lot more variability, as point 4 is showing. So these studies are based on long-term data and climate normals are expected to be less reliable. And point 5 is again talking about statistics. We don't have a stable climate so we can't just throw out numbers like one in a hundred years and one in a thousand years.

Okay. The next slide.

When there's extended heat waves, like Winnipeg, water temperature will rise, there will be less evaporation. The inflows will be lower. There will be less hydro power generation in the province and, you know, there is going to be more export from other places. Point 7 is just saying that a lot of the rivers that feed through the province, starts in Alberta, feeds through to Saskatchewan, feeds through to Manitoba, you know it's glacial melt from the Rockies. That water is melting, running through the river system, supplying the rivers. And as the glaciers are melting, that supply is less certain.

So next slide, please.

So there can be less flow in these

rivers. So this is not, you know, the reduction of high elevation glacial water storage affects a lot of people around the planet, it's not just Manitoba. I mean, people in the Himalayas, the Andes, the Rockies, all these mountains supply water basically for agriculture, for all kinds of things. I mean, we have to look at the source of that supply because it's at risk.

Point 8, the climate normals, you know, take an average of '81 to 2010. A lot of Manitoba Hydro reports use that as a benchmark. The problem is that we have had lots of climate change occurring from 1981 to 2010. So using that as a baseline, it means a lot of climate change has already happened. Why are we using that number? Right? The older climate normals make more sense.

Okay. Point 9 on slide 63, you know, we're getting in a wet cycle in Lake Winnipeg Basin for awhile, but there's no expectation that this will continue. You know, as we lose Arctic sea ice, we've got extremes change that much more, extreme weather events ramp up, we change location. It continues on. So we get a lot of variability.

I guess with the MMTP grid, extreme weather events are going to stress it for sure. There's going to be more high wind event, there's going to be more torrential rain events, the flooding, et cetera. So the question that, you know, we want to build resilient systems. The climate is changing rapidly, we want to build resilient systems. Maybe self-standing latest tower technology from a hundred years ago isn't the way to go.

I was just driving for five days through tornado alley. There's many different types of designs for tower, Hydro transmission line and towers, and there's single pole design, they're much shorter, they're in tornado alley. I guess they got tired of forever replacing and rebuilding transmission lines, so now they are building some that are supposed to be durable enough to withstand, you know, very, very high wind. Nothing will withstand a tornado, but at least it will only take out a few lines in a narrow path and you can quickly rebuild them.

Next slide, please.

You know, as the climate is shifting, we have an area in the U.S. called tornado alley,

exceptionally large number of tornadoes.

The reason it exists is the warm humid air from the Gulf comes up, clashes with cold dry air from the north in that particular region. As the jet streams are shifting, as it's getting warmer and warmer farther north, there's no reason why that warm humid area which comes a lot further north, clashes with cold air over Canada.

For example, we can have a shift of this tornado alley up into parts of Canada with a rapidly warming climate. These things need to all be looked at, okay. We can't ignore these things.

The derechos, point 12, these are straight-line winds. Just happened in New Brunswick, just happened in Moscow, they had a massive storm a couple of years ago. These are not tornadoes, these are straight-line winds. They're frontal winds, like a warm front pushing against a cold front. The air gets lifted up a line, maybe hundreds of miles long and about 20, 30 miles wide, and you can get very, very severe and strong winds there, it can damage lines.

So this is becoming more frequent in our new climate.

Ice storms are still generally rare events. This is point 13 on slide page 65. But it's sort of, there is a bit more uncertainty, you know, in a much warmer world. It depends on the length of time, I guess, you spend near zero degrees as to what the effect will be on ice storms. We all know about the ice storm in Quebec and Ontario in 1998.

Increased heat waves and droughts may be problematic to the grid. Right. Heat waves cause power lines to expand and sag, can increase the risk of fires if the line sags into tall vegetation. Conductivity of the copper wires, decreases as temperature increases. As the conductivity decreases, that's the higher resistance, that's more heating, and more absorption of the electrical current.

Of course, the substation and power stations can be flooded from torrential rains, things like that.

Next slide is point 15. The bottom line is the climate is rapidly changing, extreme weather events are ramping up rapidly. Whatever infrastructure we build has to be resilient. We can't just rely on the Intergovernmental Panel on

Climate Change and large scale GCMs to tell what's happening. We need to look out there and look at the observations, somehow figure out a way to incorporate yearly observations into policy maker decision. Because it takes time for the peer-reviewed process, right, it takes time.

So like I said, the solid data from the IPCC is years old. The 2013 report is from 2009. We're in 2017, we're seeing all kinds of things happening in the Arctic, on the ground, extreme weather events, flooding.

Look at Sri Lanka right now, the flooding there. Peru had flooding that they have never seen before. We're setting records in Ontario and Quebec. The Great Lakes are at record high levels and still rising, flooding large parts of cottages of people on it. A few years ago the Great Lakes was at record low level. This weather whiplashing is happening. We have to be prepared for this. We have to consider these things when we build structure.

So again, the Prairie Climate Atlas, that uses the GCMs, again it's very useful information but the GCMs aren't projecting the rate of climate events that are happening now.

They can't project how quickly sea ice is going. And then go into the next slide, the next to last slide. So we really have to re-examine how we do things to make resilience.

I talk about the tower in point 17. And in point 18 it gets back to this. We don't, climate expert, climate science, you know, how we study things is behind the 8 ball all the time. We're always lagging. You know, climate change is always happening faster than expected. Is this going to continue? Like are we going to keep having this type of framework with climate change, or are we going to say, hey, our expectations have to be different. Right? When you do a search and you say climate changes happening slower than normal, or as quickly as normal, and those searches find you an equivalent number of hits faster than normal, that will mean we have a much better understanding and handle on the system. Until then, how can we rely so much on model?

All of the policy work relies on IPP, all of the policy work from Paris, the 2-degree, 1 and a half degree, that is all based on the 2013 IPCC report, AR5, which is all based on large scale models which are not capturing the rate of

change that are happening now.
And I think I'll stop here. Thank you.
THE CHAIRMAN: Thank you very much for that presentation, Mr. Beckwith, thorough and interesting to all of us. And yeah, I apologize as well that we had to hurry you along, but we have our schedule to meet. So thanks very much for accommodating that.
Are there questions from Manitoba Hydro? No questions? Questions from the panel? All right. No questions from the panel either.
So we'll move then to the panel's questions, or do you have any announcements first? All right. Prior to moving to that, is Hydro ready or do you want to postpone that to after lunch?
MS. MAYOR: After lunch, please.
THE CHAIRMAN: Okay. We'll do that then. So are there any announcements at this point? So we'll do some filings now.
MS. JOHNSON: Okay. For the record, DPWO 002 is the outline that was provided. DPWO 003 is the history of Dakota education in Portage la Prairie. MWL 006 is Mr. Beckwith's report, and 007 is his presentation.

(EXHIBIT DPWO 002: Outline Dakota Plains Presentation)
(EXHIBIT DPWO 003: History of Dakota education in Portage la Prairie)
(EXHIBIT MWL 006: Mr. Beckwith's report)
(EXHIBIT MWL 007: Mr. Beckwith's presentation)

THE CHAIRMAN: Just give us one minute here, please.

All right. Thanks all for spending the morning here, and we will take an early break for lunch. Can we come back then at 1:15? Is that going to work for the technical people as well? We're going to try for 1:15. Thank you.

(Recessed at 12:10 p.m. to 1:15 p.m.)

THE CHAIRMAN: All right, welcome back, everyone. Any announcements to start with? All right. So we are going to begin the questioning now from the panel, the questioning of Manitoba Hydro by the panel. And we've provided you with these questions in advance, so we will hopefully move on to the answers. And I believe Hydro's preference is that we do this, obviously,

one at a time, and that we follow the order that you were given. Okay. So that's what we will do. So Mr. Gillies will start with the first question.

MR. GILLIES: Ian Gillies, on the CEC.

My question is: If the right-of-way is close to homes or places with high visual value and create high impact, have you considered mixing tower types and using the shorter tubular towers to reduce the visual impact?

And if you could, please explain what the considerations around that would be. That would be great.

MR. SWATEK: Okay. Thank you very much for your question.

This is something that Manitoba Hydro would not consider doing. When you reduce the tower height, you have to bring the towers -- you have to bring the towers closer together to maintain conductor-to-ground clearance. So by putting shorter towers, we would be putting more towers on the right-of-way and restricting our ability then to optimally spot those towers. The sections with reduced height would be more costly, due to the associated costs of additional towers.

Even if we were to just reduce the

height of one tower, we would have to bring the towers on either side closer to it. So, it's not likely to have the desired effect.

Furthermore, we would not be using tubular towers; we would want to maintain our ability to do safe live line maintenance on those towers. The tower-head geometry would be the same as what is proposed for the MMTP line, to ensure that we have safe live line working clearances within the tower window. And we would want to be working from a lattice steel structure so that we can do non-invasive live line work, so the workers can climb the tower and work safely from the tower window, or safely from the tower structure.

So if we were to build shorter towers, they would be -- they would be shorter versions of the lattice steel tower. And there would necessarily be more of them.

And I understand that Ms. Bratland will be saying more about Manitoba Hydro's ability to address -- to address site mitigation.

MR. GILLIES: Thank you.

THE CHAIRMAN: Mr. Nepinak will be next.

MR. NEPINAK: If the MMTP is located

on private land and the landowner does not want herbicide spraying, would Manitoba Hydro grant that request? And could you please explain.

MR. MATTHEWSON: Good afternoon, Commissioners. James Matthewson, for the record.

So Manitoba Hydro would first discuss the concern with residents to understand the nature of the concern. It would share information about its specific integrated veg management plans for the area, including the objectives, the mitigation measures that it puts into place, the treatment method options, chemical and mechanical, and the applicability of those options on that particular site, and the potential environmental effects of all the different options.

And it would honour -- after those discussions with the landowner, and explaining the concerns, it would strive to come to some type of consensus on an alternative management technique, which may include a reduced herbicide use, such as a backpack spray operation, or -- potentially the landowner has a concern with more of a broadcast application over the entire area.

So really understanding the nature of the concern can help Manitoba Hydro explain to the

landowner the different types of things that it could do. But if, ultimately, the landowner chose that it did not want to use any type of herbicide on their land, then Manitoba Hydro would honour that request.

MR. NEPINAK: Thank you.

THE CHAIRMAN: Ms. Streich.

MS. STREICH: Thanks.

Yeah, this question actually just follows on that, and you may have already provided some of the answer, but I will read it, so that it is in the record.

So it relates to advertising, the general notices with respect to annual spray -- herbicide spraying on the transmission line rights-of-way. If residents of the province indicate their concern or opposition to spraying specific areas, such as areas of traditional plant gathering, areas close to sensitive areas, what processes would be put in place to address such concerns? And is there a possibility of addressing these with alternatives for vegetation management?

MR. MATTHEWSON: Okay. It is similar to the response I gave Mr. Nepinak, but I've got a

little more extensive explanation of some things.

So, Manitoba Hydro of course is sensitive to the concerns of herbicide uses by any and all residents of Manitoba. When I first started working with Manitoba Hydro, I was actually working with Manitoba Conservation at the time, about 15 years ago, and we were looking jointly to develop technologies to monitor and map the exact location of herbicide rates and locations, because we are aware of the concern, and growing concern, in the public and First Nations and indigenous, about herbicide use, and we wanted to make sure that we were taking every step and effort to wisely use them.

So through that integrated vegetation management approach that I spoke about in my previous presentations, herbicides are a valuable tool in the toolbox of multiple tools that we have at our disposal for use in various specific locations, and in choosing a variety of different management objectives to maintain that safe operation of the power line, but also to try to develop that ecosystem on the right-of-way that supports that wide variety of wildlife habitat.

The use of herbicides for industrial

purposes is through -- is very similar to what -- the reasons Manitoba Hydro use them is very similar to other industrial users, such as the Highways Department, who may spray road rights-of-way to clear vegetation to maintain line of sight for driver safety, or for weed supervisors across the province that spray to control noxious weeds.

Manitoba Hydro is using herbicides selectively on its rights-of-way to manage those trees, to prevent fires and prevent power outages, ultimately, what we are trying to do with the controlling of the tree vegetation.

And as we've discussed previously, we've received sensitive site information through the First Nations and Metis engagement process and our public engagement process, and we will incorporate those sites into our integrated vegetation management plan, so that there is no herbicide spraying on these sites.

If, through general notices, as you mentioned, or other mechanisms, residents of Manitoba identify their concern or opposition to spraying in specific areas, Manitoba Hydro, as I discussed with -- in my response to Mr. Nepinak,

will discuss all the different options that are available to get to the nature of the concern that the resident may have. It may be a very spatial concern about a specific area, or it may be just a broad concern overall about the use of chemicals on their lands, or in Manitoba in general. We will just talk about all the different environmental options and effects of all of the different options that we have.

But I can't necessarily commit today that we would not use herbicides in a particular spot, as that may be the only solution to deal with something like an invasive plant species. There may be a very invasive plant species on a parcel of land that the only mechanism to control it is herbicides, and we may ultimately be directed, under the Noxious Weeds Act, that we have to control that weed.

On private land, that responsibility falls on the landowner, so it is the landowner's responsibility, as Manitoba Hydro only has an easement on that land.

Or the options to herbicide use in a very specific area may be -- may have a higher environmental risk than the selective application

of the herbicide; I talked about that before, with all the different potential effects of all the heavy equipment in mowing operations, and so forth.

So with respect to how we will implement this, Manitoba Hydro's -- the line inspectors, so the folks involved in the transmission line and Manitoba Hydro's forestry department, that works on the distribution side of things, works with residents on a daily basis during an integrated vegetation management approach program annually, every summer, when we are doing these programs.

People's concerns are not solely restricted to herbicide use. In our mowing programs, people have concerns about the mechanical methods, such as noise, and the flying debris, and rutting, and the development of monocultures on the right-of-way.

So, generally, it has been Manitoba Hydro's experience that there are solutions that address both parties' interests and concerns. There are a wide variety of things in the toolbox. If we have all of the tools in our toolbox, we have lots of different options by which we can

work with the landowner or the concerned residents to come to a mutually agreeable solution.

In the development of that integrated veg management plan, any identified sites, as we mentioned previously, and other areas, such as the wetlands, or -- Manitoba Hydro has already said we are not doing herbicide applications in wetlands -- will be described to not receive herbicide spraying.

If the sites identified through discussions with the residents of Manitoba become a no-spray area, an area that we won't spray, they will be added to the operational environmental protection plan as sensitive sites, and then those sites will be available and followed by all the maintenance staff in their planning of veg management activities and during their operational activities themselves.

I hope that answers your question.

MS. STREICH: Thank you.

MR. GILLIES: Just to follow up to that, this is not something that we provided to you.

A lot of farmers these days use various forms of precision agriculture, so they

are looking at georeferencing portions of their fields to control flow rates, or non-spray, where the weed populations don't really justify, from an economic point of view, spraying.

Does Manitoba Hydro employ some of those precision agricultural methods? And specifically, do you georeference your rights-of-way so that you precisely control your application?

MR. MATTHEWSON: That is exactly the technology that I was talking about, that we started implementing with Hydro approximately 15 years ago. So it was a trial basis, where we actually took precision agricultural equipment, that was actually designed for spray planes, and placed it in the cab of machines that were doing applications, and attached the flow rates to the flow meters, and did all that type of guidance, actually, in guiding the equipment to reduce duplication of overapplication, because this was used in a broadcast application when I was working with Manitoba Conservation.

So we wanted to make sure we weren't applying an area twice. So we used an aerial guidance system directly from a spray plane and

put it in the cab of the skidder, and the operator just drove, and he knew that he was -- he had on his display the exact application rate that was going down. It was mapping, on a per-second basis, the application rate being distributed out of the machine, and geospatially, geographically mapping the footprint of the -- the swath of the spray pattern.

So Manitoba Hydro has that technology on its contractors' equipment, and it has mandated it for much of its equipment for the past five years, I think; it has been a contractual obligation to have that monitoring equipment on the larger spray equipment.

Of course we don't have that technology on the smaller, ATV-level sprayers, where we are driving around and do a little spray, and -- but we do use that equipment, yes, for precise application of our herbicides, and tracking.

MR. GILLIES: Thank you.

MR. MATTHEWSON: Could we have the audio turned up a little bit? It is hard to hear the Commissioners' questions.

MR. GILLIES: That might just be me.

THE CHAIRMAN: This is Serge Scrafield, the Chair.

I think they were just asking to have the volume turned up, so I'm going to keep speaking here, and you can tell me when it is working. In the legislature they were reading fairy tales, and passages of the Bible, and other things, but I don't think that I will go that far. But -- can you hear me now?

MR. MATTHEWSON: Yes.

THE CHAIRMAN: Okay. I don't think I would make it in that scene.

All right. We are down now to what you probably have as Question four. So during the hearing, the Commission has learned that Manitoba Hydro intends to establish a monitoring committee of First Nations, Aboriginal organizations, and the MMF to advise or be involved with the monitoring program for MMTP. If this committee identifies additional areas where alternative vegetation removal and management are recommended, such as less intensive clearing, avoidance of herbicides -- which we have been discussing -- avoidance of certain areas, seasonal avoidance, et cetera, will Manitoba Hydro be willing to

consider and modify its operations?

MS. COUGHLIN: Hi. This is Sarah Coughlin speaking.

So yes, Manitoba Hydro will consider and modify operations in geographically specific locations that are identified either already, by communities that we have heard from, or new sites that are potentially identified by the community monitoring group, or by Manitoba Hydro staff as they conduct preconstruction surveys, or by the Conservation Data Centre.

And one of the next steps in the process is that we will work to validate those locations, and they will become part of the environmental protection plan, which is continually updated.

THE CHAIRMAN: Just one follow-up question, not related to the actions that you would follow, but at this point in time, do you envision how often that group would meet and how often, therefore, you would be able to react in terms of management practices?

MS. COUGHLIN: One of the things that we heard Mr. Sutherland testify to during these hearings is he discussed a desire to meet

quarterly. So he talked about the need to meet more than a few times of year, because of the seasonality of plants.

And I think that's something that sounds interesting to us and something that we could be responsive to, so that -- we would need to meet with the group, to talk to the group more broadly, but that would be an idea that seems reasonable.

THE CHAIRMAN: Okay, thanks for those responses.

Mr. Gillies.

MR. GILLIES: Thank you.

I would just ask if it is possible for Manitoba Hydro to state definitively that the operation of a new 500 kV line will not result in the increase of stray voltage incidents in homes and farms near the right-of-way. And could you explain, in lay language, why this is so?

MR. SWATEK: Thank you very much.

Yes, the problem of stray voltage is not related to transmission lines; it is not a problem related to EMF. The problem of stray voltage is -- well, stray voltage is caused by -- it is caused by unbalanced loads in facilities.

If the load is not -- if the load is not balanced, then the net unbalance goes through the ground, through -- it goes through an earth connection, and that ground current will flow through the cattle barn or wherever it is.

And it's particularly a problem for dairy farms, because of the distance between the rear legs and the front of the cow. As currents flow through the ground connections, metallic objects connected to that ground will pick up voltage. And as the current spreads, the voltage drops; so the voltage at the rear of the cow can be very different than the voltage at the front. So this poor cow goes to take a drink of water and gets an electrical shock.

But it is a problem that is corrected by looking at the grounding within the barn, and looking at the electrical panel, the electrical connection, and ensuring that that load is balanced. In fact, even within your own home, your electrical panel has two sides. And electrical contractors, when they wire up a home, they are trying to ensure that the load is equally balanced on both sides of the panel. If the load is -- if the load is balanced, then there should

be no current going through the ground connection. But if that load is unbalanced, you will have current through the ground connection.

In your house, you might not notice it; but in a large dairy operation, that can become a real issue.

So the problem of stray voltage is completely related to load balance and grounding; it is not related to electric and magnetic fields. The current that's in this 500 kV line is a perfectly balanced three-phase current that is not connected to the ground in any way.

So, yeah, stray voltage is not related to overhead high-voltage transmission.

MR. GILLIES: Thank you very much.

THE CHAIRMAN: I had just one quick follow-up question. How far away -- I know you said it is not related to the transmission; does that also mean that it doesn't vary, depending how far away you are -- the risk of having the issue, does it vary depending on how far away you are from the line? Or does it not?

MR. SWATEK: It would have no relation to the line.

THE CHAIRMAN: Okay. That's what I

gathered from your answer, but I wanted to be sure. Okay.

All right. Ms. Streich.

MS. STREICH: The Commission has heard, during Open Houses, some of the mapping and imagery did not include newly constructed homes and buildings, and the Commission assumes this is because the air photography or other imagery did not capture more recent building activity. So can Manitoba Hydro comment on the -- how dated -- for example, the year the imagery that was used for each round of consultation, and how it accounted for this gap in its planning and consultation activities?

And can you also provide more information on the year of the base imagery and whether it was updated during the consultation process?

MR. MATTHEWSON: Okay. The imagery for the area of MMTP was acquired in 2009, 2010, and 2012 by the Province of Manitoba as part of its orthographic photography refresh program. And it was the same imagery that was used throughout each round of consultation.

Manitoba Hydro is very aware of the

rapid changes in the landscape, such as new building construction, which is why we conducted numerous windshield surveys and aerial surveys, and reviewed other aerial imagery sources, such as Bing and Google Maps, as they were newer versions, in each round, to update its various geospatial layers, especially the buildings layer, prior to route evaluation.

More recently, a small band of imagery has been acquired along the final preferred route, and that was conducted in 2015/2016, when the final preferred route was flown for high-resolution imagery and LIDAR, which is mapping of the topography and the vegetation, for the purpose of design engineering and environmentally sensitive site evaluation.

So essentially we did use imagery that was circa 2009 to 2012; that was the best available stuff that covered this area at a very high resolution. Certainly there were satellite data sources of -- Landsat and -- are available, and are newer, but they do not have the resolution required to delineate buildings and other features on the landscape, which is why we started with that, and we updated it with continuous ground and

aerial surveys and other imagery sources in each round of consultation, as well as getting feedback from landowners that they had just built a new house during the public consultation process. That also updated our geospatial data.

MS. STREICH: Thank you.

THE CHAIRMAN: All right. That brings us to Question 7. Mr. Nepinak.

MR. NEPINAK: This is kind of a longer question. You can kind of sit back if you want.

During the presentation of the Southern Chiefs' Organization, we believe it was Elder Dave Daniels who described the findings from the ATK report of the Long Plain, Black River, and Swan Lake First Nations. The elder identified a number of rare plant species along the preferred route. It was unclear whether the plant locations he was referring to were in the PDA or LAA, or other.

We have a couple of questions on this, and the first one is, for the specific plants and locations that this study identified, are these sites outside the PDA, or can be restricted from ROW clearing and other effects?

Second, will the SCO and other First

Nations, Aboriginal, or Metis organizations be provided the opportunity to more closely examine the PDA for potential plant areas of interest and have access to further plant surveys within the PDA?

That's it.

MS. COUGHLIN: It wasn't that long.

Yes, so some of the locations that were identified by Elder Daniels in the presentation were outside of the PDA. And as we understand, some of the images that he shared and some of the sites that he talked about are described in Appendix C of the ATKS management team report, although some of the images might be from the botanical survey that was also conducted, and that's the survey that the group has asked us not to share at this time.

One of the things we'd like to do is talk with the group directly about specifically those sites that may or may not be included, and find out exactly where they are, and practices that they would like us to consider.

Your second question was about whether or not the monitoring committee -- make sure I answer this correctly -- will SCO and other First

Nations, Aboriginal, and Metis organizations be provided the opportunity to more closely examine the PDA for plant areas of interest and have access to further plant surveys within the PDA?

Yes. So we would like to work with the groups that we've discussed in the community monitoring program and to chat about those kinds of things and others.

MR. NEPINAK: Thank you.

THE CHAIRMAN: All right, that brings us to Question 8: Does Manitoba Hydro have an overall communications plan for how it will interact and communicate with the public during the construction and operation phases of the project?

We were very clear -- I just want to editorialize a bit -- we were very clear on the communication plan around blasting. But at least as far as we were concerned, we were not so clear on your overall communication plan.

MS. BRATLAND: This is Maggie Bratland, for the record.

So as I understand your question, it is pertaining specifically to construction and operations, so I will address those specifically.

During construction and operations, we do have an overall engagement plan, and it takes off from the communication plan that we have in place now, which seeks to be responsive, timely, and meaningful.

Part of the fundamental basis for that communication plan will be the role of the landowner liaisons, so specifically dealing with those that are traversed by the transmission line, to be that one point of contact into Manitoba Hydro, to be able to articulate to us their concerns, and for us to communicate back to them specific project milestones.

We will also be communicating to rural municipalities in an ongoing fashion, continuing to meet with them regularly, providing updates and addressing concerns that they have regarding project activities that affect their constituents or their municipality.

Stakeholder groups will continue to be notified regarding key milestones in the project and the regulatory process construction phases, and to assist in dissemination of information to their groups as well.

We have ongoing email campaigns. We

have over 790 individuals subscribe to these campaigns. They will receive notices, throughout construction and operation, of key milestones and activities on the project, such as the specific stages of construction.

The project website will continue to be updated with information, and a document library maintained and refreshed, so that anyone interested in the project can have access to that information.

We also have internal processes that enable those communication mechanisms to be effective and to track that they are complete. So we have communication through our department, through the Licensing and Environmental Assessment Department, that interacts with the landowners now, through to the Construction Department and the Operations Department, to make sure that any sensitivities and concerns of specific landowners and communities are handled and incorporated, and we document and track follow-up on those activities in our centralized database.

THE CHAIRMAN: Was that just the construction phase, or was that construction and operation?

MS. BRATLAND: I forgot to turn the page on my notes.

There is also the First Nations and Metis engagement process, so I don't want to understate that, either.

Specifically I also wanted to address the access management plan. So as part of that access management plan, affected landowners, stakeholder groups, First Nations, MMF, and indigenous organizations will be notified by letter or email, depending on which they prefer, regarding right-of-way restrictions to access construction sites at certain times. This will be sent out prior to construction start, and information will be placed on the project website. Local newspaper ads will also be used to notify the public of upcoming construction activities.

Now, with reference to the operational phase of the project, we will continue to have discussions with landowners. In particular, our maintenance staff will also have discussions in regards to activities that will be ongoing on their land, so anything requiring access to a land for maintenance of our infrastructure, landowners will be contacted prior to that, and whether they

have preferred access points on their property, and timing issues, they will let us know, and we will respect those.

And in terms of communication through the licensing and environmental assessment liaison team, that will remain open, and we have a 1-800 number that will remain open as a window to gather concerns and address them during operations.

THE CHAIRMAN: A follow-up question to that is, is this plan -- I mean, you've described a fairly thorough set of processes here, but is this plan written out, and is it publicly available?

MS. BRATLAND: Because it is an adaptive and ongoing plan, we have it in a draft format, internally. It is not currently publicly available.

THE CHAIRMAN: You know the question that's coming next: Will it be?

MS. BRATLAND: Would you like me to undertake to provide a draft?

THE CHAIRMAN: Yep. I think that would be a good start. And then if -- I'm unsure of the process here if we then want to follow up.

Perhaps, when you provide us with a

draft, if you could also provide us with a plan to communicate the plan, if that is -- or not; if you could provide us with that as well as the draft plan, that would be good. Thanks.

Is that ... ?

MS. BRATLAND: We can undertake to provide that.

THE CHAIRMAN: Good. Thank you very much.

(UNDERTAKING # MH-13: Provide draft communication plan)

THE CHAIRMAN: All right.

Ms. Streich.

MS. STREICH: Thank you.

A number of participants during the hearings have described how Southern Manitoba has undergone a significant loss of natural habitat since settlement, and they further indicated that there will be a further net loss of natural habitat and associated traditional opportunities with that habitat in Southern Manitoba as a result of the MMTP project.

In other jurisdictions, the concept of biological or biodiversity offsets have been implemented to allow for opportunities where an

overall net benefit may be achieved with respect to a specific species or habitat. This appears to be a potentially useful concept for projects where it is difficult to demonstrate an overall net benefit or no net loss of habitat with relation to the project.

Has Manitoba Hydro considered whether this concept could be applied to its operations, and Manitoba in general, whether within either a voluntary or a regulatory context?

MS. COUGHLIN: So offsets are part of current Manitoba policy, related to what you are speaking about. So Manitoba Hydro hasn't volunteered them at this time, in light of the nature of the effects to natural habitat with this particular project.

So we have assessed the magnitude of effects to natural habitat areas, and we will be removing trees and forested areas that are required for certain species, such as ovenbird; but that habitat will be modified, and will provide species habitat that will result in different conditions. So some of that discussion was covered when we were talking about golden-winged warbler habitat that will be

developed.

And we've also employed mitigation measures to limit effects beyond the construction footprint, and -- such as maintaining shrub and herbaceous vegetation along riparian buffers and in sensitive areas, constructing during winter conditions.

Thank you.

MS. STREICH: Thank you.

THE CHAIRMAN: Mr. Gillies.

MR. GILLIES: I always get the short questions, which is nice.

In the last two CEC reports, on Bipole III and Keeyask, the Commission made recommendations on implementing third-party audits on those respective projects to assess the accuracy of assumptions and predictions. Other than concerns with regard to cost, does Manitoba Hydro have any concerns with respect to the undertaking of such audits?

MR. MATTHEWSON: Cost is certainly a concern for Manitoba Hydro, given its current financial operating environment and obligation to ratepayers. And with that said and already acknowledged by the Commission, Manitoba Hydro's

concerns -- other concerns respect to that duplicity of effort that a third-party audit potentially brings to a project such as this -- keeping in mind this is a unique project in Manitoba, and that it will undergo extensive oversight by both Provincial and Federal regulators, including the requirements of monitoring reports to demonstrate the effectiveness of the mitigation measures, the accuracy of the assumptions and predictions, and use of -- sorry -- accuracy of assumptions and predictions, and that use of adaptive management.

Manitoba Hydro does see the value of third-party audits, as it does currently conduct them on its environmental management system and biosecurity programs, and through its extensive monitoring programs implemented by scientific experts in conjunction with the indigenous community monitoring working group. Experts in traditional knowledge and the respective world views provide another form of third-party oversight, and the reports available from these programs will be available to Manitoba Sustainable Development scientists, the National Energy Board, First Nations, Metis, and the public, for review

and comment.

Manitoba Hydro certainly appreciates the potential value of a third-party audit, as illustrated and recommended by Dr. Fitzpatrick, with respect to the accuracy of the assessments of assumptions and predictions, and we have expended much effort in designing and implementing monitoring studies for all of its projects, to be effective in measuring the potential effects of its projects.

The upcoming Bipole III audit -- expected to occur in 2018/2019, once the Bipole is in service -- will provide Manitoba Hydro with an extensive review of a 1,384-kilometre transmission project that spans many types of ecosystems and potential effects. As some of the potential effects are very similar to -- as those discussed in the MMTP EIS, conducting another audit of similar assumptions, predictions, may yield limited new information or knowledge.

But a potential licensing recommendation with respect to third-party audit, though, it is considered -- I would consider wording such that if the audit of Bipole III yielded learnings with respect to the accuracy of

the assumptions and predictions of that project, that -- and that were significant and applicable to this project -- as you can imagine, there are certain effects on caribou, boreal woodland caribou, that won't be realized on this project -- that the Director of the Environmental Approvals Branch would trigger a requirement for an audit of MMTP.

So this, I believe, gives us an efficient and effective way to reduce potential cost and duplicity of effort if it isn't warranted.

So to summarize that, if the Bipole III audit yields some very important significant findings in the assumptions and predictions of that EIS, we would simply -- there could be a licence condition in MMTP that would be triggered, if that report, by the Director of Environmental Approvals Branch -- if that report essentially would trigger an audit on MMTP.

But we would learn from the Bipole III audit first, is a potential recommendation.

MR. GILLIES: Thank you.

THE CHAIRMAN: All right. Question 11, and Mr. Nepinak.

MR. NEPINAK: I see this one is even longer, and I don't know how many questions are in here.

A few concerns have been raised about the lack of access controls on private lands where transmission lines occur. If a landowner requests significant access controls on the transmission right-of-way that spans their property, does Manitoba Hydro grant that request?

Related to that question, the Commission imagines that some property owners likely have a number of conditions or concerns that they would like to have satisfied with respect to how the transmission right-of-way should be managed on their properties. These concerns could include access, herbicide spraying -- which we've already discussed -- areas where less vegetation removal is desired, what to do with residual biomass, et cetera.

What type of legal instrument does Manitoba Hydro utilize to ensure such agreed-upon conditions and/or concerns are implemented? How do Manitoba Hydro field staff know about such conditions, and how do they adhere to them? Please explain, with as much detail as possible.

Furthermore, with respect to access, does Manitoba Hydro have an overall policy, or does Manitoba Hydro work with Government on implementing or carrying out a policy with respect to where access is allowed or should be controlled?

Do you want me to repeat it?

MR. MATTHEWSON: I think we have got it. No, not required. Because of the multi-part nature of the question, myself and Ms. Bratland will be answering the different parts of it.

With respect to access controls, Manitoba Hydro has had numerous discussions with landowners about access controls, as you can imagine, on the construction of the Bipole III project.

An example of this is a very large bison ranch that's on the Bipole III route, where the landowner expressed concerns with access, biosecurity, animal penning, vaccinations during construction, and of course Manitoba Hydro had concerns with respect to worker safety, with a very large bison herd, and working in around the bison.

So Manitoba Hydro worked with that

landowner to develop a very extensive plan and agreement about relocating the bison and penning the bison away during the construction period, constructing new fencing and gates, and biosecurity procedures to be implemented during the construction phase, as well as procedures to be implemented during the operation phase.

So while we have had extensive discussions with some landowners about access-related concerns, such as a big landowner, like a bison ranch, generally it has not been a major concern, historically. A lot of landowners that have a fence that Manitoba Hydro crosses with the right-of-way, we will work with them to install a gate in that fence, as I discussed earlier, with double locking.

But there are a variety of different mechanisms by which we work with the landowners to control access on their land, while still maintaining access for Manitoba Hydro staff to get to that portion of the right-of-way in an emergency situation.

Ms. Bratland is going to touch on the legal instruments.

MS. BRATLAND: Our primary legal

instrument between landowner and Manitoba Hydro is of course the easement agreement. So to the extent possible, we do document any additional conditions the landowner may have on their property with respect to access, for example, debris management.

We also have a slightly less formal arrangement where, if a landowner has some specific concerns and just want to make sure they get to see it in writing, we often will exchange a written document that indicates what they would like to see done on their property, our acknowledgment that we understand it and commit to undertake it. And we sign it and they sign it.

MR. MATTHEWSON: So with respect to how the Manitoba Hydro field staff know about these conditions and adhere to them.

So the Manitoba Hydro field staff, during construction, are provided with the conditions and the easement agreements, and those letters, as Ms. Bratland discussed. That information is also placed into our environmental protection information management system, for storage and retrieval at any time from the Manitoba Hydro staff.

During operations, those commitments that Ms. Bratland talked about, on the easement agreements and letters, they are stored in our property department's geographic information system, and they then get transferred into the transmission geographic information system, which is used on the field computers by our line maintenance staff. And they have access to all the constriction -- any other commitments and concerns that the landowner may have on that particular parcel of land.

Some of that information may ultimately also appear in the operational environmental protection plan, depending on the nature of the information.

With respect to -- does Manitoba Hydro have an overall policy on access; it does not. And I'm assuming this refers to Crown land, potentially, and we do work with the Government, as we do not have the right to restrict access on the Crown land. We work with the Government, with Sustainable Development, the regional biologists and the integrated resource management team, to address concerns they may have about increased access to an area for resource use. And it is

there -- if they do want to implement some type of action, there is mechanisms by which they do consult with the First Nations and Metis people about incorporating any type of restrictions on access roads or the right-of-way itself.

The -- this is common, something that we are working quite closely with Sustainable Development on currently, on the Lake Winnipeg East system improvement transmission project, where there was extensive decommissioning of old forestry roads for the purposes of protection of the moose population in that area, they wanted to reduce the four-wheel-drive vehicle access but still maintain access for resource users from ATVs and snowmobiles.

So they implemented a variety of different ditch and gate-type mitigation measures, to block access down these access roads. Manitoba Hydro had to re-open those roads in order to construct the Lake Winnipeg East system improvement project, but we worked and developed processes by which we would temporarily decommission those access points on a seasonal basis, because it is a multi-year project, and then permanently restore them back to the

decommissioned status that they were, but still allow the line maintenance staff to get there, flex-track-type vehicles to get in there to provide maintenance to the line in times of emergency situations.

THE CHAIRMAN: All right. I get to ask the next question. For the record, it is Serge Scrafield, Chair.

Based on what the Commission heard from the public, there are certain cases where it appears that some residents are bearing a disproportionate share of effects of lines and towers closer to their homes. Are there any fine-tune adjustments that can be made -- for example, tower placement, retaining vegetation, or other methods -- by Manitoba Hydro to address landowner concerns? What is the mechanism for doing this?

MS. BRATLAND: It is Maggie Bratland, for the record. I feel like I'm answering all the questions that you ask, Mr. Chair.

During Round 3, we started our very detailed discussions with landowners about their specific concerns, and started to gather those through our Open Houses, landowner information

centres, and one-on-one meetings. Through the ongoing discussions with liaisons, we are having detailed on-the-ground discussions with landowners about what their site-specific concerns are.

So, for example, just to give you something that happened through that process, we have a landowner who shared something he called as a no-tower zone on his land. It held a number of sensitive features that he really didn't want to see a tower footprint in, but was generally accepting of the overhead wires running over top of.

Our engagement team shared that with our design team, ran them through the context of the specifics of that land use, and that information was then incorporated into the overall design and tower-spotting process. And I can tell you that there are no towers in that no-tower zone.

Part of why we are able to accommodate that is because of when we hear about that information. Unfortunately, the further we get into the final design process, the less flexibility we have, because every adjustment we make depends on what is north, south, east, and

west of that adjustment, and how far into that final design process we are.

So that's why we try to seek information early, and be responsive to it. Before the first-ever placement of towers on the landscape, conceptually, by our designers, we met with them and ran them through the entirety of the feedback we had received, so that their models and their considerations had that fit in of that process. And we continued to feed that in, but the impact that that can have, as I say, is constrained the further down we go through that process.

So as Dr. Swatek mentioned, visibility and the aesthetic impact to landowners is a concern. The shorter tubular towers are not under consideration for this project, and the ability to mitigate those concerns, I would say to you, are a very site-specific determination. Whether a landowner's house faces directly towards the line, where those towers are specifically placed, the vegetative screening that can be in between those locations; those are all mechanisms that can be used to help to mitigate those concerns, but they have to be based on that very site-specific

understanding of what the challenge is at hand. Those are all things that Manitoba Hydro absolutely will consider and undertake to mitigate those concerns.

I just wanted to point you to the -- clause 6 in the Bipole III licence. That was an example of a clause that said that Manitoba Hydro should undertake to have those site-specific discussions and make those site-specific adjustments wherever practical, unless there was a compelling reason to depart.

And for us, in general, a compelling reason to not make that adjustment would be similar to how we screen mitigative segments. We would not make an adjustment if we knew that it would be causing a disproportionate shift of an impact onto another individual, if it shifted from one person's home to three homes.

So we would do an evaluation of a request and try to meet it, if at all possible.

Does that answer your question?

THE CHAIRMAN: Generally, yes. But as you are well aware, this was raised by some of the residents at the La Broquerie meetings, and it sounds that some were affected by changes made by

Manitoba Hydro to the routing to benefit other landowners. So they were made for good reason, but may have disproportionately affected someone who might not have been affected quite in the same way originally.

So, yeah, it is later in the process, but not through any fault of their own. So is that something that you would give extra attention to? Because it is sort of a byproduct, if I understood it right, a byproduct of you trying to adjust the line to help out someone else.

MS. BRATLAND: So, I want to say two things in response to that. The addition of mitigative segments in our routing process comes at the end of engagement, we either are proposed mitigative segments, or we develop them in response to concerns that we've heard.

And as Mr. Matthewson indicated in his testimony previously, every route segment on the landscape has a different balance of land-use effects and trade-offs of interests, necessarily, no matter what.

So, of course, we could walk all the way down the line on every single parcel, and you could hear about how one receptor is affected more

than another, and we are certainly sensitive to that. But as we get to the late stage in planning of a project, and if we are approved to move forward with this project, any changes that we make now need to be very small, for that exact reason.

The assessment that we've done has always looked at that balance of interests and perspectives and effects, and I can tell you we are absolutely very sensitive to the effects of individuals. We were with you at those public meetings, and we understand those concerns, and that they are very serious, and we take them very seriously. And we are very willing and open to have ongoing constructive discussions about whatever we can do to manage that.

So if that looks like us -- for example, we heard about shelterbelts from a number of agricultural producers. If there's ways for us to make slight shifts to the line that then take at least part of that shelterbelt out of the clearing zone underneath that right-of-way, we will certainly undertake to do that. In fact, we have been looking at it all along, as we go through the design process, and we've flagged

those as areas of concern.

If we do have to take those shelterbelts, because they fall under the right-of-way, we will work to replace those shelterbelts in a location that make sense to that landowner, that doesn't interrupt with the safe operation and maintenance of the land through those discussions.

Of course it is never going to be, maybe, as ideal or effective for the purposes that they put it there for, but we will try our best to address those concerns.

THE CHAIRMAN: Okay. Thank you for that response. It will just take me a minute to bring up the additional question. I tried to avoid getting on the phone during the entire hearing, but for this one, I have to.

So this was a question not part of the original 12, but which I believe you were given at some point this morning.

On Map 5-21, the route segment alternative BWZ is identified as an alternative. The Commission, by the way, though, is only interested in the segment south of Richer, and where this segment rejoins BMY west of the

Watson P. Davidson Wildlife Management Area.

That segment is further east of the final preferred route, and is further away from La Broquerie and slightly east of Marchand. So I assume at least all of the Hydro people are familiar with that alternative.

This is approximately -- and we are doing our best guess here, but it is approximately 20 to 25 kilometres long. It was that segment, BWZ -- or at least the portion of it we are talking about -- was considered in Round 3 of the consultations; that's our understanding.

In this Round 3 assessment, BWZ was compared to some other alternatives, including BMY, which also shares some routing with BOB, and that appears -- BMY, that is -- appears to be the final preferred route, or close to the final preferred route.

So our question regarding all of this -- and sorry for the long intro -- what were the identified constraints and opportunities for this segment, and how do they compare with the segment that you did choose?

MS. BRATLAND: Thank you for the question. And we've handed out a couple of

materials for you, and I'm going to put some things on the screen to help us walk through this comparison and discussion. If you will just bear with me for a moment while we get the screen up.

All right. Okay.

THE CHAIRMAN: Go ahead.

MS. BRATLAND: The projector is warmed up enough, so it is not yellow any more.

Okay. So as I understand the question, what you are asking is for a comparison of the segments of BMY and BWZ that split off from each other just south of Richer, and then rejoin again at a more southerly point, west of the Wildlife Management Area. And for the rest of the route, we will just assume it is the same; we are just comparing those two segments for right now.

So I will use the terminology of BMY, which is approximately -- it is the FPR, and BWZ, which is to the east.

As you mentioned, this represents about a 25-kilometre section of the line. Route -- not "Route", Segment -- Segment BWZ is seven kilometres longer. And just to clarify, the segments that make up Route BWZ were added after Round 3 engagement, because of what we heard

during our Round 3 engagement. And they were developed on the concept of utilizing Fireguard 13 as an opportunity to move the route further out of the town of La Broquerie.

So that's based on a mitigative segment.

This is a constraints map, showing these two segments.

I can't figure out how to use this.

But the route to the west would be Route BMY. This is the point just south of Richer, and then this is where the two routes would connect.

Now, I will point out to you here that in the southern area here, this is not what the FPR looks like. The FPR is smoothed out; it doesn't take a hard right-hand angle here. So we are just looking at these two, to this point, for the purposes of comparing these two segments to you and giving you the differences.

Now, as you can see on this map, these yellow dots represent the more dense residential development. So if you can see my mouse here, this is where we pass through the town of La Broquerie, and this approximates the town of

Marchand.

This black blob down here is the Watson P. Davidson Wildlife Management Area, just so that we can all be oriented, and then the existing 500 line is over here.

The pink and red dots indicate livestock operations of different types.

The orange shading over here represents an area of special interest, which is a designation made by Manitoba Conservation.

Underneath that, you can see some bluey-green areas; those are wetland areas.

I'm going to stop, because Carter needs to talk to me.

Now that Carter has sorted me out with the technology, I will get back to explaining my colours.

The dark green areas are generally forested areas.

And the blue dots -- sorry, the blue areas over here are wetlands; the more blue they are, the more open the water. And the other blue dots are other types of buildings.

THE CHAIRMAN: Serge Scrafield, Chair.

Could you repeat the last --

description of the last two kinds of dots?

MS. BRATLAND: So the pink and the red were the livestock operations. The yellow are residences and homes. The blue, I believe, are buildings, other buildings, so they can be a variety of different types of buildings.

Okay. Now, Crown -- Crown land is also represented on this map, and it is the yellow hatched squares. So anything that has a yellow hatch is Crown land. It is fairly difficult to make out, but it is all over here.

So I've handed out to you a table that is similar to a table that we have in chapter 5, that compares the different routes and the final stage, broadly. And so in the time that I had available to do this for you, I was able to pull this together, and it summarizes the two segments and the comparison of them from a potential effect.

And feel free to ask questions, if you want to try and drill down on that, and I will do my best.

I've listed for what segments make up those segments, because they are bunches of other different segments that come together on your

table. But in terms of summary, I will just run you through the two different segments and the difference between them.

BMY -- again, that is the western route that most closely approximates the FPR -- the closest residence to Route BMY is 125 metres away. The concerns that we heard related to Route BMY in this area, on this segment, are related to the proximity to the town of La Broquerie, future development, visual impact, concerns around health and property value.

We also heard concerns about potential agricultural impact in the amount of Class 1 to 3 agricultural lands that could be affected. And we have addressed the concerns of landowners along that portion of the route with specific tower placement and route modifications.

Route BWZ, in contrast, which travels to the east, down that Fireguard 13, avoids the town of La Broquerie, but moves close to the community of Marchand, on the east side of the road. The closest residence is 93 metres. So we are now closer to the closest residence with this segment.

This segment is definitely better from

the perspective of affecting Class 1 to 3 agricultural lands, but it is -- less better? No, that's not a word -- it is less effective at addressing concerns of hog operations and manure draglines, because there are a number of additional livestock operators that would be affected towards the south of Marchand.

We heard feedback during Round 1 from the community of Marchand, because we did have a segment that went east to west in this area, in that round. The concerns heard from that village of Marchand were pretty much the same as the concerns we heard from La Broquerie, regarding proximity, impacts to residences, visual impact, property value, and impediment of future development.

So it is the -- like I said in my presentation previously, similar challenges, different location, different people.

So let's take a closer look at the town of La Broquerie. The location of the current proposed final preferred route, the area here is referred to as Quintro Road. And as you recall, we made an adjustment to the final preferred route to move it further away from Quintro Road and make

it a little more equidistant between these homes and these homes. And I believe the closest home in proximity would be this one here.

This is the village of Marchand. The alignment that is proposed for BWZ, or was evaluated, is on the opposite side of this road. The development of Marchand is to the west, and that's because to the east is the RM of Reynolds, and this is Crown land. So the development generally stops here, with a little bit carved out to this direction. But this community also has a high rate of proposed development and growth in its residential area.

So I just -- I want to turn you to your table, and walk you through the information that I have there. I'm going to go back to the constraints map while we talk about this; I think that would be helpful.

So talking about Route BMY, which is this: From a natural perspective, Route BMY is -- Segment BMY is more preferred, because it avoids more forest and more important habitat.

As you can see in this area, first off, it is longer, so there is seven kilometres more potential effect. There is forest clearing

that would occur in areas that support important habitat. This includes habitat for black bear, deer, and a variety of birds.

It also would introduce additional access in these areas, which could introduce the risk of introducing weed species, and increased access for hunting. It crosses additional wetlands -- actually three times more wetlands -- than the other segment.

So from a natural perspective, it is quite clear that this segment is preferred.

I'm going to go to engineering next, because it is also fairly clear.

Engineering, BMY is shorter. BMY is farther from the existing 500 line. Those would be the two key things that are different. There is also the difference of seasonal construction restrictions, and access. So where we have the more forested land and more wetlands, there is more seasonal construction restrictions, and it is slightly more difficult to access.

So from an engineering perspective, Route BMY is preferred.

From a built perspective, Route BMY is not preferred. And not surprisingly, this is

driven by the Class 1 to 3 agricultural lands that occur on this segment, and the level of proposed development. There are more proposed developments on this segment than this segment, that we have in our database and we are aware of.

The type of agricultural impacts are certainly different on these two routes. There aren't zero agricultural impacts here, because as you can see here, we go through agricultural lands. These lands, though, are predominantly livestock-based, with a hayland land cover, and have that manure application; so when I talked about the fact that there was a little bit more impact to hog production operations, that's down in this area. In this area, we have more Class 1 to 3 agricultural lands.

So for the distinction between the Class 1 to 3 agricultural lands and the value of that to the overall agricultural economy, in terms of the potential effect, built would see this as slightly more preferred than this, recognizing that there is a built effect here, but when you add up all those considerations, BMY would be less preferred -- sorry, BMY would be more preferred.

This is why I wrote it down on the

table, because I'm going to flip those around when I speak, unfortunately.

Okay. So BMY is more preferred from natural, less preferred from built, more preferred from engineering.

What does the community feedback -- the feedback we received from First Nations and Metis engagement and public -- say about these two segments?

I will remind you that because Route BWZ was suggested, and then, as a mitigative segment, it was not drawn and shown to the public or the First Nations and Metis engagement process to gather specific feedback on. It was added and evaluated as per our process. But we do have data, information, and knowledge in those regions, and about the land uses that are of value, to be able to discuss those two things.

From a public perspective, again, the closest residence on BMY is 125 metres. From the public, we heard those concerns around proximity to residences and concerns around private land ownership that are similar in La Broquerie and in Marchand. However, we also heard that impact to Class 1 to 3 agricultural lands, and the

difficulty that causes agricultural operators, is a key concern; and because of this, it was felt that from the public engagement perspective, BMY would be less preferred, because it has that additional impact to those types of agricultural operators.

We do, however, feel and have noted in our EIS that many of these site-specific concerns can be mitigated. And when the community team goes together to make their overall community consideration of a route, that is a very important part of their consideration.

Do we feel the concerns can be mitigated through those site-specific mechanisms, through ongoing engagement, all the different mechanisms we have in place?

From the First Nations/Metis engagement process, based on what we understood and heard, we feel that BWZ would be less preferred.

There are areas that this route crosses that have been identified via oral knowledge through our ATKS studies, through ATK information. They would need to be further ground-truthed in order to determine their exact

locations, but we understand this to be an area with traditional use.

This crosses an area of Crown land that would introduce natural habitat fragmentation, which we understand to be a concern through the First Nations and Metis engagement process.

This is an area of historic and contemporary use, with traditional hunting and trapping areas, heritage resources, and by introducing a segment in this area, on this Crown land, it would increase access to sensitive areas further east.

We heard throughout the hearing that the further east you go, from approximately Marchand, the higher the prevalence of areas of concern and traditional use.

This map is taken from -- I'm going to try and read the fuzziness -- the ATKS management team study. And I just want to point out a couple of features for you here.

First, I will point out that this is not BWZ; this is a segment from Round 2. BWZ would go down here, roughly at the edge of this black box. The town of Marchand is here.

This circle here is a traditional hunting area that was identified. Route -- Segment BWZ would go directly through that.

This black box that's noted here, that the route segment would travel just inside of, is that area of oral -- there is an oral knowledge of traditional use that has been identified in this region. There would have to be additional ground-truthing and studies to be able to find out specifically where that is, but there is a very high probability that those locations exist.

And in general, the areas we heard of with the highest level of sensitivity are east of the town of Marchand. So this area of Crown land, directly east of Marchand, really starts to get into that area of concern that we have heard about.

So from the First Nation/Metis engagement process, Route -- Segment BWZ is less preferred, for those reasons.

So looking at the comparison of BMY west to BWZ east, as stated in the EIS and as summarized here, Manitoba Hydro, through its analysis and evaluation, prefers BMY over BWZ, as we feel that this route has a lower potential

overall effect. It is more preferred on the basis of potential effects on natural environments; it is shorter, with less seasonal construction issues and better access, making it more preferred from the engineering perspective; it is less preferred from the built perspective, because of the degree of potential effects on Class 1 to 3 agricultural lands and proposed development.

And overall, from a community perspective, Route BMY is preferred, because it offers a better overall balance of concerns and perspectives. And the specific concerns heard through the public engagement process, we feel many can be mitigated with site-specific addressing of those considerations.

From a reliability perspective, Route BMY is shorter, and further from the existing 500 kV line, so would have a lower risk for reliability.

So that, in a nutshell, is the comparison between those two segments. I hope that gets at your question, and I'm open to further questions, if you have any.

THE CHAIRMAN: First of all, just a comment: It is remarkable that you were able to

pull that all together in about three hours, so that's -- thank you for doing that. That's a very thorough comparison of the two segments.

So I would ask the panel if they have got follow-up questions.

I have a few questions that I would qualify as clarification questions.

The source of the map at the bottom of page 3 on your handout, the title of it is "FNMTP". You gave the source; I just didn't catch it.

MS. BRATLAND: Here, I will give you some specifics. Sarah will give you the specifics.

MS. COUGHLIN: You can find that map located on page 13 of the ATKS management team's community report.

THE CHAIRMAN: Sorry, page 13, of ... ?

MS. COUGHLIN: The ATKS management team's report. It is a self-directed study completed by Swan Lake, Long Plain, and Black River First Nation.

THE CHAIRMAN: Okay.

In the report itself, chapter 5 -- and

I don't have the table numbers with me -- but there appeared to be more potential developments along -- I realize these are full-length comparisons, so it could be different for the segments -- but along BMY than there was along BWZ.

Now, I thought I heard here the opposite.

MS. BRATLAND: No, you are correct. There is more proposed developments along BMY.

THE CHAIRMAN: Okay, good. Thanks.

You noted that the line is closer -- the BWZ line is closer to the 500 kV line. Is it, or is a portion of it within the buffer?

MS. BRATLAND: Yes. It is within ten kilometres.

THE CHAIRMAN: And how much of it? Do you know?

MS. BRATLAND: I don't know offhand, but I can certainly get that information for you.

THE CHAIRMAN: That would be good. Thanks.

(UNDERTAKING # MH-14: Advise how much BWZ line is within buffer)

THE CHAIRMAN: And if I understood

correctly, because this segment was developed after the third-round consultations -- first of all I've got that right, I think? Right? It was not shown as part of the consultation, the First Nation/Metis consultation process. Therefore there wasn't necessarily a reaction to the specifics of that line.

MS. BRATLAND: Yes, because of the nature of when mitigative segments are developed, it would not have been shown publicly through the PEP or the FMF process, until such time as it was filed with the EIS.

THE CHAIRMAN: Thank you for that.

I'm just checking my notes here.

Would it be possible to send us the maps in electronic form?

MS. BRATLAND: The maps that I included there?

THE CHAIRMAN: Yeah.

MS. BRATLAND: Sure.

THE CHAIRMAN: Okay, good.

All right. That finishes the -- my clarification questions. We do have a couple more questions which you have not had beforehand, so you can choose to answer them now, of course, or

take them under advisement.

So we will start with Mr. Nepinak.

MR. NEPINAK: Mr. Matthewson, earlier, at the beginning, we talked about some pictures that I've taken of Bipole III. And we didn't -- this isn't on record; it was not part of this. But I had some interest in pulleys or sheaves that are hanging off of the insulators. Are those going to -- and I believe you answered it, or -- do you recall the conversation?

MR. MATTHEWSON: I believe it was probably pulleys hanging from the insulators for the purpose of stringing the conductor.

MR. NEPINAK: Yes. Were those permanent?

MR. MATTHEWSON: No, the pulleys are removed, and the insulator is clamped to the conductor.

MR. NEPINAK: All right. That's all I need to know, because if they were, I wanted more explanation of what they would -- what their purpose was. So ...

MR. MATTHEWSON: They are simply to allow the pull line for the conductor, and the conductor -- because the conductor is pulled over

approximately a three-kilometre distance, it is pulled in those travelers, and tensioned, and then attached to the clamp, and ...

MR. NEPINAK: Actually, I am going to ask: This morning we heard that we will probably experience higher winds in the near future, by Mr. Beckwith, in the climate change. Are the towers built to -- now, there was -- what was it, 105-kilometre winds? Straight -- I forget the terminology.

What is the breaking strength at that point where the lines are connected?

MR. SWATEK: I don't have that information on hand, but we can undertake to find that for you. Can you repeat the question exactly? And we will make sure we have that.

MR. NEPINAK: Okay. At the point of connection, where lines are connected -- and from what I've seen they are connected under the -- they seem to have some kind of connection at the insulator. Is there a breaking point at that connection?

MR. SWATEK: There would be a breaking point, but that connection is welded via an implosion technique. I'm not an expert in that

process, but subject to check, that is probably one of the stronger locations on the line.

MR. NEPINAK: Okay. So what would the breaking strength of the line itself be, then?

MR. SWATEK: Okay, that's a figure I would have to search out.

MR. NEPINAK: Okay. I imagine it would be in the hundreds of thousands of -- simply because I used to work wire line in the oilfield, and seven-sixteenth lines, we had a -- I believe we had a 20,000- or a 50,000-pound breaking point of that line. And ...

MR. SWATEK: We can find that.

MR. NEPINAK: All right. Thank you very much.

THE CHAIRMAN: Mr. Gillies.

MR. GILLIES: This may not be a question for the panel; it might be more directed to your legal counsel.

Yesterday we had fairly lengthy discussions over the potential for diminished access to Crown lands as a result of the right-of-way. My first question, do you use easements or permits to cross Crown lands for rights-of-way?

MR. BEDFORD: I think the simple answer is using Bipole III as an example, both an easement from the Province to Manitoba Hydro, a Crown corporation, and a series of work permits that authorize specific working activities on Crown land.

My understanding is the Province may be rethinking the issue of granting Manitoba Hydro an easement for the MMTP project, as yet undecided, but historically the experience has been both an easement and permits.

MR. GILLIES: Okay. My follow-up question, then, is: In current practice, is there any language in those easements and permits that speaks to concerns over constitutional rights of access or use of lands in the right-of-way?

MR. BEDFORD: I would say no. There is a lot of language that one would naturally expect from a regulator, that tightly tries to determine or dictate what is allowed and what is not allowed and when it can be done. But in my experience, there is no power -- as was said yesterday in evidence -- that delegates to my client, Manitoba Hydro, a right to evict people or to tell people when they can or cannot practice

traditional or recreational activities.

MR. GILLIES: Thank you.

THE CHAIRMAN: All right. Thank you, panel, for the questions. And thank you, Hydro for some, again, very comprehensive responses.

There is a couple of items I think coming back to us that were taken under advisement, so we will look forward to receiving those. And I will turn it over to the secretary for anything we have to table or file.

MS. JOHNSON: Yes, Mr. Chair. We have MHO68, will be the comparison table we have in our hands. And 069 will be the small presentation we just saw.

(EXHIBIT MH-068: MH Comparison table)

(EXHIBIT MH-069: MH presentation)

MS. MAYOR: Mr. Chairman, we have one matter to clarify from yesterday in the afternoon. There was a question asked about -- or there was a comment made during the presentation yesterday about what exactly Manitoba Hydro was applying for and whether or not it was the FPR, if you remember; and I think, Mr. Gillies, you talked about it a little bit in your question. And we just wanted Mr. Matthewson to clarify, so there is

no question in anyone's mind as to what is being applied for.

MR. MATTHEWSON: Yes. So all the maps in the environmental impact statement that contain a blue line, labeled "Final Preferred Route", is the -- so there are maps that are very large-scale maps, but there is also a map folio, as part of the EIS, which contains very large-scale imagery, with imagery showing where the FPR is in relation to parcels of land, and exactly which parcels of land it intersects. It is also coloured blue, and labeled the "Final Preferred Route" in those maps.

MS. MAYOR: And just one other point; I'm getting signals from Ms. Bratland that she may have one of the answers that you requested this afternoon. I'm going to let her do that, rather than make you wait for it.

THE CHAIRMAN: Sure. Go ahead.

MS. BRATLAND: Your response related to how much of the segments are within the 10-kilometre buffer.

For BMY, there is 4.56 kilometres, and BWZ, there is 26.05 kilometres within the 10-kilometre buffer.

THE CHAIRMAN: And what was the size

of the buffer, again?

MS. BRATLAND: Ten kilometres.

THE CHAIRMAN: Thank you.

All right. Mr. Beddome, I believe, wanted to ask a question.

MR. BEDDOME: Thank you very much, Mr. Chair. Just a real quick question for clarification.

I notice there was a couple of undertakings specifically with the communication plan. It is just for incorporation into any closing submission, if it doesn't come in time, I take it we would just have to deal with it via further written submissions; I think the deadline is June 15th. Is that my correct understanding? I just wanted to make sure of that.

THE CHAIRMAN: Let me begin by asking Manitoba Hydro how soon that communication plan -- I realize it is a draft, but how soon it could be gotten to us.

MS. BRATLAND: We can have a high-level draft to you on Monday.

THE CHAIRMAN: All right. So we will have it Monday. So that will be --

MR. BEDDOME: As I understand it, I

guess I will be doing closing submissions on Monday, so that's fine. If there is anything to address from it, we would address via written submissions.

THE CHAIRMAN: Yes, there will be a week or so after the close for that, so absolutely, you could address it in the written submission.

MR. BEDDOME: Thank you.

And just one quick comment: In future, it might be helpful to circulate the questions to all participants, not just Hydro to the CEC. I don't believe it was circulated; maybe I'm mistaken on that, though. It is just a comment; it's not ...

THE CHAIRMAN: All right. We will take that under advisement. Thank you.

MR. BEDDOME: Thank you.

THE CHAIRMAN: All right. Then I've got a couple of closing remarks.

So we are back next week -- this is it for this week, by the way -- and we will be back in the Pan Am Room at the Convention Centre; I think you all know where that is, on the second floor.

Hydro has indicated that if they have rebuttal, it will be short. That's my latest understanding.

Did you want to add anything to that?

MS. MAYOR: There won't be any rebuttal.

THE CHAIRMAN: So there will be no rebuttal from Hydro on Monday. Therefore the schedule will be moved up, and we will do the final arguments -- they will be starting Monday morning, and should wrap up, we are expecting, by the end of Tuesday.

So participants should be ready to appear in the order established at the beginning of the hearing, and I believe you all have that order; if you don't, you can obtain it from the secretary.

And there will be more details provided about this, provided to the participants tomorrow.

All right? Thank you.

Okay. Thank you all very much, and we will see you Monday morning.

(Adjourned at 3:00 p.m.)

OFFICIAL EXAMINER'S CERTIFICATE

Cecelia Reid and Debra Kot, duly appointed Official Examiners in the Province of Manitoba, do hereby certify the foregoing pages are a true and correct transcript of our Stenotype notes as taken by us at the time and place hereinbefore stated to the best of our skill and ability.

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Official Examiner, Q.B.

Debra Kot

Official Examiner Q.B.