MANITOBA CLEAN ENVIRONMENT COMMISSION

REGIONAL CUMULATIVE EFFECTS ASSESSMENT

WORKSHOP

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Transcript of Proceedings
Held at Manitoba Hydro Building
Winnipeg, Manitoba
THURSDAY, JUNE 15, 2017

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CLEAN ENVIRONMENT COMMISSION

Serge Scrafield	- Chairman
Terry Johnson	- Commissioner
Glennis Lewis	- Commissioner
Neil Harden	- Commissioner
Tim Sopuck	- Commissioner
Cathy Johnson	- Commission Secretary
Phil Shantz	- Consultant
Doug Smith	- Report writer

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AGENDA TOPICS:

THURSDAY, JUNE 15, 2017

UPON COMMENCING AT 8:30 A.M.

MS. ZACHARIAS: Okay. I was going to quickly -- I'm Allison Zacharias, by the way. I work at Manitoba Hydro, in the Environmental Licensing and Protection Department. I was going to start by reviewing the agenda for the day.

So I don't have my back to anybody. Sorry.

Okay. So as far as the day, this is how we have broken it up. We are going to have Tracey Braun come up and give an introduction, talk about the purpose of the workshop and the RCEA terms of reference. I'm going to do a presentation on the RCEA methodology.

We are then going to have the Manitoba Hydro system description, which will be done by Nick Barnes. The People section, which will be done by Laura McKay.

We'll take a break. We then have the physical environment sections; that will be done by Brian Giesbrecht for the water regime, and Wil DeWit for the erosion sedimentation.

We will then start our water technical presentation with an intro water quality

presentation by Megan Cooley at North/South. The fish community and fish quality by Richard Remnant, North/South. We'll have a lunch break in there; lunch will be provided.

We'll then continue after lunch with water presentations. We have a sturgeon presentation by Cam Barth, from North/South. Mercury in fish, Wolfgang Jansen, from North/South, and seals and belugas by Chandra Chambers, from North/South.

And then we will move into the land technical presentation. We will have the intro on intactness and terrestrial habitat, which will be done by James Ehnes from ECOSTEM.

We'll then move into waterfowl, moose, colonial water birds, polar bears, by Rob Berger at Wildlife Resources Consulting, and then some caribou herds will be done by Joro Consulting, Doug Schindler.

We'll then take an aftermoon break, and then we're going to go into our integrated summary report. This is the summary report based on the Phase II report. And we are going to have Gary Swanson talk about the process that we undertook to come up with that report. And then

Don MacDonald and Rachel Boone, to talk about some of the findings coming out of that report.

Then we will have open discussion, and then Shelly Matkowski is going to end up with wrapup and next steps.

So, any questions before we get started?

So, because this is being transcribed, we have to make sure that our transcriber can clearly hear everyone. So if there are questions that are coming up, and if she can't hear answers, you may have to come up and use the microphone. She'll give us the signal if she can't hear what we're saying.

Okay. So, with that, I will turn it over to Tracey Braun.

MS. BRAUN: Great, okay.

Good morning, everybody, and welcome to today's workshop on the Regional Cumulative Environmental Effects Assessment, also known as RCEA. I'm pleased to provide the introduction to you today. And with that, I will get into -- see if I can use this machine here. There we go.

So the purpose of today's workshop is to provide an overview of the RCEA process and

what the key findings were of that process, and to provide information to the Clean Environment Commission members to assist with their public outreach process, which is just beginning early this spring and throughout the summer.

With that, I would like to introduce the members of the Clean Environment Commission. Here is -- Mr. Scrafield is the Chair of the Commission. And we have Cathy Johnson, who is the Secretary to the Commission.

And did I miss anyone else in here? No? Okay.

MS. ZACHARIAS: I think there are additional members.

MS. BRAUN: Oh. I apologize. Okay.

I would like to introduce the other members of the CEC. Could you raise your hand for me, and -- Serge, can you help me out?

THE CHAIRMAN: Sure.

MS. BRAUN: Sorry, I don't know their names.

THE CHAIRMAN: Terry Johnson, and Glennis Lewis. And Neil Harden. Doug Smith. Phil Shantz, who is our consultant. And Tim Sopuck.

MS. BRAUN: Okay. Thank you. Sorry about that, Serge. I didn't mean to put you on the spot. I really didn't.

So -- okay. Background, and terms of reference. Where this all came about: Some of you may remember back in the Bipole days, in the hearings, the CEC at the time wrote a report with licensing and non-licensing recommendations. And one of the non-licensing recommendations was as we've said it here; I'm not going to read the exact assignment here. You can see it there.

But basically they recommended that a full Regional Cumulative Effects Assessment be done for a specific area in the north of Manitoba before any future licences would be considered or granted -- with the exception of Keeyask, because that project was already underway, in terms of the regulatory side.

So, that is what kicked this off. And the Minister at the time agreed to adopt this recommendation, and that's how we started to do this work.

So, the terms of reference for the RCEA were developed and approved by -- in cooperation with Sustainable Development, and also

by Manitoba Hydro. And the terms of reference basically provide the scope, the study approach, the challenges, the end products, the process for collaboration between Manitoba and Manitoba Hydro, and then of course the schedule.

Those terms of reference are available publicly on the registry and websites. One of the things -- key things in the terms of reference is we were going to be able -- what we wanted to do was identify and describe what the cumulative effects had been up in the North, and document those, and then how those cumulative effects impacted the people that lived in that area over the past, and then what can we do going forward, what kind of monitoring should we implement, what sorts of next steps should we be doing, based on our assessment of those two things. That was the overall objective of the study.

And it was -- here again I am going into a little bit more detail in the terms of reference. But it was to identify and describe, as I mentioned, that -- describe the current state of the environment. And it was really based on a review and synthesis of past and ongoing studies and monitoring programs. And it came in -- and it

included hydroelectric developments along the Nelson, Burntwood, and Churchill River systems.

And we actually ended up deciding -- the working group decided on doing an area larger than that, because from an environmental consistency perspective, it made sense to extend the area a little bit larger. So that's what we did.

And we made a commitment at the beginning of the project, and I believe it was back in 2015, that we would do some form of public outreach. Again, we weren't sure exactly how that would look, but that's the commitment that we made. And between the two organizations, we developed a working group team. And that's how we kicked this whole thing off.

Is that the end of my slides? Is it? Okay.

Well, I wanted to just identify a couple more things. One is that if -- we decided, because of the volume of work that had to be done, is that we wanted to do it in chunks, you know, sizeable chunks. So we started off with going and taking all of the information and monitoring that had been done in this area for the past, you know,

30 years or so, way before the days of computers and that sort of thing, when people used typewriters and files and things like that.

So the folks at Manitoba Hydro really put a huge effort, over six months, in getting all of this past historical information and making it electronic, so that it would be available for future generations, and that it won't be lost.

And it really -- it wouldn't be a fun task, so to speak, because it involves a lot of -- you know, putting the stuff in a -- you know, putting it electronically. But it certainly is worthwhile in terms of the future development in the area, because any time anybody wants to go now and do something there, they have the history of data to be able to build upon in the environmental impact approach.

So it was a good exercise to do, and it was finished in a report that was basically a Phase I report. And it is just a report that has all of the information in it. It is a large compendium of information. It is not meant to be read from cover to cover. It is there as a resource.

Then we embarked on Phase II of the

RCEA. And Phase II basically was taking all of that information and getting a working group together and setting out what are the key things that we would want to assess in terms of cumulative effects.

So we came up with some measures, and you will be hearing about those later today. And then we started to assess the current environment against those things.

And that was our Phase II report. And that was finished, I believe, in December of last year.

And both of those reports and all of that information is available on the websites and electronically, and I think our working group is confident that it will become a good source of information for Manitoba going forward.

We also developed -- because we wanted to have an easier-read-type document, what we call an executive summary. And it takes all of that work and puts it into a simple language format, and could be used as we go into our next stage, which is where we are right now, the public outreach. And that document, the summary document, will be used to help facilitate that

public outreach.

And that's where we have the Clean Environment Commission coming in. They have kicked off that program, and that's where we are right now. I anticipate it to take place over the summer, and sometime in the fall we will get some feedback, or towards the end of the year. And then that feedback will help us to conclude what the final part of our terms of reference is, which is what do we do going forward, and what kind of monitoring should be undertaken to continue to manage this area appropriately for future generations.

So that's my introduction. I'm sorry I eliminated the slide. I wasn't supposed to do that, but anyway, I did.

Unfortunately, I will not be able to be with you here all day today, but I would like to introduce two of my representatives, should you have any questions of the Environmental Approvals Branch.

I can't remember if I introduced myself at the beginning. I'm Tracey Braun; I'm the director of the Environmental Approvals Branch with Manitoba Sustainable Development.

I would like to introduce Darryl Guenette and Bruce Webb and Rob Matthews, are all in my branch. They will be here with you all day today. So if you have any questions, from a government perspective, please feel free to ask them. They are very friendly folks, and I'm sure they will be happy to talk to you.

With that, thank you very much, and enjoy your day.

MS. ZACHARIAS: Any questions for Tracey before we move on?

Thank you. Okay. I'm going to talk about the RCEA methodology. So, as I mentioned earlier, I'm Allison Zacharias; I work here at Manitoba Hydro.

Tracey nicely touched on this, so I don't have to go into a lot of detail, but we did undertake a phased approach for the Regional Cumulative Effects Assessment.

So we did a Phase I, as Tracey mentioned, that was completed back in May 2014. This was considered what we called an interim product, and it provided an early indication of the approach and available documentation that would be used to undertake the RCEA, Phase II.

This was also an opportunity for Manitoba and Manitoba Hydro to get together and ensure that we were all on the same page with respect to the approach for Phase II.

We then undertook the Phase II, which was completed in December 2015. And this document, quantitatively where possible, or qualitatively, describes post-project cumulative effects of hydroelectric development on the people, the water and land in the region of interest, and I will speak about region of interest on the next slide.

It also describes, to the extent possible, the current health of the ecosystem in the region.

So with respect to the spatial scope, or the region of interest, as we call it, this area was selected to encompass the main areas directly affected by Manitoba hydroelectric development associated with the Lake Winnipeg Regulation, Churchill River Diversion, and associated transmission and infrastructure projects. So it included the Nelson, the Burntwood, and the Churchill River systems.

As Tracey mentioned, this region

encompassed a broader area than was recommended by the CEC in the Bipole III report. The Bipole III recommendations spoke about the Nelson River subwatershed, and specifically mentioned that at a minimum, we needed to include Jenpeg, Kettle, Long Spruce, Limestone, Bipole I, Bipole II, Bipole III to the extent possible, and associated infrastructure in the RCEA.

So, recognizing the impacts associated with the Churchill River Diversion, we felt it was important to ensure that we were including both Lake Winnipeg Regulation and the Churchill River Diversion in this document, and also recognizing that a lot of the concerns that the Clean Environment Commission had heard came from communities affected by not only Lake Winnipeg Regulation, but also the Churchill River Diversion. This area also encompasses resource management areas, as well as registered traplines that have been also directly impacted by hydroelectric development.

So this map shows the region of interest. You can see the black line outline here shows the entire region of interest. And as I said, it includes the Lake Winnipeg Regulation,

Churchill River Diversion, transmission and associated projects.

Continuing on with scope, as far as the information that was used for the RCEA, we used, to the extent it was available, pre-development data to describe pre-development conditions. We also then used information on hydroelectric-specific effects that had been collected from approximately 1950s to the present date.

As far as the developments that we included in the scope, it was all existing Manitoba Hydro development, starting with Kelsey GS in 1957 to present, which we took up to 2013.

As far as developments that were currently under construction in the region of interest, including Bipole III and Keewatinook Converter Station and Keeyask, the information was used to the extent possible.

While the RCEA focused primarily on Manitoba Hydro impacts, we also did look at non-hydro projects and activities, to the extent that they provided either important context for the assessment or additional information relevant

to understanding the current state of the environment.

Often we found, when we were undertaking the assessment, it was difficult if not impossible to tease out Hydro-specific effects from other factors that had been happening in the region, whether it be domestic harvest, commercial harvest. And so we did try to include that information, because that was part of the story as well.

And then as far as additional information on understanding the current state of the environment, when we were looking at something like habitat fragmentation, we took into account other projects and activities on the landscape as well.

So, as mentioned, this is a retrospective study that used, to the extent possible, actual contemporary environmental assessment and post-project assessment methodology to meet the objectives of the terms of reference.

It is important to note that the differences in environmental assessment requirements from the 1960s and '70s to present day has really influenced the type and the

quantity of available data that was used to conduct the RCEA.

So, while Manitoba Hydro met the requirements of the time, we need to acknowledge that environmental assessment methodology has evolved from being nearly absent in the '70s to more of an ecosystem-based approach in the 2000s. And that -- as I mentioned, these have influenced the methods that were used for RCEA.

So as far as information sources, I won't go through this in a lot of detail; there is a lot of data on this slide. But suffice to say that a very comprehensive literature search was undertaken, and there were lots of different pieces of information that were pulled together for the RCEA. This information came from many different sources, including Manitoba Hydro, Manitoba, federal government, affected First Nations, as well as others.

Also important to note that some of the early studies in the '70s and '80s, the issues -- the way the studies were focused were more issue-specific. So it might have been a particular fish on a particular water body. So again, that affects the type of data that's

available from the '70s and '80s.

As we moved into the '80s and '90s, the scale started to get a little broader for the assessment. And then we come to current day, where we are looking at a more ecosystem-based approach to monitoring conditions.

For example, the Manitoba/Manitoba Hydro coordinated aquatic monitoring program, we relied heavily on the data from that program, as well as environmental assessment baseline studies for some of our recent developments, including Bipole III, Keeyask, Wuskwatim.

There are some challenges in undertaking a retrospective assessment dating back many, many years. And just a few examples of some of the challenges: Quantitative pre-development data is really hard to come by. So to the best of our ability, we included it where we could.

Also data sets, over time, change. So, whether it is analytical methods or equipment, that will also affect how you can use the data sets and how you can compare between data sets.

Also, as I mentioned, differences in the types of study or the objectives of the study; that sometimes makes comparisons between data sets

difficult. And the ability to quantify effects from Hydro being masked by other factors or effects from other activities.

So, again, the fact that there are a lot of other projects and activities happening throughout the region of interest, and it is very difficult at times to pull out hydroelectric-specific effects, because of these other compounding factors.

Also, Regional Cumulative Effects Assessments are typically government tools. They are used for planning purposes for regional development. The Clean Environment Commission and terms of reference speak to assessing past Manitoba Hydro developments, and the fact that major decisions about this area were made over 40 years ago, and so there has likely been some confusion with the term "Regional Cumulative Effects Assessment."

As far as the Phase II report, the structure, at a high level, it was broken down as follows: We had an introduction and approach. We talked about hydroelectric developments in the region of interest. We had a section on people, physical environment, water, and land.

I did want to mention that originally we had talked about identifying data gaps as part of the Phase II reporting process. As part of Phase II, we did hear some concerns from communities that they were not being consulted as part of the Phase II process, and so we thought that it would be faster for us to hold off on presenting what we felt the gaps were until we completed outreach and heard the perspectives from communities.

So things like data gaps will be considered as part of our "next steps" approach.

So as far as healthy approach to the People section of the Phase II report, it documents Manitoba and Manitoba Hydro's understanding of the socio-economic effects, hearings by communities throughout the region of interest, and it is broken down by type of development, generating station versus transmission. It also provides a summary of key settlements, or settlement agreements programming, mitigation, and remedial works that have been established that address these effects.

This is just one of the maps that was used in the People section, and Laura McKay will

probably speak to it a little bit more in her presentation. But basically it outlines both the resource management areas and registered traplines for the key communities in the region of interest.

As far as the general approach to the Physical Environment section, this section describes the key changes to the physical environment resulting from hydroelectric development, and includes changes to water regime, ice regime, erosion, sedimentation, area flooded, and terrestrial landscape changes.

This is one of the maps that was used in the Physical Environment section. You can see that the areas throughout the region are broken into four areas: Area one, which is the upper Nelson; area two -- sorry, area two, which is the lower Nelson; area three, which includes Southern Indian Lake and the Churchill River Diversion; and area four, which is the Churchill River.

In the Physical Environment section, they then further subdivided those areas into what they called hydraulic zones of influence. And Brian Giesbrecht I'm sure will talk more about those hydraulic zones of influence and how they were chosen.

As far as the general approach to the Water and Land sections, we provided an assessment of the effects of hydroelectric developments on both the aquatic and terrestrial environment, and where possible, quantitative description was provided. And where sufficient data was not available, a qualitative description was provided.

In order to try to focus the Phase II assessment for the water and the land, we developed what we called regional study components. So we came up with a set of criteria for determining regional study components, and these included importance or value to the people and communities in the region; whether something was considered an umbrella indicator for groups of species and ecosystem components; its importance or value to the overall ecosystem functioning; and whether it was susceptible to direct or indirect effects from hydroelectric developments.

So this lists the water and land regional study components that we came up with, based on the criteria. So for water, we have water quality, fish community, lake sturgeon, mercury and fish quality, beluga whales, seals.

And on the land side, we have

terrestrial habitat, intactness, colonial waterbirds, waterfowl, aquatic furbearers, moose, caribou, and polar bears.

Both the approach to water and land used a "pathways of effects" approach. For the water assessment, to provide the most meaningful assessment, we broke down the region of interest, again, into those same areas that were used in the Physical Environment section, so areas 1 through 4.

And then for each water RSC, they were further broken down as made the most sense for the RSC. And typically it was dependent on the development for each area, hydroelectric generating station, how it was operated, et cetera.

And so areas were further decided, and then cumulative changes across the region of interest as a whole were then discussed.

For the land assessment, again, to provide the most meaningful assessment, land regional study components were broken down into six ecozones throughout the region of interest. And then these ecozones were further broken down to terrestrial regions, as it was found that

ecozones were too broad to assess effects.

The assessment areas for wide-ranging populations, such as the barren ground caribou, that move well beyond the region of interest, were based on the population's range.

So, given the strong link between habitat changes, the effects on wildlife populations, and then the effects on resource users or harvesters, the regional study components for land were broken into two -- broken down to two scales.

So a local scale, which acknowledged that there has been substantial effects as a result of particularly hydroelectric generating stations. So the fact that shorelines have been substantially affected, and that by affecting the shorelines, this has then affected the wildlife's ability to use the shoreline, which then affected the resource harvesters in the area.

So if we only looked at the regional scale, the localized effects, which have been profound for the communities, would have been lost on a regional scale. So we felt it very important to acknowledge those impacts.

Then things were wrapped up at a

regional level, and we describe the cumulative effects on the terrestrial regions.

This map, the different colours denote the different ecozones. There are six ecozones throughout the region of interest, and those ecozones were further subdivided into 17 terrestrial regions for the purpose of the assessment.

We also then developed appropriate indicators, metrics, and benchmarks for each of the regional study components.

So just as an example, so under water quality, which was one of our regional study components, one of the indicators was water clarity. One of the metrics, because there were three under water clarity, was total suspended solids. And the benchmark that we used to compare against was the Manitoba Water Quality Standards, Objectives, and Guidelines.

So, again, that is one example of the indicators, metrics, and benchmarks that were used for the various regional study components. And additional details will be provided in each of the specific RSC presentations.

So, in summary, submission of the

Phase II report in December 2015 fulfilled the CEC's recommendation. At over 5,000 pages, it is a very comprehensive collection of environmental and community knowledge, and we feel that it will be a very important resource for Manitoba as a whole.

And as Tracey mentioned, from it we did develop an integrated summary report, recognizing that 5,000 pages is a lot of information to go through. So we do have a presentation talking about integrated summary later as well.

That's it. Any questions on methodology?

If anyone wants to top up a coffee, or -- there are some waters that have come. Please help yourself.

If not, I will introduce Nick Barnes, who is going to give the history of hydroelectric development in the region of interest.

MR. BARNES: Thanks, Allison, and thanks to the Provincial EAP reps and the Clean Environment Commission representatives here today.

As you probably know, it is going to be a very information-heavy day, so hopefully you

can get something useful to help you in your process.

My job today is to talk about the history of hydroelectric development in the region of interest. As Allison mentioned, my name is Nick Barnes. I'm currently with the Licensing Environmental Branch of the transmission staff. I actually joined Hydro in 2000 to coordinate the environmental assessment of the major generation projects that we had as well; Keeyask, and potentially Conawapa at the time.

It's funny, when I was assigned this task, I was thinking back: You know, I've actually been working on Manitoba Hydro projects for more than 30 years. My first job in Manitoba was to work on a portion of the Lake Winnipeg Regulation project. And as we got that -- I worked with Provincial Fisheries on the Limestone project, and I did my master's thesis on the subject in Lake Missi Falls. So I've got some hands-on experience with some of the elements I'll be talking about today.

So, basically I'm going to be talking about this graphic, which if you've read the integrated summary, you will notice -- I think it

is on page 9 -- talking about basically where we are at right now and how we got there, in terms of Manitoba Hydro.

So I'm not going to spend a lot of time on this, but I'll give you some examples of the information that's on this graphic right now.

I thought I'd start with Manitoba Hydro, what we have at the present time, our current integrated system. As you know, it's primarily water-power-generated hydroelectricity. Renewable resources. We have 15 generating stations. I think we have six in the region of interest, potentially seven, hopefully seven, in the very near future.

We have a number of other aspects to the utility, a lot of potential still remaining in the province in terms of resources. We have a number of wind farms right now, a couple in Southern Manitoba. We have a couple of thermogenerating stations.

We have, obviously -- every generating station needs to have transmission lines, so we have quite a network of transmission distribution lines in the province. And in those remote areas in Northern Manitoba, we still have a number of

diesel facilities. As I mentioned, we have an integrated system in terms of generating electricity. So that's where we're at right now.

Actually, you can go back a further step in the past and talk about electricity in Manitoba and where things came from. It started in the -- I guess when -- European settlement, and Winnipeg being the gateway to the West, a lot of activity in Winnipeg in terms of electrical development. A number of independent companies generated and sold electricity. And development, primarily in rural areas, agricultural development was really expanding quite rapidly, so there was a need to provide power.

What evolved was a number of independent companies providing that power. And there was a recognition by the Province that there was a need to coordinate the growth and development of electricity. So there was the formation of the Manitoba Power Commission, whose primary function was to try and manage and consolidate responsibility for power generation.

After the War, a lot of industrial development in Winnipeg, and Manitoba in general. So, again, a sort of almost exponential increase

in the need for electricity.

The Winnipeg River was developed further. The hydro generation on the Winnipeg River certainly began at that time. And there was a recognition of the need to maybe be more structured in the planning of developments.

And that's probably one of the primary reasons that the Manitoba Power Commission and the Manitoba Hydroelectric Board joined. 1949 is when the Manitoba Hydroelectric Board was established to do that more structured forward planning. And then in 1961, there was a merger of those two organizations, to really look at basically what we had and where we're going in a more structured kind of way.

So there was a lot of development, and recognition that there was a need to really do some forward planning in how we supplied that. The Winnipeg River facilities had pretty much been tapped out, and there was a search for -- how are we going to supply this electricity?

There were a couple of factors -- probably more than a couple of factors, but two primary factors that actually caused the activity in our region of interest. One was in the late

'50s and early '60s, development of this high-voltage direct-current technology. Transmission lines had been alternating current. And this technology, that allowed much less line loss over long distances, really was a catalyst for development in the North. AC transmission, five, six hundred kilometres, was really not being efficient, and Thompson is more than 730 kilometres away from Winnipeg, so it wasn't feasible to bring power.

So, it was that, in combination with -- I think actually it probably stimulated as part of the transfer of some of the Northwest Territories to Manitoba in 1912 or so, and there was a big federal study in what is now Northern Manitoba, by the Department of Mines. And one of the focuses actually was to look at power development in the Nelson and Churchill River. So there was that really good, detailed data base, which seemed to demonstrate that there was a lot of opportunities.

So those two things in combination, the fact that there was another source available, and to get that power down to the South was what stimulated the Federal/Provincial development.

And it was actually the formation of the Nelson River Programming Board in 1963 that began to, in a very organized way, look at how we are going to extract that power from primarily the Nelson River.

So there were a number of projects developed, as you heard; Allison touched them. Lake Winnipeg Regulation, that had evolved. I guess initial studies of that was looking at controlling Lake Winnipeg, primarily for flood, from a flooding perspective; local land owners, Lake Winnipeg. And there looked to be some opportunities with that project.

The diversion of the Churchill River into the Nelson was another obviously big component. And then of course developing a generating station to start with, and an HVDC transmission line to bring that power down South. So those were the key elements of the first phase of activity.

Just to sidetrack, just so we are aware, it was -- this activity and development was also done in a very different age, in terms of societal development, and governments took a very paternalistic kind of perspective in developing

projects and so on. There were a number of very strong pieces of legislation, both federal and provincial, but there wasn't detail in terms of some of the environmental aspects, environmental and socio-economic aspects.

We had the Federal Constitution Act, but it was much later that there was the sensitivity to Aboriginal rights. The Federal Fisheries Act, we get to have a policy that defines some of the details.

Interestingly, in 1968 is when we had the Clean Environment Act, where the Clean Environment Commission was established, with quite a limited role to today, so it was a more limited role than today. It was more an approvals role back in the '60s.

So there was legislation, but not the type of legislation that put a lot of constraint, and a very different mindset in terms of development, which influenced how things evolved.

The other thing I want to mention -- I think Allison touched on it too -- yes, hydro power development dominated this area that we're talking about, but there were other activities occurring; throughout the project, there were

other things occurring. Railways, commercial trapping and fishing, mining roads, and so on. So we weren't the only game in town, for sure, but we were certainly probably the biggest.

So the other thing I want to mention is -- actually, interesting enough; this was prior to the formation of Manitoba Hydro. The Manitoba Hydroelectric Board responded to a request from Inco, in the Thompson area, to provide a source of power for the mining development; a big stimulus for the development of Thompson.

So there was an initiative to develop the Kelsey Generating Station on the Nelson River to provide -- it was all AC power -- to provide that local power source to Inco.

So we're talking about the time frame now, and again, if you're looking at the RCEA study, 1950 to 1976 is the phase that we're talking about right now.

So, all four of those projects I mentioned previously, developed by the Nelson River Programming Board, were constructed between 1966 and 1976. And the elements -- I'll use this screen over there; hopefully everyone can see this.

So we're talking about the CRD project, which was basically providing control on either end of South Indian Lake, Missi Falls to the north and Notigi to the south, raising the lake 10 metres, diverting basically 80 per cent of the Churchill River through a channel that connected the Rat River and the Burntwood River into Split Lake, and into the Nelson drainage basin.

There was a need to develop reliable power in the Nelson River. One of the challenges that we have in development of electricity is it doesn't match the natural flow of rivers. We get the spring freshet, and then of course things dissipate with the summer. The needs for electricity are typically in the winter, when it's cold, and in the summer, when it's hot. So that's when your big power supply needs are. So there was a need to kind of develop a power source that met those needs, and that required reservoirs. So that was one element.

The other big project was the Lake Winnipeg Regulation, and that was developing a control structure at Jenpeg, and doing some channel modifications to make the flow of water --

particularly in the winter time, with ice issues -- more efficient into the system. And as I mentioned, the generating station and the HVDC transmission line.

So I'm going to just briefly go through those examples. We have the generating station, the Kettle generating station, and that was -- construction started in 1966 and went until 1974. We had the HVDC transmission lines. One was Bipole, and because they established a big right-of-way, they were able to put both the Bipole I and Bipole II in the right-of-way.

Converter stations: When you move electricity through -- high voltage, direct current -- you need to bring it up from alternating to direct and then take it back down to alternating. So there was a need to put converter stations both in Northern Manitoba and one in Southern Manitoba, so you could link back to the -- to and from the alternating current systems that we had.

As I mentioned, Lake Winnipeg Regulation was certainly one of the big components. And so the Jenpeg control structure controlled the flows and the levels in Lake

Winnipeg, and the flows through these channels that were converted that were developed into the Nelson River.

And then the CRD, as I mentioned before, you had the Missi Falls control structure at the north end of South Indian Lake and the Notigi structure at the south end of South Indian Lake that raised the lake levels and allowed the flow of water against the flow to the south and into the Nelson River.

And then Phase II was the development of a number of power stations on the Nelson River. Long Spruce was started in 1973. And, yeah, that was a sidetrack I wanted to talk about, is this phase of development sort of post '76 or post '80.

Now we began to transition into a much greater awareness of some of the environmental and socio-economic issues associated with projects. There were amendments to existing pieces of legislation, to be more sensitive to some important aspects. The federal government developed its first form of environmental assessment review process. It wasn't really an approval process, but at least it was a structured planning process.

The Fisheries Act had a bit more structure and details, so instructions and guidance in how it should be addressed. The Environment Act came out in the late '80s, which was way ahead of its time at that time, and provided very good guidance and requirements in terms of assessing and approving projects.

And then later, of course, we had the Canadian Environmental Assessment Act, a couple of versions of that.

And then more recently, some of the more recent projects, we've been working through the new implications in terms of federal legislation, based on Bill C38, with the Canadian Environmental Assessment Act, Fisheries Act, Navigation and Protection Act, that provided additional instruction and guidance to the regulatory environmental assessment process.

So, anyway, in that sort of time frame, the next project was the Limestone project, started in 1976, postponed because -- I guess the decrease in -- well, lower than expected load growth, and then restarted in 1985, is when I was involved in it.

Wuskwatim, we're probably all familiar

with. It was actually a transitional project between the old Environmental Assessment Act and the new. That's now constructed, in 2012.

And we are dependent on a number of these aspects. Bipole III, of course, we are all aware of that, with the associated converter stations, both in the North and the South.

And then Keeyask, under construction right now, started in 2012. Not only the generating station, but the associated infrastructure, the roads were started earlier than the generating station for the construction camp, and the generating station itself and the associated transmission, which is planned to be finished in 2021.

So that, basically, is what I want to talk about. So, again, we're back to where we started, and this is the configuration that we have for a number of generating stations. We have the Churchill River Diversion project, the Lake Winnipeg Regulation project, generating stations, and then HVDC transmission, to be converted, and bring that power down to Southern Manitoba.

So that's what I have to say. I hope I didn't go too fast, and you sort of picked up

what I was communicating. If there are any questions I'll try my best. I'm not expert in some of these things; somebody may have more understanding of the history than I do.

THE CHAIRMAN: This is -- I realize it is not directly related to the project, but -- at what point did Hydro make the decision, or did it begin exporting power? I guess those are two different dates. Do you have any idea of that?

MR. BARNES: I know there are others that can answer more specific. Power export, it was actually another ingredient in the thinking about developing the North. From the federal side, I know there was interest in that grid, the national grid, and I know there was some discussion and interest in exporting.

Is there anyone here that's more familiar with exactly when that happened? We can list that as a question. I'm not sure.

THE CHAIRMAN: And I raise it only because, obviously, the timing of developments in the North would have been affected, I assume, by that factor. That's what I'm assuming. But I don't actually know the dates.

MR. BARNES: Obviously, the primary

incentive was addressing the needs of the domestic load growth. But as I say, I know there was an interest in opportunities not only to export to other provinces -- which happened in the late '50s, I think; we began to develop transmission East and West. But I think there was discussion even then about potential opportunities.

MR. DAVIES: I think it was thought about as early as the Bipole I and II because Canada originally paid for of development of Bipole I and II and then Manitoba Hydro I believe later paid them back.

THE CHAIRMAN: Yes. I wonder if I could interrupt for a second. Because we are having this all transcribed -- that's our doing, not yours, so I apologize, in a sense, for that -- I wonder if you could speak up--

MR. BARNES: I can repeat it, if you like.

What Stu was saying is his saying is, from his understanding -- and he's been around for a long time -- that Bipole I and II, during that period, they were actually built by Atomic Energy of Canada, a federal organization. So that was

probably another reason their interest, probably for export power.

MS. COLE: We should probably make the point that the primary driver for most of that early development was domestic need; we weren't exporting a lot of power.

Export of our power to the U.S. really started to ramp up throughout the '90s and early 2000s, and that's when we started to export some of our -- with the export market in mind, knowing we need them long term, like Wuskwatim. But prior to that, there weren't -- it wasn't the same as it is now.

And the exports are primarily done to keep rates low within Manitoba, so we're exporting our power typically at a higher cost, to keep rates lower in Manitoba. But the primary driver is domestic need; it is not the export market.

THE CHAIRMAN: So at least up until -- I think you said the '90s -- the primary reason, the driver, was the domestic load, and then the surplus, or the unused capacity, was exported; whereas in more recent years, there's been more attention to the export.

MS. COLE: Yeah, still the primary

driver is the domestic market. There has to be domestic need.

MR. JOHNSON: If it is of assistance, with regards to the export side of things, you might want to refer to Line Y20P that delivers power to the United States out of the La Verendrye substation, and also Ridgeway with the Man Dam line that went into service back in the '70s.

MR. BARNES: Yeah.

MS. LEWIS: You described the environmental assessment legislation in Canada. I wonder if you can elaborate a little more on how the federal environmental process fits into assessment of these projects.

MR. BARNES: Of the -- well, we can go back to that slide; maybe that would help a little bit.

It's been evolving, and as I mentioned, in terms of federal EA, you had the environmental assessment review process in the '80s, but it didn't have a lot of teeth; it was more of a planning tool. Again, people like Stu probably know more detail about that.

It wasn't until '92 that the Canadian Environmental Assessment Act was in place, and

it had an approvals process of the projects. Prior to then, I think it was more planning and guidance.

Am I missing anything?

MS. ZACHARIAS: So, Nick, I think our first big project that went through the federal EA process was Wuskwatim.

MR. BARNES: Yeah, it would have been Wuskwatim, for the review process, for sure. The earlier version of Conawapa was I guess happening when -- it was transitioning, but -- yeah, that's right.

Other questions?

Okay. I'll be around if you have any that you think of later. Thank you very much.

MS. ZACHARIAS: Next up we have Laura McKay, who is going to speak about the People section of the report.

MS. MCKAY: Good morning, everybody. My name is Laura McKay, as Allison mentioned, and I work in Manitoba Hydro's indigenous relations area.

If I speak too fast, please let me know, as that's my natural tendency.

As Allison mentioned, today we'll be

speaking to you about Manitoba Hydro's Phase II People submission. I'm going to spend a little bit of time speaking about communities in the region of interest, talk a little bit about the approach, the People submissions, and as well the limitations and challenges we experienced when putting the materials together.

And for the remainder and large part of my presentation, I'm going to focus on providing a summary of key effects and related compensation, mitigation, and remediation measures that have been taken to address those effects.

If you have any questions throughout, please feel free to stop me as we go along.

Allison already showed you this map. This is our RCEA region of interest. This map does show the community resource management area and registered trapline areas.

In the region of interest, we have eight First Nations communities, eight Northern Affairs communities, three towns, and one major city.

The Phase II People submission includes five chapters. The first is an introduction, the second being study scope,

approach, and methodology.

The third chapter is a regional profile, and the regional profile includes a summary of key historic events that have affected people in the region of interest, as well as a demographic profile, over time, of this region.

The demographic profile summarizes the information we have on key demographic indicators related to population, economy, other socio-economic topics, like education and crime. And it also presents information we have on regional planning and health and well-being.

The fourth chapter provides a summary based on Manitoba and Manitoba Hydro's understanding of hydroelectric effects at a regional level, as well as, again, the related compensation, mitigation, and remediation measures that have been taken to address those effects.

And the fifth chapter presents a summary of community information that was available at the time of the study.

The summary of community information is broken down by community. It includes background information and demographic information by community. It also includes a summary of

hydroelectric development relevant to each specific community.

It provides a summary of what we've heard from the communities over time. Those summaries are based on materials we have from the communities themselves, and while they don't replicate the communities' voice, their intent is to share what we have from the communities over time about their experiences and perspectives.

The summary of community information also includes and provides information on resource use trends over time, and our understanding of hydroelectric effects on those resources.

The RCEA People Phase II submissions, overall, attempt to document perspectives and understanding of effects, as well as socio-economic trends that have been observed over time in the available information.

The approach was guided by a number of important factors. The first, which has already been spoken to, is that hydroelectric development in this area spans six decades. Many of the projects pre-date monitored environmental assessment. As a result, the types of information that were collected at the time of development are

very different than the type of information we look at collecting and documenting today as part of our environmental assessment process.

The approach has also been affected by the fact that there have been significant and substantial other developments and policy in this area. I won't talk a lot about this, because other folks have already spent time speaking to this issue. What I will say is when we think back 60 years, in the region of Northern Manitoba, the City of Thompson, for example; Gillam looks very different, and the town of Snow Lake. The regional transportation and infrastructure looks quite different as well.

The third major factor that affected our approach to the People submission -- and it's an important one -- and it again looks back to the timing and the fact that many of our early projects pre-dated monitored environmental assessments is that effects weren't predicted and documented in the same way. Community concerns were addressed as they arose, oftentimes following construction and operation of the development. Issues were resolved through negotiated settlements, and as part of that process -- which

you often had with the involved parties -- each undertaking their own studies to inform negotiations.

Oftentimes those studies didn't align. Sometimes they did, but oftentimes they didn't. And what we came out with in the end is when you look back at the record of information, there is an absence of mutually agreed-upon record of effects. Many of them were reached in an adversarial process related to settlement negotiation.

So by focusing on understanding the perspectives of effects, and documenting available historical information, the People approach recognizes that there has been a significant history of interactions between Manitoba, Manitoba Hydro, and the communities in the regions of interest.

There is a very complex history of settlement negotiations and agreements between communities, and again, Manitoba, Manitoba Hydro, and in some cases Canada. And we are acknowledging that there is the presence in some cases of divergent views on scope and magnitude of effects.

As you would expect, looking back 60 years and trying to pull together a historical record, there were a number of limitations and challenges in putting the document together. In the regional profile, we did have to be selective in what we included in the history piece.

I don't mean to belabour the point, but there are many -- entire books dedicated to the history of Northern Manitoba, even entire books dedicated to the history of the registered trapping system, commercial trapping and fishing activities in this area.

There is very little pre-project demographic data available for this area. What is available is generally spotty and random. For example, you may have noticed that when you look at the demographic indicators, most of those indicators were not collected in the Canada census until the 1980s. So that would include all the major indicators related to population, economy, and health and well-being.

For another example, data on Aboriginal identity wasn't even collected until the 1990s.

We also found that it was very common

to find data suppression in the communities, and that would be for entire census years, or for the NACs overall for a number of years. Data would be suppressed due to small population sizes in some cases, or just errors in the collection over time.

When we were pulling together the summary of effects, compensation, and mitigation, we are aware that we are missing historical information on certain agreements. As was already mentioned, this is a long period of time. It was a very complicated period. Settlement negotiations, a vast amount of material, accounts for how much material is available in relation to settlement agreements.

So we did our best to pull together agreements and processes as we were able to, looking back. And the focus here is on Manitoba Hydro processes.

When we were looking at pulling together the summary of community information, pretty early on, we realized a significant challenge was that we were dealing with confidential materials in many cases by community. The reason being that -- again, as I referenced, a lot of the studies were undertaken as part of the

settlement negotiations, so those materials were obviously privileged and confidential. So we set out to ask communities, on an individual basis, to have access to those materials specifically for the purpose of the regional cumulative effects assessment. For the most part, we were successful in obtaining that information, and those confidential materials have been related throughout the RCEA documents.

We also found that there was substantial variation in the breadth of materials available by community. Just as an example, in the community profiles, you might notice that there was more information available for communities like Cross Lake than there was for a community like NCN.

And so that -- those differences in materials don't necessarily reflect a difference in scope and magnitude of effects experienced; it's just a function of how the history evolved over time. As settlement agreements proceeded, different studies were undertaken.

Lastly, in terms of obtaining information, one limitation -- and it is an important one -- is that information available

from community documentation often pre-dates compensation and mitigation measures. So today, when we undertake an environmental assessment, you pull together a baseline that demonstrates what the conditions were pre-development, and you monitor effects following construction, and then following compensation and mitigation and remediation measures, you look at your remedial effects. It is not possible to do that, looking back 60 years, from available materials.

The limitations and challenges based in pulling together the resource use summaries in the community materials include that there was an incomplete and sometimes absent record of harvesting consumption information that makes pulling together very challenging.

We found there are methodological differences among the studies. There can be high annual variations that are present in some species in terms of abundance that influence perception of effects, and the degree of post-development recovery. As well, perceptions of fish and wildlife quality vary by individual, and sometimes depending on the context.

As well, we also have socio-economic,

and cultural effects that have influenced resource harvesting and use over time.

For the remainder of my presentation, I'm going to focus on providing an overview of chapter 4 in the RCEA submission, which presents Manitoba and Manitoba Hydro's understanding of the effects on people at the regional level, and provide a bit of an overview of the settlement agreement processes over time.

The settlement agreements are generally intended to cut across a number of effects, and so you will see that theme recuring throughout the slides. I felt it important to give you a bit of an overview of that process up at the front.

Then I'm going to focus on providing a high-level overview of what we call key areas or key things of effect at the regional level. This includes effects on culture, way of life, and heritage resources; navigation, transportation and public safety; resource use, home relocation, worker interaction, loss of Reserve land, health issues and concerns, personal property loss and damage, employment and training opportunities, and benefits of electrification.

Given the volume of material that was submitted, I will be doing a high-level overview of each of the key things, so please feel free to pause and ask me any questions that you have.

Over time, over the 60-year period, there have been various development processes to resolve grievances. This would include the Northern Flood Agreement, the Comprehensive Implementation Agreement, as well as other settlement agreements.

As well, measures have been established to reduce, mitigate, or compensate for effects over time.

Our understanding of effects, and how to address effects, have been informed by a long history of communication and interaction with First Nations, Northern communities, and groups in the region of interest.

The Northern Flood Agreement was signed on December 16, 1977. The agreement was signed by Canada, Manitoba, Manitoba Hydro, and the Northern Flood Committee.

The Northern Flood Committee represented five First Nations: Cross Lake First Nation (Pimicikamak Okimawin), Nelson House First

Nation, which is now known as Nisichawayasihk Cree Nation; Norway House Cree Nation; Split Lake First Nation, now known as Tataskweyak Cree Nation; and the York Factory First Nation.

The Northern Flood Agreement provided the framework for addressing effects on land, pursuits, activities, and lifestyles. It included key provisions for land exchange, notice and consultation in relation to future developments, navigation and safety issues. It included broad policy issues. It included provisions for remedial and compensation measures, and included provisions regarding the fishing and trapping programs that were intended to encourage people of the community to be out the land carrying out their pursuits.

The Northern Flood Agreement introduced the concept of community resource areas. It included what we call a reverse onus clause. Under the reverse onus clause, there was an obligation of Manitoba Hydro to prove the effect did not occur. The Northern Flood Agreement also included an arbitration process to resolve things related to the disputes.

At the time the Northern Flood

Agreement was signed, not all effects on communities were well known or completely understood. That meant that it did have broad languaging, which proved challenging to implement, and left a lot of room for interpretation.

In the wake of an initial limitation period in the 1980s, a number of claims were filed by the communities. This did result in the filing of a number of agreements, particularly related to resource use activities. Many claims went to arbitration, which is a particularly adversarial process and can be quite cumbersome for all parties involved, but from a community perspective would be quite cumbersome, given that the issues were dealt with on a claim-by-claim basis, with requirements for documentation and process being very substantial.

As a result of that process, in 1986, the Northern Flood Committee proposed global negotiations to address all outstanding land claims under the Northern Flood Agreement. While efforts did occur to achieve that, the global approach did not succeed. Individual CIAs were eventually negotiated, however, starting with Tataskweyak Cree Nation in 1992, the York Factory

First Nation in 1995, and Nisichawayasihk in 1996, and Norway House in 1997.

Comprehensive implementation agreements are each unique, but they do include common elements across the agreements. Overall, they address outstanding grievances, resolve claims as one, rather than on a claim-by-claim basis, and they included provisions for compensation, trust indentures, land exchange -- land exchange was a much more favourable route to the communities than the Northern Flood Agreement.

Resource management areas, environmental monitoring, and consultation on future development.

Negotiations did occur with Cross Lake, with the objective of reaching a comprehensive implementation agreement, between 1994 and 1997. In 1997, Cross Lake decided to proceed within the specific terms of the Northern Flood Agreement on an ongoing basis. Since that time, we have worked with communities to develop action plans to address ongoing NFA obligations.

Today, Manitoba Hydro continues to work with Cross Lake/Pimicikamak, Manitoba, and Canada to implement the Northern Flood Agreement.

Examples of programs that would be undertaken; shoreline protection measures, installation of docks, elder (inaudible) programs, safe ice travel programs, portages, alternative route programs, school hot lunch programs, the establishment of a community information centre, construction of an arena in the community, the debris program, and the weir.

At the time these other points are being initiated on comprehensive implementation agreement, we undertook efforts to finalize other settlement agreements with a number of communities. Over time -- these settlement agreements are outlined in the Phase II People submission; but just at a high level, this is included: South Indian Lake, Fox Lake, War Lake, Wabowden, Cross Lake Northern Affairs Community, Nelson House Northern Affairs Community, Norway House Northern Affairs Community, the Town of Churchill, the City of Thompson, as well as agreements with various resource user groups and individuals.

Manitoba Hydro is continuing to work on an ongoing basis with the Thicket Portage, Pikwitonei, and Norway House Northern Affairs

Community, to reach an agreement.

More recently we have engaged in future development agreements as part of our current projects, and have established agreements with the Manitoba Metis Federation.

Before moving to summarizing the effects on a regional level, are there any questions about the settlement agreement processes?

MR. SOPUCK: Briefly, I just -- if you could explain this very briefly.

So Cross Lake went back to the Northern Flood Agreement; that just means -- basically left open? It's not settled? Or ... ?

MS. MCKAY: It means it continued to operate under the provision of that agreement, meeting our obligations under that existing framework from 1977. So if they left the agreement and came back, we have continued to operate under the obligations and provisions of that agreement.

MS. COLE: We should mention that for all the key -- the NFA communities. What was negotiated were agreements on how we were going to implement the NFA. The NFA is still in place with

those communities. It is just we have implementation arrangements that have been negotiated and how we will implement them.

MS. MCKAY: Hydroelectric development in the region of interest has had effects on ways of life and heritage resources. These effects are inter-related with resource use, navigation, and the way the landscape looks. These effects are related to physical changes on the landscape and on affected waterways, and they are described by communities as changes in their connection to the land, and their ability to practice customs and traditions, and their ability to transmit traditional teachings across generations, traditional teachings that are at the core and centre of their cultural well-being.

These effects are described as "mino pimatisiwin," which is "living the good life," which is centred on living in balance and connection and harmony with the earth.

Specific examples of effects on culture, way of life, and heritage resources include the loss of or reduced access to traditional spiritual sites, burial grounds, meeting places, important navigational markers,

beaches, and seasonal family campgrounds.

A number of measures have been taken over time to address effects on culture and way of life. This includes archeological programs. Examples are provided in the submission, but will include, for example, the Sipiwesk Lake archeological program and the system-wide archeological program.

Effects have been addressed broadly in the settlement agreements through ongoing shoreline protection measures.

For more current projects, cultural effects are addressed in part through ongoing cultural ceremonies that happen in different periods in the construction cycle to acknowledge the effect of disturbance on the lands, and what that means for communities.

Heritage resource impact assessments are undertaken as part of the environmental assessment process, to identify important resources and ensure protection.

It is important to note, though, when we are talking about effects on culture, way of life, and spirituality, that those losses can't be replaced or substituted. For these effects,

specifically, place and connection to the land is important.

So, for example, if your grandmother is telling you a story that is related to a specific island or landscape marker, and that story was taught to her by her grandmother, and her grandmother, and her grandmother, and so on, if that island or land marker is flooded or lost, that's a loss that's not replaceable. You can't replace the history of intergenerational transmission and meaning of that site.

Hydroelectric development has also had effects on navigation, transportation, and public safety in the region of interest. Shoreline erosion and woody debris has inhibited access to shorelines and bays, and created navigational hazards in the water.

These pictures give you a good example of what these effects look like on the waterway.

Changes to water regime have altered timing and quality of ice cover, which has adversely affected winter travel. This includes things such as slush ice and hanging ice.

These pictures provide a good understanding of what this looks like out on the

landscape.

Manitoba Hydro has undertaken a number of measures over time to address effects on navigation, transportation, and public safety. Again, these measures include the broad covering of the settlement agreements, as well as a waterways management program.

That program is intended to support and promote the safety of people traveling on affected waterways. It includes three elements: Our boat patrol program, our debris management program, and our safe ice travel program.

The boat patrols are focused on having patrols of about two people from those communities out on affected waterways collecting log debris.

The debris management program was originally an NFA obligation, but became formally the debris management program, which was expanded later on. It includes working with communities to identify sites where debris has been beached, and collecting that debris so that it doesn't reenter the waterways and become a navigational hazard.

Our safe ice travel program includes working with local resource users to install and maintain trails out on the land, to help ensure

safe travel during the winter season. Trails are marked and monitored and tested for ice thickness throughout the season, for safety.

We also have our water level forecast notice program in place. The water level forecast notice program was initially an NFA obligation that has been significantly expanded throughout the region, and included monthly notice forecasts of our water level forecast. And again it is intended to provide information to people living on affected waterways to ensure their safety when they're traveling on water and on the land. Notices are provided in Cree and in English, and is posted on Manitoba Hydro's website.

I would like to show a short video -- it's just a few minutes -- but this is was pulled together recently by Manitoba Hydro to provide our waterways management program, which gives a strong sense of why we do these programs and what they mean for local people. It gives a sense of the impacts of hydroelectric development that they are intended to address.

The video is not working today. It is just unfortunate, because it is a good project that was done to profile that work, and the

involvement of communities and why they do it.

We can provide that afterwards. Plus it is more interesting to listen to me talk for 45 minutes.

The RCEA considered -- in terms of effects on resource use, we considered effects on domestic and commercial harvesting and effects on fishing, trapping, hunting, and gathering.

Effects on resource use in the region of interest include effects on presence and abundance of resources, include increased access along transmission rights-of-way and along roads, the loss of access to shorelines for hunting and gathering, and the presence of fewer safe landing sites. And we just spoke about the navigational hazards on the water.

Those two effects increase both costs and risk to resource users while they're on the land practising hunting, trapping, and gathering.

Hydroelectric effects on resource users also include effects on the knowledge of the landscape and the resource itself.

Overall, when you look at these together, there has been an effect on individual confidence and the sense of pride one has in

providing for one's family from the landscape.

The specific effects on hunting, trapping, and gathering include changes to the abundance and distribution of plants and animal communities, changes to the pattern of animal movements, concerns about reduced potency of traditional medicines, and reduced reliability, again, of knowledge about animal locations and behaviour.

Important considerations when thinking about effects on trapping include that effects can vary significantly by trapline. The scope and magnitude of effects is dependent on proximity to an affected waterway, right-of-way, or other infrastructure.

Trapping in Northern Manitoba has been strongly influenced by fur prices and by species abundance. In overall, trapping activity has declined over time, but it remains an important cultural activity in this region.

Measures taken to address effects on hunting, trapping, and gathering have again included the settlement agreements. This has included specific agreements with commercial and domestic trapping groups, as well as agreements to

address effects on community traplines.

The Northern Flood Agreement included a registered trapline program, and that program is time-limited. It was intended to address effects, and included trapline compensation of losses as well as rehabilitation efforts. We also have an ongoing program in the Cross Lake registered trapline that is implemented as part of an ongoing implementation of the Northern Flood Agreement.

Effects on domestic fishing include debris in nets, causing net fouling and equipment damage; navigation challenges; changes in fish abundance and distribution; changes in the knowledge of the resource; concerns about soggy, thin, and poor-tasting fish; fear of mercury and other pollutants in fish; and resulting changes in the traditional diet.

Commercial fishing has been affected in ways similar to domestic fishing. However, it is important to note that commercial fishing is an important industry to Northern Manitoba. It is affected, however, by other factors, including fish prices, transportation costs, subsidies, and overall market demand.

Measures to address effects on

domestic and commercial fishery have included settlement agreements; the waterways management program; ongoing processes with O-Pipon-Na-Piwin Cree Nation, which includes environmental monitoring in South Indian Lake; sturgeon boards and enhancement programs; Keeyask adverse effects programming, which is intended to encourage continued consumption of fish; and the coordinated aquatic monitoring program.

In the region of interest, there are two cases where communities have experienced partial relocation. We know that community relocation and home relocation can have substantial socio-economic effects on a community as a whole.

The first example is South Indian Lake. In South Indian Lake, approximately 40 per cent of households -- can't hear me?

In South Indian Lake, post-CRD, communities were located on both the east and west side of the narrows. At the time of the CRD, discussions got underway to relocate approximately 40 per cent of community households from the west side of the narrows to the east side of the narrows. The reason for this was the CRD was

going to change the water regime in the narrows after development, and this raised safety concerns for local residents.

Prior to CRD, community members regularly crossed the waterway as part of daily life, to access the store and the school, family members, and other infrastructure in the community. After CRD, in the winter, it was predicted that there would be open-water conditions that would make travel unsafe for people. So about 96 lots were developed as part of that relocation.

Following relocation, community concerns were raised, both about the quality of housing and also the social impacts on the community structure.

When you look back at the documentation, the community has indicated that the design of the old community reflected family and kinship networks. People weren't located close together; they were actually quite spread out, and social interactions weren't -- for the community as a whole, were not a common occurrence. Families tended to keep to themselves somewhat, except for larger celebrations and other

important events.

When they were moved to the east side of the narrows, people were now living in close quarters to one another, and the design of the town did not reflect the same family kinship patterns. Ongoing community concerns led to NFA claims, and these claims were addressed in a broader settlement with the Community Association of South Indian Lake in 1992.

In Gillam, just in terms of a bit of background, the Fox Lake Cree Nation, there's documented efforts that Fox Lake Cree Nation was attempting to establish a Reserve in Gillam as early as 1920. In the 1960s, as we proceeded with development along the Nelson River, Gillam was developed as a key Manitoba Hydro operations and service centre, and became the LGD of Gillam.

This led to significant changes almost overnight as the community described them. At this time, Fox Lake Cree Nation families residing in Gillam were viewed by the government as squatters, and homes were demolished, or moved, and residents were relocated. Over time Bird established a reserve in 1985, and a small urban reserve was legally recognized at Kettle Crescent

in Gillam in 2010. Today, we work with Fox Lake Cree Nation quite intensively to collaborate on community planning through the Harmonized Gillam Development Committee.

There have been concerns, over the 60-year period of hydroelectric development in the ROI, about worker interactions. Worker interaction issues are associated with both construction camps and more permanent settlements. They are related to the influx of non-local workers, permanent or transient workers.

Worker interaction issues are associated with a range of social impacts. General change, including things just for example concerns about racism, concerns about impacts on local infrastructure, increased demand for services. They also include concerns about treatment of local women and violence and crime.

Worker interaction concerns have been addressed in past settlements. And for more recent projects, as our understanding of these specific concerns has evolved, we've addressed worker interaction concerns in our plan for our current projects, including for Keeyask, Wuskwatim, Keewatinohk. Those include measures

that are intended to reduce off-hour visits. So that would be the establishment of construction camps to house workers, where we provide a number of amenities, hopefully to make it enjoyable and desirable for people to stay on site.

We have established a Keeyask worker interaction subcommittee that meets in Gillam a few times a year, involves the town, Manitoba Hydro, and Fox Lake Cree Nation. They talk about -- focus on issues and concerns related to current work force in the areas as part of our current developments.

On an ongoing basis, we have the harmonized Gillam development process. And another important measure that we do for our current projects is undertake cultural awareness training on site. In that program, we seek to both educate incoming workers on the region, the history and the people, and also create an awareness of the impact of certain actions and the long-lasting effects certain behaviors can have.

Again, hydroelectric development has resulted in the inundation of Reserve land through flooding. This flooding, and potential future loss of land due to erosion, has been addressed

through the granting of an easement over land below a severance line.

Under the NFA, Reserve land taken is compensated by replacement land at a 4-to-1 ratio. Under the compensation implementation agreements, that ratio was significantly increased, I think over 10 to 1, for different communities.

We also undertake shoreline protection measures along Reserve land, and for transmission lines, our site selection and environmental assessment process is used to route transmission lines away from Reserve land.

We have heard a number of health issues and concerns from communities in the region of interest over time. I'll speak about a few today.

One positive benefit of hydroelectric development has been the establishment of new health infrastructure in Gillam, which includes the hospital in Gillam, which now is available to regional residents. We have heard concerns about potable water raised by the Northern Flood Agreement Committee. These issues have been resolved between the parties as part of the claims process. While there are outstanding concerns

about potable water raised by communities, these are the ongoing responsibility of the federal government.

Concerns about mercury, as a result of flooding, have resulted in stress and anxiety for community members, and have resulted in changes to traditional food consumption. Communities will tell you that in some cases they are scared to eat the fish. This has, in some cases, resulted in individuals and families consuming more foods -- more store-bought foods. Those foods are often more expensive, and can be of less nutritional value.

Mitigation measures to address concerns about mercury have included monitoring programs undertaken by the Federal, Provincial -- and Provincial Government, Manitoba Hydro, that included monitoring programs related to mercury in fish, and monitoring programs related to mercury in humans. Mitigation measures have also included fish consumption guidelines.

Specific community concerns raised regarding transmission line effects have included concerns about electric magnetic fields, and their effect on health. These have been addressed

through ongoing research and educational research.

We have heard about concerns related to audible noise, the hum of the transmission line. Those effects are addressed by provincial guidelines regarding noise levels.

Herbicide use has also been a concern raised by communities. Concerns about herbicide use are typically addressed through public notifications, low-disturbance clearing methods in sensitive areas. They are also directed by the site selection and environmental assessment process, whereby through the routing of a transmission line, we seek to avoid sensitive areas where possible.

There have been instances of personal property loss and damage in the region of interest. This would include damage from floating or submerged debris, exposed rock surfaces, slush, and adverse ice conditions.

These pictures provide examples of what that damage can look like, or how it can occur.

There has been damage to outboard motors, snowmobiles, boats, nets, and traps. Claims processes to address these effects have

been instituted in the Northern Flood Agreement, the Comprehensive Implementation Agreement, and other settlement agreements. There is also provision to address personal property damage and loss in the cumulative effects agreements for Keeyask and Wuskwatim.

Manitoba Hydro also has a property compensation policy for transmission lines.

My last two slides are focusing on the positive benefits in the ROI, the region of interest, that have resulted from hydroelectric development. This includes employment, training, and business opportunities, for both short- and long-term employment and business opportunities. Over time, Manitoba and Manitoba Hydro have developed a number of programs and policies that are designed to encourage and enhance indigenous representation in both projects and operational work forces and temporary work forces, and to promote participation of northern indigenous businesses. This includes training, for example.

Lastly, I will speak a little bit to the benefits of electrification. When we look back to the 1960s, there was limited electrical service for many communities in the region of

interest. Often small generators were used, and they were powered by diesel or gas, and electrical services were only provided for stores, nursing stations and government offices.

Many communities were connected to the Provincial grid in the 1970s, and they were provided with full electrical service, which eliminated the environmental risks that are associated with the transportation and burning of diesel fuel. The provision of the service would have had substantial socio-economic effects for individuals, families, and communities in the region of interest.

And that's all the slides. Are there any questions?

SPEAKER: Laura, so -- I don't really have so much a question as a comment. You and Allison both touched on -- sorry. Effects on people are profound and ongoing. And one of the challenges of the RCEA is we can look at hydroelectric -- the effects of hydroelectric development, but there are other things that happen in the ROI prior to, and one of the things that struck me over and over is the effect on culture.

Hydroelectric development has major effects on the ability to practice traditional lifestyles and ways. It's also an example where you do have other influences, and the one that I've come across a number of times is, for example, residential schools. So in cases where people were physically removed from their community, that was another example of an interruption in the ability to practice culture and pass on traditional teachings, and it is also an example where you can't differentiate proportionate influences hydroelectric development versus residential schools. But I think it is safe to say that they do impact on each other. So it is really an example you have multiple forces and influences at play.

MS. MCKAY: Yes. And that would be why I spoke of a different -- that reality was a determining factor in the approach to the RCEA materials.

Today I focused on what we understand as specific hydroelectric effects. But when you look at the region, as Mark said, it has -- over this time period, and immediately prior to the period of hydroelectric development -- has

undergone significant socio-economic change related to a number of factors, including infrastructure and road development, changes in hunting, trapping, and fishing -- even just the arrival of the commercial fishing industry in this region had a longstanding effect on people.

Government policies, like residential schools, the establishment of the Reserve system, the Indian Act: Those types of government policies have intergenerational effects that were created prior to hydroelectric development, or during hydroelectric development, and occur today.

Recognizing that when you look back over this period, you can't tease these effects out. We chose to focus on documenting, when possible, without signing attribution, trying to document this type of socio-economic change that we've observed in available information over time, focusing specifically on -- in chapter 4, what we know to be specific hydroelectric effects.

Property damage, for example; that's a very specific kind of electrical effect. The effect on people's ability to get out onto the land and the resulted changes to the waterways; that's a specific hydroelectric effect.

Those effects, yes, are common, and there are other things occurring in the socio-economic environment.

So, yes.

MR. SOPUCK: Was there any thought given to analyzing communities that were directly affected by Hydro, versus communities in the North that were not? It strikes me that's kind of a natural experiment that teases out Hydro effects versus all of the other effects that were discussed.

I know it could be a coarse analysis, but it might be the only way in which you can address that question of Hydro effects.

MS. MCKAY: That has been considered, and you'll find various sections of the RCEA document actually do those comparisons, particularly when we look at what is available in terms of information on how -- for example, we do compare to Manitoba First Nations, as an example.

And for most indicators, not all, you do find the trends are actually quite similar. The problem with those types of comparisons is that again, First Nations in Canada have undergone -- over this time period have undergone

such significant change, it's hard to tease out what is causing which.

But also, each community history is some what unique. So even in Manitoba, if you choose to compare to -- you have to be pretty careful. Even in terms of our affected communities, there would be significant differences in their evolution over time that are a function of what is their proximity to a road, for example; what other effects have occurred in -- I'm just trying to think of a good example.

If you were to look at War Lake First Nation, in the War Lake -- sorry, in the Ilford community, if you were to look at trends of what happened over time, comparing it to a non-hydroelectric community would be somewhat skewed, because there have been such other significant changes in that particular region that were related to what we refer to as the Hub of the North, and a number of factors changed that community's destiny over time.

So trying to look at that community, as an example, and compare it to an off-system community, it's just not a -- it's not a perfect comparison.

But what I can say, is we where we have at certain indicators in the RCEA, comparing ROI communities to non-ROI communities some of these health and well-being things can be quite similar.

MR. JOHNSON: Terry Johnson speaking.

Picking up on what Tim just asked, is it possible, or was there some discussion in the working group about comparing the cumulative effects on First Nations communities in the region of interest versus the similar effects that occurred on First Nations communities that occurred in, possibly, Quebec, when they underwent a large development of their resources, just for comparative purposes, to see whether the effects were similar or what the outcome was?

MS. MCKAY: I'll make a few points. The first would be, it is important to note, too, in terms of when you do an assessment and you are looking at key indicators of change, and this is a theme that you hear a lot about today, even looking at pre- and post for the affected communities is difficult. I mean you can go to the census data, which we often use to pull together a baseline understanding, those indicators aren't

even available until the 1980s, and postdate almost all of these developments we're talking about.

So your ability even to do pre- and post for effects on community, looking at those indicators, it is impossible. You can't do it.

So the regional profile presents information that for the most part starts in 1980s going forward, because that's what we have.

So what we do look at is, how do communities -- what is our understanding, based on our experience working with these communities, and what have communities told us?

An important point to make in thinking about indicators versus talking about understanding, I could pull together, based on available census information, some really neat information that's going to tell you all kinds of things about communities, both in the ROI and -- you know, for example, no matter where you are income levels have generally increased over time. Employment circumstances have generally got better. You're seeing less infectious disease, but you are seeing more diabetes, universally, across Canada.

It doesn't matter how many indicators I look at, so they are going to tell me a lot of things about standard of living; they are not going to tell me a whole lot about how communities feel about their lives, which is what we call quality of life.

When we start to talk about hydroelectric effects, how people feel about these effects does matter. So that has lent itself to the focus on trying to document people's experiences.

I would say, though, that I do feel -- I think most people at Manitoba and Manitoba Hydro would feel confident that we have a good understanding -- looking at specific indicators and those trends, we have a good understanding now of what hydroelectric development has meant for communities. And those would be the types of effects that we see today.

MR. JOHNSON: Thank you.

MR. DAVIES: We did actually look at some reports that had compared communities that were affected and not affected. There was a very large six-volume study done by Cross Lake that compared trapping in Cross Lake to trapping in

Oxford House, that wasn't affected.

And they found that the patterns were almost identical. And the reason for that was that trapping was very price-driven.

The one thing that they didn't show, however, is the amount of effort that Cross Lake may have had to put into maintaining the harvest, as compared to the amount of effort that Oxford House did. So even though they looked the same, they could be quite hard to compare, and the net profitability of one, you know, being the same as the other, could be quite -- quite different.

And if we are looking at a community like South Indian Lake, the harvest at South Indian Lake during the first year was maintained. It was maintained artificially. The only reason that the harvest hadn't dropped, if we were going to compare it to another community, was because Manitoba Hydro was paying a subsidy to the fishermen to catch lower-grade whitefish, and they were being paid as high-grade whitefish.

So without knowing that, if one was going to compare the catches at South Indian Lake to catches in another community, they would look similar, where in fact there was a lot more

effort, and the only reason they were maintained was because Manitoba Hydro was paying for it to be maintained.

So it would be a very difficult thing to do, from a resource use perspective.

MS. MCKAY: I'm sorry we weren't able to show you that video today. We will send you a link. It was quite a unique video.

MS. ZACHARIAS: We will try and get it up and running over lunch. We will hook it over to the other computer.

If I'm not mistaken, I think it is time for a break.

Right, okay, we are actually even a few minutes ahead of schedule. Why don't we take our 15-minute break, and come back at 5 to 11, and continue on.

(RECESS TAKEN)

MS. ZACHARIAS: We are going to get going now. So while everyone is getting ready to take their seats, I just wanted to make a couple more announcements.

Cecelia, who is transcribing all of the information today, is having a hard time hearing everybody. So even the speakers up here

speaking into the microphone, we all need to speak louder. Also, if anyone is asking questions and responding to questions from the floor, we are going to have to come up here and use a microphone. We don't have a portable microphone, but this way we will be able to help Cecelia out.

The other thing, before we get started, I have been informed that some people are plugging their computers in, and you may not always have power. So we have a solution. But if you don't have power, we can definitely either help you now or help you at lunch, to make sure your table has power. Just -- we had to move all the tables and unplug everything. So we can help.

Without further ado, we will introduce Brian Giesbrecht. He is now going to speak about the water regime.

MR. GIESBRECHT: Okay. Good morning. As Allison mentioned, I'm Brian Giesbrecht. I'm with Manitoba Hydro's hydraulic operations department, and I will be going through the water regime parts of the RCEA with you this morning.

I'll start by defining what I exactly mean by "water regime," just so we are all on the same page; talk about how we broke up the region

of interest into zones, and some of the logic behind how we did that.

One of the important components of our analysis was the flood area mapping, which interests a lot of people. Talk about the study methodology overall, and how we've presented water regime information in the RCEA, give you kind of a 10,000-foot view level of system operations through a typical year, and then get into analysis of some other operating nuances, like cycling, and some other abnormal operations. And then close out with some gaps and limitations that we found as we were doing the study.

So, water -- when I talk about water regime, I'm talking about the pattern and frequency of water-level inflows in a river system. Water regime is driven by precipitation in the drainage basin, but it is obviously influenced by other natural and human factors. And it is obviously -- human factors are the reason why it is included in this discussion.

So we have seen this map many times, and you will probably see it more than you want to for the rest of the day.

So there's three basic zones, or -- we

will call them "zones"; I don't want to confuse the terminology. But you have got three reaches, essentially. And I apologize, but I'm going to point over here.

So there is an area where the lakes and rivers are affected by Lake Winnipeg Regulation only, or primarily; the area that is Churchill River Diversion influenced, and then Split Lake, down to Hudson Bay, where those two flow regulation projects combine, and we have combined effects in that small reach from Split Lake down to Hudson Bay.

Within that, we've also then subdivided into a series of 12 zones; hydraulic influence zones, I think Allison called them. And that's where the effects of these two major flow regulation projects, as well as the generating stations, is consistent, and we expect to see the same -- similar effects.

And so within this CRD zone, there is a series of five or six zones: Three within that LWR influence zone, another three in that combined zone.

Just to kind of give you an idea of why we bother slicing and dicing so much, we will

look at a couple of different areas here.

So this is now looking just down to the Jenpeg Generating Station, so Cross Lake, Sipiwesk Lake, and up to Kelsey. Both of these zones are affected by Lake Winnipeg Regulation outflows, but the influence of Kelsey and the conduits of Kelsey only affects the river reach up from Kelsey and to Sipiwesk Lake. It doesn't go further up, into Cross Lake, and that's why we put a break on the river system at the inlet of Sipiwesk.

Similarly, if we are looking downstream, lower Nelson River system, so from Stephen's Lake down to Hudson Bay, there's two zones. This is in that combined Lake Winnipeg Regulation and Churchill River Diversion area.

In Zone 11, you have essentially three forebays, where the levels are very well controlled and predictable, regardless of flow.

And then once you get past Limestone, this is where the river now responds directly to the flow in the river, and so rises and falls, sometimes great amounts, with that flow.

Since we have Conawapa shown on here, if/when Conawapa were to be developed, we would

basically take this zone, divide it, and move it down, because now you have a series of forebays that would go Kettle, Long Spruce, Limestone, and Conawapa, before you got into the free-flowing and flow-responsive area of the river.

I hope that helps you understand how we came up with these divisions, and how we decided where those would be.

So I talked about the flood area mapping in the introduction a little bit. So the footprint of a generating station, or of a hydro development, often -- well, that looks terrible; the map got bigger. Oh, well. I'll speak to it, and it will all make sense.

So one of the ways you can see the effects of hydroelectric development, on a permanent basis, is through the flood area mapping. So what we did for the Phase II document was to use the best available, 1 to 50,000, federal mapping products, pre and post development to, do a comparison.

For the scale of mapping that we are looking at for the report, that was the right scale; for intensive examination of effects, you use much smaller-scale mapping -- or was it

larger? I can't remember.

1 to 50,000 would be more appropriate for that, but for reporting, this was good. Had the added benefit of being coverage across the entire system, post and pre-development, which is a little trickier than 1 to 50,000.

I will give you a preview on some of the limitations with this mapping, especially pre-development. There is a bit of a scarcity of mapping prior to 1976, and so you basically take what you can get. So, if it happens -- you don't get to choose whether it is a wet, dry, or average year, whenever that mapping was created on. If it is available, that's the best you've got.

Post development, there is often a little more variety of mapping, so you can actually select one that more accurately represents an average condition or a median condition.

In any event, in the Phase II report, there is a series of maps that will show you flooded areas. A lot of times it is very hard to see, because at that scale, actual effects of development are not as much as sometimes imagined.

This example is from South Bay Channel

down to Notigi, which is where the greatest amount of flooding in the North has happened.

So the dark lines are the old -- the pre-development shorelines, and then the blue shading is the current lake extent. So there's very obvious increases in flooded area in this location.

So for the description of water regime in the report, we compared pre and post development water regimes by using monthly averages in the Phase I report. That gave a good overall view of what the changes were, both in the levels as well as the flow sequencing. So, if it was higher flows in the winter versus summer, by comparison to a normal regime, that would show up in that kind of charting.

For the Phase II report, we went to the daily time step to further describe the operations, added upper and lower core files. Rather than take a single median line, we had a range where you would expect water levels to fall within most of the time.

And then also how did it -- for example, the drought in 2003, and a flood from 2011, to give you one instance of what the

outcomes were on water levels and flows under those conditions.

In areas where we didn't have enough data, we were also able to use some simulations to estimate the water-level increases on the lakes on the CRD route, so the Burntwood River, and also the decreases in the water levels on a number of areas on the Lower Churchill River, where the water was taken away by development.

So here is that 10,000-foot view I was talking about. So typical seasonal operations, and this is really focusing in on how we operate the Churchill River Diversion and the Lake Winnipeg Regulation for generation of power through Manitoba. It doesn't get into the subtleties and the specifics of any particular generating station, but this is kind of the big picture of what is going on, kind of as a foundation of our system.

So in winter, to the surprise of no one, Manitoba electricity demand is the highest throughout the year. And so we operate these two projects to maximize flow to the lower Nelson River, where 75 per cent of our generation is concentrated.

Maximized -- it is a target, it is not a specific flow; it is not a specific way of operating, but we are trying to generate as much power in the province as we can, minimizing the amount that we have to import. But of course it is all dependent on what are the inflows, what's our reservoir levels, all those kind of things that go into it.

Once we get into the spring, as things warm up, our demand is lower. And then things start to get a little more varied, as the operations that we are planning are often based on what are the source levels on our reservoirs, what is the snow pack, what are the inflow forecasts from other provinces, as well as the inflow forecasts coming off the land from within Manitoba.

So there is a great variety of ways that we can operate. Typically, because we've been maximizing flow over the winter, our reservoirs are at a lower level, and so one of the things we are trying to do is put water back into storage on Lake Winnipeg, and onto South Indian Lake.

In the summer, there's even a greater

variety of ways in which we operate, because it all depends on precipitation input. You could be in the middle of a flood; you could be in a drought. A lot of times we meet somewhere in the middle.

So if you look at the hydrographs we provided in the report, in the winter, there is a much narrower band of possible water levels or flows. In the summer, that widens out, as the extreme drought/extreme flood band gets a lot wider.

Another thing that happens in the summer is that you can very quickly transition from a normal or an average condition to a flood condition with a few major events that cover a wider area.

And then in fall, Manitoba demand again is lower, because we are done with the air-conditioning season, and we haven't kicked into the heating season yet. Inflows also drop off as the summer rains peter out and -- you know, the snow hasn't started yet. And so, often we will reduce outflows from the control structures in order to conserve water for a number of weeks, until we get into winter, and then we go into a

maximization type of operation. So that's the whole system.

On top of that -- it's funny the way these things turned out, they looked fantastic yesterday.

The lower Nelson River, there is the additional operating nuance, I guess, that gets added to this base foundation of the Lake Winnipeg Regulation/Churchill River Diversion flows. We will cycle the flows out of Kettle Generating Station to meet daily demand.

So we have -- on this chart, this is Limestone, where the flow passes right through the three lower Nelson stations very similarly. So you've got a blue winter line and a greenish summer line.

And this is under a kind of lower base flow condition, so we have room to cycle. And we will match the demand within Manitoba with the flow that we are putting out through those stations. So you see a rising flow in the morning as everybody wakes up and turns on coffee makers, and the furnace kicks in, all that kind of good stuff. And then that demand stays high during the day, as you know, businesses are booming and

factories are turning out product and people are up and doing things. And then in the evening it comes down as lights go out, factories shut down for the night, and that kind of thing. And that cycle repeats day after day.

You can see here on the scale here that the flow change is substantial, from a low of -- as low as 1,000 cubic metres per second to a high of just under 5,000. So there is a big change in the flow within a single day. Obviously, it would never happen in the natural state.

But on these forebays, you don't really see the effects of that flow. Where you will see this is below Limestone, where this flow pattern will show up as a water-level pattern. But I can't show that to you, because we don't have any water-level gauges down there.

Continuing on with the cycling; we do, in our RCEA document, have a more fulsome example from Wuskwatim. Obviously the scale is much different; the flows are much lower, and the change between the maximum and minimum is lower.

But we do have more gauging on the Burntwood River, so we can show, for the flow

change on Wuskwatim, which is the lower line here, and this is the effect on Opachuanau, which is the first lake downstream of Wuskwatim.

We don't cycle very much on the other two stations within the region of interest, Kettle and Jenpeg -- sorry, Kelsey and Jenpeg. And when we do cycle them, both of them discharge into very large lakes, into Split Lake for Kelsey and Cross Lake for Jenpeg. So the effects on lake levels are imperceptible.

One question that was asked of us after the Phase I report was to add something on some of these more abnormal operations, so we have included one example in each region.

The only thing that really kind of stands out would be a full shutdown of a structure, and usually those are very short-term, especially at a generating station; there's not a lot of room. We tend to operate our structures at their full supply level, and so there is very little room for totally shutting down the flow and putting that water into storage with a pretty nasty emergency.

More common is a full shutdown at our control structures, where there is a large

reservoir stream that can take that additional flow for a time. Usually it is for maintenance, or some sort of an emergency.

And so we've got those described in the RCEA document. But I would caution you to not spend too much time on them, because they are abnormal; they are very rare. This is not a once-a-year kind of thing; this is once every number of years. So as interesting as they are, they are also extremely rare. So take that for what it is worth.

Gaps and limitations on this water regime data. The biggest thing we came across is having either no or a very short period of pre-development data.

The short record, we can overcome with modeling. We can take the relationship between flow and level again this is on the lake, and if we model a flow record, we can then create a synthetic level record. But if there was absolutely no pre-development data, then we're done. There is no way to create a pre-development water-level record without at least a couple of data points in that pre-development data.

The other issue we came across was a

very sparse gauge network. We had enough gauging in place to run our system and to be able to understand what is going on, but to start to pull out effects, maybe for Wil's interest, on erosion, that kind of thing, more gauging would be better. But a lot of stuff was put in place for the operation of the system, and not so much for an environmental assessment type of look at things.

The other thing that came across was there have been a number of reports done by various people over the years, whether they are predictions on effects of our developments on people, or after-effects reports; they give various values for how much area is flooded.

As we went through this ourselves, to try and determine how much area was flooded, we realized it really depends on how you define lake extents. In a lot of cases, it is very simple. The lake is -- you know, the entrance to the lake and exits from the lake are very clear. In areas that I showed earlier, from South Bay to Notigi, those lakes have increased immensely. So where, now, is the entrance to the lake? Where is the exit of the lake? Where do you say this lake ends and the river starts, if there is no clear

connecting-off point? Because it hasn't been flooded. In a natural system, the outlets are very clear; in an affected system, sometimes it's not as clear. So where you put that boundary can affect what your calculation spits out for a flooded area.

So I will just say that the values that we have included in the RCEA documents were determined consistently between the areas, and as far as we are concerned, are the best available today. So there is no report that says there was, you know, 10 per cent more, 10 per cent less. I don't know what methodology was used to do that, but I can tell you that we were confident in how we determined those flooded areas for the purpose of the report.

And that's it. Any questions? Yes.

MR. SOPUCK: You know, I have worked in the past with Hydro -- or not with Hydro, but with -- you know, water engineers, and just about any little project we have worked on, we have always had stage areas. Does Hydro not have that, for all of these reservoirs?

MR. GIESBRECHT: We have stage -- for the purpose -- for lower-stage area, I would say

for the most sources we will have that, and there are probably other areas where we do not.

It's funny, because we don't rely on storage in a lot of areas; we primarily rely on our river system in a lot of cases, and so the storage almost -- isn't all that useful.

So it either would be roughly defined, or -- in some areas it is very defined. There is no doubt about that. But we are not as concerned with the storage area curves, just because of the way our system is set up. Our storage is seasonal at best. Some of it is only a couple of months. On Stephen's Lake, I think it is, like, a month or so of storage. Very little storage.

MR. SOPUCK: Okay.

MR. GIESBRECHT: Moving on to our presentation, on erosion.

MS. ZACHARIAS: So next up we have Wil DeWit, and he will talk about erosion and sedimentation.

MR. DE WIT: Good morning.

I have quite a bit of material, unfortunately, to cover; I'll try and do it as quickly as I can, to make it clear for the notetaking.

So we will take a look again at our popular map on the areas that were divided in for the hydraulic zones. It has already been discussed, so I won't go into any detail, really, on that.

Our study area is based on where they rate and what types of regulation, and how it is affected by different regulation.

So if you take a look at the approach for the study, generally it involved a review of historical information, and additional consideration of some more contemporary information obtained through studies such as those conducted for Wuskwatim and Keeyask developments, and the Conawapa project that was on hold, and then also the coordinated aquatic monitoring program.

The erosion assessment did new analyses, using aerial photographs and satellite imagery to identify erosion taking place in some of those areas, as there was a lack of historical information on that.

And one of the limitations, Hydro limitations, as you have heard, is a general lack of historic data. And where data is available, it

tends to be sparse, both spatially and temporally.

In terms of community concerns related to this topic, in discussions we've had with various communities, some themes come out. There's concerns related to the loss of traditional treaty lands, impacts -- potential impacts on the infrastructure; for example, say, a road near a shoreline. Shore access, for resource use and wildlife. The addition of sediment. Creation of wave debris, which may affect boating safety and fishing, and overall aesthetics of the shoreline.

In terms of sedimentation, there's issues pertaining to the murkiness of the water, which was reported to be much clearer in the past. Water quality concerns related to drinking and swimming, and the potential effects on the fish.

So going to Area 1; the upper Nelson River, from the outlet of Lake Winnipeg down to the Kelsey Generating Station, just upstream of Flood Lake.

Looking at erosion in this area, extensive erosion occurs along the north shore of Lake Winnipeg and at the entrance to 2-Mile Channel, the west shore of Playgreen Lake, and

along Kiskittogisu Lake, near 8-Mile Channel.

The erosion rates observed on the north shore of Lake Winnipeg and the southwest shore of Playgreen, that was high, historically, prior to development, and remained high after Lake Winnipeg Regulation of similar rates.

Downstream, in the Jenpeg forebay, erosion rates -- post development erosion rates are generally relatively low, but are still higher than they were prior to regulation.

On Cross Lake, there was limited -- little effect on erosion rates.

And then increases in erosion on Sipiwesk due to Hydro development are difficult to quantify, due to the lack of historical data prior to Kelsey. Erosion is ongoing since LWR at similar rates, and appears to increase somewhat more recently, due to high water levels in the last -- since about 2005 onward. The flows into Jenpeg are set at about 2005, and so have water levels.

In terms of sedimentation, 2-Mile Channel, from Lake Winnipeg, tends to transport some additional sediment from the north shore of Lake Winnipeg into Playgreen. This

sediment generally appears to remain suspended and transported through Playgreen Lake to downstream areas.

In the lake, overall, the suspended sediment and turbidity conditions have been generally similar to what existed prior to regulation. However, 2-Mile Channel, 8-Mile Channel -- 2-Mile from Lake Winnipeg to Playgreen, and 8-Mile from Playgreen to Kiskittogisu -- have changed the sediment transport dynamics in this area, and the way it is moved downstream into the borrow area into the lakes.

So downstream and Cross Lake, Lake Winnipeg Regulation generally resulted in some higher turbidity and suspended sediment conditions in the east area of the lake, Cross Lake; but along the main flow path through the west area of the lake, the suspended sediment tended to be lower.

Within Sipiwesk Lake, again, there is a lack of pre-development data, but sediment concentrations have been similar before and after Lake Winnipeg Regulation.

As I said, the period available

remains effective due to the operation of Kelsey Generating Station.

On the lower Nelson River, that would be from Split Lake, which receives inflow from the Nelson River and the Burntwood River at its west end, from Split Lake down through to the Nelson River estuary and Hudson Bay, there is a little bit of erosion information prior to any of these developments.

But overall, Split Lake, Gull Rapids, has generally erosion resistant shorelines, before and after regulation, and generally low erosion observed after Lake Winnipeg Regulation and CRD. And except in a few localized areas, some increased erosion is observed, but again, fairly localized.

Some recent high-water levels, due to the higher flows over the last number of years, have caused some erosion concerns in their communities, which have led to the reinforcement of shorelines with riprap in those areas.

Extensive shoreline recession was observed downstream, in the Stephen's Lake area, which is the reservoir for the Kettle Generating Station, which resulted in substantially flatter

shorelines being created.

Initial high -- there is -- and then initially, the erosion rates were quite high within the forebays of Stephen's Lake, but also as well, just downstream of Limestone and Long Spruce forebays. Over time, the erosion rates tended to decline as shorelines stabilized, although there are a few localized areas experiencing ongoing higher rates of erosion.

Below Limestone Generating Station, the shoreline conditions have been quite stable since at least the 1950s.

In terms of sedimentation, there was -- despite the LWR/CRD, there was no significant apparent change in sediment and turbidity in the initial years after regulation. However, in the last number of years, levels appeared to be higher than they were prior to regulation, and this is likely related to the higher flows that have been occurring over the last number of years, resulting in higher water levels and potentially more erosion.

The Churchill River Diversion substantially increased the amount of sediment being delivered to the west end of the lake, down

the Burntwood River, due to the increased flows on the Burntwood. Overall, further downstream, in Stephen's Lake, again there is a lack of pre-development data, but the suspended sediment and turbidity conditions have been relatively stable since the 1970s.

And then in winter, more recent studies have observed some winter ice. Winter ice effects can cause higher suspended sediment minerals in winter, and so sediment concentration varying over a wider range, potentially higher average concentrations, and that results due to ice effects blocking flows within jams at certain locations.

Going on to Area 3, which is the Churchill River Diversion area, including Split Lake, down through the Notigi reservoir, up to and then to the Wuskwatim and Keeyask that was most recently completed, and then down through from Wuskwatim to Split Lake.

Prior to any development, South Indian Lake had very low erosion. The shorelines were predominantly bedrock-controlled. And after regulation, water levels were raised, and extensive erosion of shorelines has been going on,

particularly in the north part of the lake and in the South Bay area, which is where the diversion channel is located.

The highest rates -- again, the highest rates of erosion were observed shortly after the development was completed, and generally declining over time as shorelines stabilized, but there are still areas of ongoing large erosion.

In the vicinities of the South Bay and Missi control structures, sediment was -- well, the effects on sediment are variable throughout the lake, where more data is available in the vicinity of South Bay and Missi control structure. The suspended sediment was initially increased due to diversion, but more recent data -- conditions for more recent data indicate that the conditions are similar to pre-CRD, although for suspended sediment due to turbidity has been a bit higher.

Following on the Churchill River Diversion area, in Zones 6 through 9, downstream of the diversion, extensive erosion of shorelines was observed after regulation from South Indian Lake to Notigi. And as you saw on the maps that Brian showed there, that's where substantial mitigation occurred, particularly in the high

sediment area. There was large erosion in that area, downstream of Notigi to Wuskwatim, affected by increased flows, some increases in water levels.

I have to change a slide. And I've suffered the same problem as Brian, with the text overlapping.

So from Notigi to Wuskwatim, areas of large erosion are not as extensive as observed upstream of Notigi. And then below Wuskwatim, areas of large erosion are again less prevalent than upstream, and more localized, typically more located near the rapids.

And again, the highest rates of erosion were observed soon after Churchill River Diversion, and generally declining over time. Some areas of large erosion still occur in the Notigi reservoir.

In terms of suspended sediment, data from South Indian to Notigi indicated an initial increase in the suspended sediment due to CRD, but a return to conditions more typical of the pre-CRD conditions, despite the ongoing erosion in those areas.

Turbidity and suspended sediment

typically are generally increasing downstream in rive run sections, and decreasing through lakes, generally indicating loss of material and deposition is taking place within the lakes along the way.

Conclusions in previous studies, where more data is available, at Thompson, have varied, but more recent monitoring suggests more turbulent conditions than existed prior to regulation. And overall, there is a much larger sediment load being delivered down the river, due to the diversion, due to the increased flow. Although suspended sediment concentrations may not have increased as much, the load increase -- just simply due to the load increase.

In the downstream, lower Churchill area, downstream -- the lower Churchill River area, downstream of South Indian Lake, there is little erosion to note in this area. Suspended sediment and turbidity are quite low, very low, before and after regulation. And due to the large reduction in flow down the river, there is -- resulting in large sediment load reduction associated with that, downstream and all the way to Hudson Bay.

So that's all the four study areas. Just in summary, in terms of erosion, increased water levels caused increased rates of shoreline erosion, particularly in the initial years after individual developments occurred, and erosion rates tend to gradually decline over time to a more stable rate that will exist over the long term.

However, those long-term rates may be larger than existed prior to development, at least until shoreline stabilized on hard materials such as bedrock, and then your erosion rates will effectively come to zero.

More recently, the high water levels, high flows and resulting high water levels, since about 2005, have caused some increases in erosion in some areas -- for example, Sipiwesk Lake -- and caused some concerns to the communities along the lake, such as Cross Lake, York Landing, and Split Lake.

In terms of sedimentation, increases in suspended sediment and turbidity were more pronounced in the early years, after the reservoirs were impounded and flows diverted. In many areas, more recent contemporary data suggests

conditions are similar to pre-project, pre-development conditions, with some exceptions.

While erosion is greater in reservoirs that occurred before development, much of the resulting sediment tends to be retained within the reservoirs.

And then flow diversions, particularly 2-Mile and 8-Mile Channel and Churchill River Diversion, substantially altered the patterns of sediment transport within the system of the upper Nelson and the Rat-Burntwood system and lower Nelson. CRD significantly reduced sediment load down the Churchill River, and increased it on the Burntwood River, resulting in increased sedimentation at the entrance to Split Lake.

That's it. If there are any questions ...

MR. SOPUCK: I'm going to start with a comment, and I have a couple of questions.

I think the last two presentations, the last two subject areas, are probably -- aside from impacts on people, are the most important study components. When you get water level change, you get erosion, you get sedimentation; just about all other environmental effects flow

from that.

And when I looked at the way in which this was analyzed, I just -- I tried to read the whole thing, and I couldn't, but I did focus on South Indian Lake. And, you know, you commented on -- you know, there's significant areas of erosion. We know that post flooding, most of the lake is not bedrock-controlled. And yet, through your analysis, you have an estimate of 628 hectares of land -- of recession on a lake that -- you know, shoreline length of 5,600 kilometres. And you also -- I'm not saying you, but the report also says that this estimate is likely low.

Now, are we talking order of magnitude, two orders of magnitude, are we not sure?

MR. DE WIT: We're not sure. It hasn't -- the detail, there's some limitations in terms of time of being able to get that level of detail. There's also some lack of data, particularly in terms of -- because the satellite imagery can only get down to a certain level of resolution. You can't see small erosion, small things, say, less than 90 metres. Small. Air

photos are more desirable for that, but there's a lack of air photos over a lot of the area.

So, yeah, it -- that would definitely be an underestimate. We are actually currently doing some work with the community to do some investigation, a bit more investigation on some of these issues, to try to flush some of these things out. So, yeah, that would be definitely an underestimate, for sure.

I'd be reluctant to give a number without further study of a more detailed analysis.

MR. SOPUCK: The other thing I would point out here, is -- and, you know, we all know that there is a significant lack of pre-data. Perhaps the one exception to that would be South Indian Lake, where you had Newbury and McCullough's work, identified stations that were followed, but they were only followed for four years post flooding. Is there any possibility that sites like that could be re-evaluated?

MR. DE WIT: Yeah, and that's part of the discussion that we are currently -- we've really just started some work on South Indian Lake, with one of their consultants representing them on some analyses. And so we're at -- it's

kind of like a journey of 1,000 steps; we're on Step 2.

So that's some of the discussion that we are having, and we have to see where some of that analysis is going to end. One of the issues that we have, for example, on Newbury and McCullough, on the sites they investigated, it's not necessarily clear where those were.

If you want to go back and study it, they've got a dot on a map, but I don't have a specific coordinate. So that dot on the map covers the shoreline, depending -- like, if it's a dot on a map this size, I mean, the dot covers an area of five square kilometres. Which shoreline we can't compare, because you don't know where they were.

MR. SOPUCK: Okay.

MR. DE WIT: But we've talked about kind of going back and saying, "Okay, is there something that we can draw from that?" But that's -- again, that's a few steps down the journey.

MR. SOPUCK: Okay. Thanks.

MR. JOHNSON: Yes. Terry Johnson speaking.

With regards to sedimentation loads that move through the system on a regular basis, can you give us some sense on what percentage of the sedimentation actually redeposits in that lake, or another lake, and what percentage actually gets flushed to salt water? And if it does make it to salt water, have you noticed a buildup of an alluvial band, or something in the Churchill area there, or the mouth of the Nelson?

MR. DE WIT: In this analysis, we didn't specifically do the analysis of the incoming and outgoing loads. There is a bit of information on that, for example, from the Wuskwatim EIS that was referenced in the document. I don't recall the numbers off the top of my head. What I'm more familiar with, for example, is the Nelson River, the studies for Gull, for the Keeyask GS at Gull Rapids. The sediment load there was about 1 to 3 million tonnes per year estimated, which is actually quite low, considering that's along the lines of what the Red River carries. And then through Sipiwesk Lake -- or through Stephen's Lake, about 30 per cent of that load tends to be lost. You know, so you are maybe three, four hundred thousand tonnes to

a million tonnes deposited in that lake, and then sediment load going downstream, probably similar; maybe a bit higher.

I'm not quite as familiar with the bay, but a fellow I worked with who worked on Wuskwatim studies, and he said, too that at the bay, the sediment load from the Nelson River obviously contributes to the mudflats and deltas and stuff there. But he said, realistically, the load delivered by the Nelson is really quite small compared to the internal loading, due to the -- because it's quite large, flat mudflats in that area, so when the water is at low tide, you've got extensive flats that comes up and submerges that. The internal loading, due to the stirring-up of that sediment, dwarfs -- essentially on a daily basis -- what comes from the Nelson.

So that the shoreline processes around the exits of the lake kind of dwarf what is coming from the river, is my understanding.

MR. JOHNSON: One last question, and if you don't mind, it is a bit of stargazing, if you like, in consideration of where things might be for the future, for monitoring shorelines and stuff like that.

The ability to rent satellite time and stuff now, with very high resolution, has that been discussed? What are your thoughts on an ongoing basis for the future?

MR. DE WIT: For a specific example, I'm involved in monitoring physical environment for Keeyask, where we definitely want to take a look at using, say, high-res satellite imagery. In the past, people went out and did surveys at specific shoreline locations, say -- you know, ten locations, or -- Sipiwesk Lake data was to -- or South Indian Lake had, like, 17 or 18 monitoring spots on the lake. Hundreds of, like -- 2,500 kilometres of shoreline monitoring 17 spots.

You get a lot of detailed data in a very good -- one location, that doesn't really tell you much about the surrounding area. The satellite imagery can give you a good overall picture, but not a lot of detail, but we are certainly trying to going in that direction and take a look at some of these things.

But again, we're developing those processes. Now, some of that is being done in conjunction with the Province on the coordinated aquatic watering program, to try and bring some of

that out, and also trying to look at -- beyond the shoreline, using some of that to understand the sediment dynamics.

For example, they've taken a look at Playgreen Lake, and said -- it's an extremely complex system at that location, and how does that -- where it's coming from, how it moves, and what the sources are, and how it's driven by wind and flow and those sorts of things.

But we are in the process of trying to develop that capacity, to understand the system in more detail.

MR. JOHNSON: Thank you.

MR. DAVIES: Just one thing on the estuary effect. I believe the tides are so pervasive in the estuary that any effect is pretty well masked by the huge wall of water that comes and goes. There is some bathymetric work that was done in the early 1900s for Fort Nelson, and the fouling is in same place it was in the early 1900s. And a lot of the area is still very similar, and I believe it's because the tidal effect is just so massive that it controls that general area itself, much more than Manitoba Hydro would.

MR. DE WIT: Thank you.

MS. ZACHARIAS: We are going to switch over now from Physical Environment to the Water section. So we are going to have Megan Cooley come up and give an intro to the water section, as well as talk about water quality.

MS. COOLEY: Good morning, everybody. Can everybody hear me?

My introduction section is quite brief, and from what I understand, some of this material has been covered already. But I will revisit some of this for reminders for people.

So region of interest here, from the aquatics component, is the same as what you just saw through Wil's presentation; so four areas. The same areas: Upper Nelson, Lower Nelson, CRD route, and Lower Churchill River. For the aquatics component, some of these areas were further subdivided into smaller reaches, to kind of correspond with things like location of infrastructure, like a generating station, for example. I think every topic you are going to hear from here on will provide summaries of effects and conclusions for each of these reaches.

Regional study components for the

aquatics, there's five of them: Water quality, which I will be talking about; fish community; lake sturgeon; mercury in fish and fish quality; and marine mammals, which are belugas and seals.

From what I understand, Allison already covered a bit of background here about how they were selected. But one of the key factors of influence was importance to First Nations communities or sensitivity to Hydro development. So a variety of reasons regarding that decision.

Pathways and effects diagram, this appears in the report; I'm not going to go through that in detail, in the interest of time. But that was just to remind folks here about the complexities that we're dealing with.

So under here -- so regional study components over here, obviously they're affected by Hydro development, things like changes to water levels and flows, erosion, sedimentation, that you just heard about, footprints, et cetera. So a variety of pathways of effect, but they are also affected by a multitude of other factors.

So these factor things like, for instance, climate change or harvesting. One example would be for lake sturgeon, some of the

populations were extirpated in areas even prior to hydroelectric development.

So these other factors, external factors, were also considered in terms of interpreting the information.

I don't know if there is a poster or not, but -- okay. So that was it, in the way of an introduction. And I'll jump right into the water quality component.

Just a few brief points about the approach, and limitations specific to this component, though some are actually quite general and I think cast more broadly. But in terms of the approach, much like others, the assessment relied on both literature -- so published reports, et cetera -- but also the library, heavily, on compiling, analyzing raw water quality data from a variety of sources.

So there was a quantitative assessment done using that raw data, focusing on key indicators and metrics which I believe Allison also covered earlier, so I will not go there.

The analysis was both temporal and spatial. So, obviously, we looked at pre and post Hydro development to track effects, because water

moves, we also had the ability to look at things spatially, then, for effects.

A simple example would be where the water quality is different up and downstream of a generating station. So that, collectively, provides a really good approach for assessing what might have happened.

The other kind of unique feature of the water quality is that there are readily available published benchmarks. By that, I mean water quality guidelines; in this instance, a whole section of aquatic life. So they universally applied the standards of practice to apply them, so we considered that in data interpretation as well.

Limitations: We have only three kind of broad ones here. The first being -- I think this is universal as well -- some differences in sampling and/or analysis methods, which rendered uncertainty to the assessment. But it is inherent. There's not much you can do, particularly when you're dealing with multiple data sets over a long period of time. Very common problem.

You've heard already today there is

either no or limited pre-Hydro data for some areas, but some areas have more info than others. But it's a pretty common observation. A few cases even were post Hydro data; that's a little limited as well.

The last point water quality, the practical approach for erosion, sedimentation, that we just heard. Some of the episodic effects that might have occurred; things like high wind or storm events that might cause a lot of erosion, affect TSS and other conditions, typically have not been captured in past monitoring programs, because you can't be out in a boat, sampling, during those sort of events.

Before I get into region or area-by-area conclusion, just three points on overarching conclusions.

First, there were effects observed, some of which were short-term, and/or were localized, so within a lake, or a portion of a lake, for example; others were widespread and permanent.

And the differences in terms of magnitude, spatial extent, duration of those effects, largely reflected differences in the

pathways effect. So by that, particularly meaning flooding, which tends to have a shorter-term impact versus divergent, which is long-term, permanent.

And the last point: Despite the fact that there were changes observed, it is that post hydroelectric monitoring data that we had available to us indicates that conditions were suitable for aquatic life at most sites and most time periods. So, generally, fairly good conditions.

Area one. So this is the upper Nelson River. There were some temporal changes and conditions observed over the period of record, but most of these didn't actually show any clear relationship to either Kelsey Generating Station or Lake Winnipeg Regulation.

Other key points or key findings is that the water quality conditions are generally somewhere along the entire length of that river system, so from upstream to downstream. And they largely reflect the overwhelming dominance or influence of the major inflow, or the only major influence which is Lake Winnipeg outflow.

Having said that, there were some

temporary changes observed, either documented with data or inferred, based on what we know, or things like erosion, in some areas. So there were increases in turbidity -- or reductions in water clarity, if you want to turn that around.

Some had evidence or indications that dissolved oxygen was lower in some periods in Cross Lake, specifically pre-weir construction.

Leapt over to area three; this is intentional for reasons which hopefully will be clear to you in a moment. This is the CRD route. Quick reminder, this area experienced quite a large number of changes related to both flooding and diversion, and there were permanent changes due to diversion of the Churchill River into this system. That river had different chemistry prior to CRD, and that was reflected, in turn, in a change in conditions in the Rat-Burntwood system.

There were also temporary effects observed, and these generally related to flooding. You've heard earlier that there was a large amount of flooding in this area, so no surprise.

I should point out that increases in nutrients was one of those observations. The largest effect was observed in Notigi Lake,

particularly during the impoundment period, so when it was actually, literally, being filled.

You've also heard from Wil's presentation that water clarity -- so by that, meaning higher turbidity was also observed. This is fairly widespread, very well documented, and it is linked to increased erosion and/or re-suspension of sediments, an example being South Indian Lake, Area 6, where the outlet channel was being constructed would be one of those.

So, leaping back to Area 2 -- I put this third set second, because the lower Nelson River received Rat, Burntwood, and Nelson River solids, so it is affected by both of those routes.

This a bit unique from the others, such that it lacks pre-Hydro data for a number of the developments. And it also has a concomitant development, or construction of a number of developments, so that they overlap in time and space to some extent. That makes it a little more difficult to tease out what effects might have been attributed to each of those particular developments. So a bit more complex.

But, having said that, the information allows us to tell a story about each of those

major developments, to the extent that information is available.

So, CRD and LWR, the key change here really relates to the diversion of the Churchill River, so you see the effects that were observed in the Rat/Burntwood system translated down into the lower Nelson.

The Kettle Generating Station, there is no pre-data to try to characterize that system, but there is quite a wealth of data from initial years following impoundment and moving forward. And collectively, that tells us that the north arm of that lake, where it was quite isolated from the Nelson River, first off, and also experienced flooding, appears to have responded in a typical manner, which you typically observe when you flood terrestrial habitat. So increases in nutrients, reduction in oxygen, and reduction in the water clarity.

Moving back into the main flow for the Nelson River, so the southern portion of Stephen's Lake, or the forebay of the Kettle, Long Spruce and Limestone and downstream. So along that main flow path, the available information tells us that any changes to water quality were either

negligible, short-term, and/or not captured in monitoring programs.

Last area, the lower Churchill River system. Effects here, not surprisingly, relate back to the fact that there was a large reduction in flow, a large reduction from the Churchill River, specifically. What that meant is, local drainages became more predominant, and that was reflected in changes in some chemistry conditions. For example, it became harder.

Having said that, there is at least some contribution of effects related to changes upstream. So there were some observed changes in South Indian Lake, which also contributed to those changes post CRD downstream.

So for new findings, that -- not all of these are new, but definitely the extension of the period of record relative to past assessments allows, I think, more conclusions to be drawn out of the information at hand.

First off, the analysis showed that there were some differences in the conclusions from the RCEA relative to past assessments. One example is the RCEA assessment concluded no change in phosphorus for a number of sites, which is not

in agreement with all of the past literature.

The other thing the analysis allowed is there is an extension of the data sets beyond 1993. That's the last seminal quantitative assessment that was done for the area as a whole. Addition of more data told us a few things about more recent conditions.

For example, there is indications turbidity had actually gone up again in Southern Indian Lake, Burntwood River, and Split Lake. Also increases in conductivity in the Nelson River system.

So the recent conditions, there were also some indications of very recent changes. I've given one example here, which is conductivity for Cross Lake. Recent changes -- and by that I mean, essentially, the tail end of the period of record that was looked at. So this time a lot of (inaudible), 2012 and 2013, and that was reflected pretty much through the upper Nelson River system. So very recent kind of condition changes there.

A sort of second corollary to that is the study also showed the water quality pattern that you see along the upper Nelson River being quite consistent. You see essentially the same

signature from up and downstream, and that really reflects us coming out of Lake Winnipeg.

So the dominant effect, again, is the Lake Winnipeg outflow.

Last point is for the lower Nelson River region. That area experiences a variability of water quality conditions over time; it has in the past, and it will continue to. That really reflects differences from year to year regarding the proportional contribution of the two inflows, the Burntwood and Nelson Rivers, which have different chemistry. You see it bounce around, depending on how much flow you are getting from those two systems.

And the last slide here, bringing us back to kind of First Nations or community concerns.

One of the important conclusions or findings is that water clarity did indeed decrease in some areas post Hydro. That's very well documented. The largest effects, and the largest extent of effects, were observed in Area 3, along the diversion route.

There are some changes in water quality that may have adversely affected aquatic

life. The key example I gave here is lower oxygen in Cross Lake, which was observed for a couple of years post LWR but prior to weir construction.

I put in nutrients, because I know that nutrients are generally a great concern these days, not just in Manitoba but globally. Nutrients did go up in some areas, as a result of flooding, primarily. But the key point, I think, is that those effects are temporary.

And to circle back, the last point, to the very first slide, and the key take-home here as well is that post Hydro data indicates that conditions have generally been suitable for aquatic life at most locations and most time periods.

And that's all I have. So, any questions?

MR. HARDEN: The increase in conductivity at Cross Lake seems to correspond with a period of high outflow from Lake Winnipeg, sustained high outflow. Would you say that was a limit --

MS. COOLEY: I suspect you're right. There has been, I think, a pretty long period of high water levels even preceding that. But it

certainly does adjust, that there's a broader effect occurring upstream in the watershed, and that increase observed in Cross Lake was translated down the system, so it does indeed seem to be once that -- what actually ultimately drives that change in Lake Winnipeg outflows is another question. It could be effects within the you know very large drainage basin. It could be changes anywhere. Or, as you say, just sustained periods of high water level and outflow.

MS. ZACHARIAS: So next up we have Richard Remnant, from North/South as well. He is going to talk about fish community and fish quality.

MR. REMNANT: Thanks, Allison.

My name is Richard Remnant, and as Allison said, I'm from North/South, and I'm up here to present fish community and fish quality. And I'm relaying the work of many different people who have contributed to this presentation. I guess I drew the long straw, and I get the opportunity to come up here and present to you, although I will be looking to others to help me with any really hard questions, so you may hear some other people on this.

We don't have the pretty pictures that Megan had, so I will have to think back to her presentation to show you the water bodies.

So with the fish community, in terms of approach and limitations, what we did is we looked at work that had been done in the past, and we tried to come up with a way that we could look at fish communities over the entire ROI. And we knew that we had a fairly robust set of limitations, which I will get to in a minute, of an index data across the province, and that's what we wanted to look at for our main source of data.

So in terms of the approach, what we did is we -- it was a compilation of available data, and then we reanalyzed, a reanalysis of this data into relevant time periods to develop a quantitative comparison.

And part of this was driven by the fact that we knew that we had quite a robust data set, the data set in the CAMP, and we knew there were other data sets that we could make comparable to that.

We were able to produce quantitative assessments using -- for a number of indicators, using selective metrics. And again, the focus was

on index gillnetting data.

We looked at the fish community in general, but we focused primary on lake whitefish and walleye, which were important across the region and important to the communities and fisheries.

There were a couple of other species to note. Brook trout were given some importance, certainly in the lower Nelson River, and there is mention of that. And then lake sturgeon, obviously, is very important in the region, and it's formed its own section, which will be discussed later.

So in terms of limitations, the majority of the ROI has little to no pre-hydroelectric development data. The other problem that we were faced with -- again, recognizing we had a fairly good data set, but there were changes in sampling methods in terms of mesh sizes, and certainly in terms of locations, and often precludes direct comparison of the data.

So I will skip right into conclusions and findings, and we will start with Area 1.

Start with Playgreen Lake. There were no comparable pre-hydroelectric data that we were

able to use, and when we look at data collected in the 1980s and compare it with the current data, we see that there is an increase in total catch and walleye CPUE, and some shift in species composition.

Moving to Cross Lake, there was a small amount of pre Lake Winnipeg Regulation data. Adverse effects on CPUE were partly mitigated by the weir, but to date, whitefish have not recovered in Cross Lake; we aren't seeing increases in whitefish.

In Sipiwesk Lake, there was a small amount of pre and post Lake Winnipeg Regulation data, and we see some shift in the species composition.

I'm moving to Area 2. And something Megan talked about is we had subdivided our regions or areas into smaller regions, natural sort of breaks, based on infrastructure or reasons to separate them. So we looked at Split Lake. There was no pre hydroelectric data. When, again, we look at the comparison of the '80s data to the current data, it shows the total catch in whitefish CPUE declined. It showed an increase in walleye CPUE originally, but in the last few

years, there appears to be somewhat of a decline of walleye CPUE in the lake as well.

In Stephen's Lake, there's again no pre hydroelectric data. Impoundment by the Kettle Generating Station caused large changes in fish community in both river and lake habitat.

Moving further downstream, the Nelson, below the Kettle GS, this is where we have more recent hydroelectric stations. Each station resulted in changes in the forebay fish community, and changes in movements, decreases in brook trout abundance, and decreases in cisco abundance as well.

Moving forward to Area 3, starting with -- starting in the lake, we will concentrate on Area 4, which is that area in South Indian Lake where a lot of the commercial fishery has been conducted over time -- most of the time fisheries have been existing. What we found there is that whitefish are old, slow-growing, small fish, with low condition factors. Although the whitefish CPUE in Area 4 is still the highest of all the other areas, but it has decreased.

Within SIL in general, we have a fairly consistent lake-wide decrease in total

catch, whitefish and walleye. And there is lots of potential causes, including poor egg survival due to drawdown, emigration, sedimentation, lack of food, and persistent fishery.

Moving down into the diversion routes, there were no pre-CRD data. Effects since the 1980s include shift in species composition, and again we see a decline in whitefish abundance, an increase in walleye abundance. We also have the blockage of upstream movements at Notigi.

Area 4, which is the Churchill River downstream of Missi Falls, there were no pre-CRD data. You have a substantial reduction in the amount of fish habitat, and this is due to the reduction of growth out of Missi, but fish communities are -- fish communities remain, despite the reduced flow and habitat loss.

Fish catch in the upper -- in the lakes in the upstream part of this area are somewhat lower than those of nearby off-system lake.

Further downstream, at Churchill, the weir was built in the late 1990s, and we have seen a fairly recent increase in catch for a small water body, and it's largely driven by an increase

in whitefish catch in that area.

In terms of new findings, I think one of the real -- I think I would say strengths of this exercise is being -- the ability to compile and compare quantifiable fish community metrics for different time periods. This is something that had not really been done before. We were able to get a lot of data from ODEA (ph), and from Manitoba Fisheries Branch data sets and compare it with the CAMP data sets, and in terms of the exercise, actually bringing a data set together and having quantifiable data to compare, and obviously we were having some limitations with it.

In terms of a new finding, and really what we are seeing in most -- we call it system-wide, but in most areas, we are seeing, I think, an increase in frequency of walleye and a decrease in the frequency of whitefish in many of the water bodies from the 1980s to the current period.

So in terms of importance to the community, the abundance of key commercial species has changed in many waterways. Walleye, currently important to commercial fisheries, have presently increased in many of the areas. And whitefish,

which historically were important to domestic fisheries and preferred by elders in communities, whitefish have decreased in many of the areas.

And that's all I have for fish community. Again, I'm open to questions, or I can move on to fish quality and deal with that one, and then get questions on both of them.

I don't know what you want, Allison, or what people want to do.

MS. ZACHARIAS: I'd say if there are questions about the fish community, you could address them now.

MR. REMNANT: Sure.

MR. JOHNSON: This is kind of similar to the questions we had before, like the changes that you're noting, rising walleye and lowering whitefish stocks in the region of interest, have you done any assessments outside of the region to see whether -- what are you seeing in those areas, to see whether it's a similar type or whether it's different?

MR. REMNANT: I think I can answer that. I'll start to answer that question, and maybe others will chime in.

It certainly is part of the CAMP data

set, which is the current data set that we've got. It is data from 2008 to 2013. We have off-system water bodies in every -- in all the CAMP regions that are sampled for that very reason. And in some cases, we are seeing similar trends -- and again, this is just looking at the 2008 to 2013 data.

We are seeing similar trends; in some cases, we're not. One thing about these off-system water bodies is that they are primarily on much smaller watersheds. It is almost impossible to get a good, true reference for a water body as large as the Nelson River, for example.

But yeah, we do have off-system water bodies. And again, for the present period.

MR. SOPUCK: You know, based on the sort of system changes that have occurred, and what you know of the biology of the species, is this a fairly predictable result; walleye up, whitefish down, on the basis of the sort of system changes that have occurred?

MR. REMNANT: In terms of -- I mean, there is some other factors at play, certainly, in many of the -- in parts of the watershed. There

are some -- what we would call other stressors at play.

You know, we know that we have changes in climate. We know that we have the introduction of exotic rainbow smelt, which has really changed food webs in some of the affected water bodies.

In terms of -- the walleye increase, again, appears to be fairly common, almost everywhere. The reduction of whitefish, where it is not being seen, is in the lower Churchill River, essentially, and I guess -- I would say lower Churchill River.

So, you know, perhaps -- and this is a cooler -- you know, the lower Churchill River is a cooler system than we find necessarily in the south, or even -- you know, the southern part of the region, anyways.

So it may be part of a play -- and something that's changing with -- again, things like changing climate and inter-species.

I don't know if any of my coworkers want to add anything to that, or ...

MR. DAVIES: This is from the people that find rainbow smelt. It is one of the main -- in some areas, it is one of the main foods for

walleye. It has a very high caloric value, so the walleye grow very, very fast, and reach maturity at an earlier age, so they do very well with rainbow smelt in the water. And walleye (inaudible) type species which you would expect to do better in a hydroelectric development setting. The fact that they have maintained their population, even though they are being commercially fished, so that there are probably other factors also affecting walleye populations. And that could be the extra food being provided by rainbow smelt, and even climate change.

SPEAKER: Some of those questions will be answered in the Nelson Kisskttо.

MS. JOHNSON: We can't hear you.

MR. REMNANT: I'll elaborate what Glen is saying there, so it's on record. Just saying that now, Stuart had to add in the possible rainbow smelt; I unfortunately take it for granted that people know about rainbow smelt. I've done a lot of work with them, and I should have elaborated on them, that they are predatory, small volume fish, very small fish that got into the system and done very well, in Lake Winnipeg particularly, and the lower Nelson River.

What Wolfgang is alluding to is we are seeing now collapses in the abundance of rainbow smelt throughout Lake Winnipeg, and we're seeing it in the lower Nelson River as well. And so I think we will see just what sort of a role -- how important rainbow smelt were to the success of increasing the abundance of walleye.

MR. DAVIES: Just to add to that, the production of walleye on Lake Winnipeg itself has been dramatically increased in the last few decades, and it's primarily due to the rainbow smelt. It will be interesting to see what happens when they do decline.

MS. ZACHARIAS: Any more questions on fish? We have one more fish quality presentation, and then we'll break for lunch.

MR. REMNANT: All right. So I'm going to talk a little bit about fish quality.

When we talk about fish quality in this presentation, we are looking at palatability, and the incidence of T. crassus, or Triaenophorus crassus, which is a tapeworm cyst in the flesh of primarily the whitefish.

In terms of the approach, the palatability indicators were acceptability to

harvesters and results of scientific tests that institutions such as the University of Manitoba would conduct.

For the Triaenophorus crassus indicator, the rate of infestation is expressed in the number of cysts per 100 pounds of flesh of dressed commercial whitefish. This is in keeping with Freshwater Fish Marketing Corporation protocols, which is what they use to grade the whitefish into different grades of fish, and those grades attached in the prices.

In terms of limitations, fish taste is very subjective, and there were no pre hydroelectric studies on fish palatability, so comparisons can only be made with off-system lakes. The pre hydroelectric rate of infestation data are only available for a few water bodies, and the quantity and quality of that data is inconsistent.

With respect to the conclusions, findings, with respect to palatability, there is no known scientific study directly linking changes in palatability with hydroelectric development in the region of interest. However, it is understood that hydro development can cause changes to fish

diet, water quality, algae, and growth rates, which can all affect the taste and texture.

Tests conducted by DFO on fish from Playgreen Lake, all of the fish passed their tests. Tests were done by University of Manitoba at Nelson House, Split Lake, York Landing, and Bird, which is in the Fox Lake Cree Nation. They found no statistically significant differences between on- and off-system lakes.

Now, that said, many First Nation members still feel that taste and texture have changed. And that's a perception.

Under the key conclusions and findings in respect to Triaenophorus crassus, the rates of infestation of lake whitefish, we do see increased rates in several water bodies -- for example, Southern Indian Lake, which came about after the hydroelectric development -- but not in others. Wuskwatim Lake is one where we did not see an increase in T. crassus levels.

Pathways of effect vary between water bodies, but include changes to the abundance or distribution of any of the three hosts for the parasite.

Importance to communities.

Palatability affects domestic consumption. Resource users will shift harvesting to unaffected lakes.

In terms of T. crassus, it affects the marketability of whitefish, that I alluded to earlier, and the viability of commercial fisheries.

And that's all I have; short one. So I will take any questions you might have.

MS. ZACHARIAS: Thank you.

Okay, we probably just need about five minutes to set lunch up. I think we'll set it up somewhere in the room here, and then we will take a 30-minute break, so we'll come back for 1:00 p.m.

(LUNCH RECESS TAKEN)

MS. ZACHARIAS: Okay, I think we will get started again. Next up we are going to have Cam Barth, from North/South, to speak about lake sturgeons.

MR. BARTH: Thanks, Allison. As Allison said, my name is Cam Barth, with North/South Consultants, and I'll be discussing the lake sturgeon component of the RCEA.

Please don't be confused by the

walleye picture. Okay. Thanks a lot.

To reiterate, my name is Cam Barth, from North/South Consultants, discussing lake sturgeon, one of the RCEA.

Just to refresh everybody's memory, the purpose here was to evaluate and assess how populations have changed over time relative to the cumulative effects of hydroelectric development in the Nelson, Burntwood, and Churchill Rivers. So our approach here, we selected three indicators: Abundance, growth, condition factor of lake sturgeon, to quantify change over time.

What did we do? We compiled both historic and contemporary data sets that were available, and this allowed a semi-quantitative assessment, based on the historical and contemporary data sets that we were able to find.

Over on limitations, well, most notably, data sets were not comparable. Sampling methods, sampling locations often precluded direct comparison data.

To exemplify this, I will put up an example. So aging adult lake sturgeon, 50, 60, 70 years ago, biologists aged lake sturgeon, like older adult lake sturgeon. Since that time, our

knowledge and understanding of lake sturgeon has changed; we no longer age old lake sturgeon. We know that the ages that are derived from older fish are inaccurate, so we only age younger fish. So this in one way that our data sets were comparable.

Secondly, the majority of the region of interest has little to no pre-Hydro data on lake sturgeon.

Okay. We will start with Area 1, the upper Nelson River. Lake sturgeon were historically abundant in this area. Harvest records actually date back to 1832, with sales of isinglass to the Hudson Bay Company. Isinglass is a product made from the swim bladder of the lake sturgeon, and is used for a variety of purposes.

Commercial fishery in this area for lake sturgeon actually began in 1902, and it lasted until 1992. During this time, it closed and reopened several times. Each time it reopened, harvest quantities were substantially less than the previous period, and this is indicative of overharvest. So every period they overharvested, closed the fishery, and when they opened it back up, there was less fish there.

Domestic fishing was also documented during this time. Lake sturgeon numbers were low, prior to development of Kelsey and Jenpeg, based on the commercial production data.

Today, populations do remain in Area 1. Stocking is helping recovery in some areas; for example, the Sea River Falls area, where stocking of small fish has lead to the establishment of a juvenile population.

So what were the key conclusions and data gaps? Basically, it is impossible to assess the impact of Hydro on lake sturgeon in Area 1, given the lack of data and the confounding effects of harvest. So, lake sturgeon were basically decimated, due to harvest, before the dams were put in place.

Presently there are not enough fish, not enough lake sturgeon out there to know how Hydro has is or is affecting their habitat. It is basically impossible to assess at some locations how Hydro has changed spawning habitat, for example, because today, there are no sturgeon that spawn there and use that habitat.

So that brings us to Area 2, the lower Nelson River. Commercial harvest in this area is

thought to be much lower relative to Area 1. However, the abundance of lake sturgeon prior to the development of Kelsey, Kettle, Long Spruce, and Limestone is largely unknown.

However, since 1985, lake sturgeon there have received considerable study. Populations do remain in this area, but at low abundances, with the exception of downstream of the Limestone generating station, where one of the largest populations in Manitoba remains.

And for similar reasons as Area 1, impacts of hydroelectric development on lake sturgeon cannot be quantified.

Okay. Area 3. This was definitely the easiest area for lake sturgeon for this method, because this area, both historically and currently, is not known to support a lake sturgeon population. There was some data presented in the RCEA, but these were basically from upstream of SIL or upstream of Opachuanau. For these reasons, CRD likely did not affect lake sturgeon in Southern Indian Lake or other parts of Area 3, as they were either not present or existed at low abundance prior to hydroelectric development.

Area 4, which is Treaty River and

Little Missi. Based on limited information, abundance of lake sturgeon areas were thought to be low prior to CRD. After CRD, lake sturgeon are really only present in a short -- about ten-mile reach of the Churchill River proper, that includes the confluence of the Little Churchill River. Similar to Areas 1 and 2, impacts of hydro development on lake sturgeon can not be quantified in this area.

Overall summary and data gaps. Hydro development significantly altered lake sturgeon habitat along both the Nelson and Churchill Rivers. However, how habitat alterations affected lake sturgeon populations is poorly understood, given that in most cases, lake sturgeon were nearly extirpated, or existed at very low abundances prior to the developments. How recovery of these populations is affected by Hydro also remains unknown.

There are several impacts of hydro development, including barriers to movement, entrainment of generating stations, water level fluctuations, changes to lake sturgeon spawning habitat, all caused by dams, would all affect lake sturgeon in these areas.

However, the question remains: How was or how is the productive capacity of these rivers, how has it been affected by hydro development? We don't know, and that's an interesting question to ask.

The last slide here is the importance of lake sturgeon to First Nations communities. There are several reasons why lake sturgeon are important to First Nations communities, first of all, from a cultural perspective. Also important, historical perspective, in terms of the commercial sale of sturgeon, and including isinglass, and it was an important economic activity back in the past. Today, sturgeon are still an important part of the domestic harvest activities. Sturgeon are still eaten, and considered a delicacy in many communities.

With that, I will take any questions.

MS. ZACHARIAS: Okay. Next up is Wolfgang Jansen, from North/South, and he is going to talk about fish community.

MR. JANSEN: Good afternoon, everyone.

I think the main reason why fish mercury was included in RCEA, was fish mercury represents the main pathway by which humans are

exposed to mercury. And mercury is a known neurotoxin, and as such, it has affected the fishing practices, fish consumption, and the associated social activities of many northern communities in the past 40 years.

What could we do to assess fish mercury? Actually a lot of institutions, or several institutions in Manitoba have been at the forefront of mercury research for many decades. We were quite fortunate to have a quite robust data base on fish mercury concentrations.

These came from several sources, so the first task was to compile it all into one data base. And since 1969, just in the region of interest, we have over 54,000 records on mercury concentrations in fish, mainly from 23 species and from more than 200 water bodies. This was pared down to 24 focal water bodies in the four areas. That included on-system and off-system reference water bodies. As almost 80 per cent of all of the data were collected for lake whitefish, walleye and northern pike, these became our focal species. We then proceeded to do some quantitative assessment.

It is well known that mercury

concentrations is correlated with fish lengths: The larger fish have the higher the mercury concentration. So it was -- one method of dealing with that problem for statistical analyses was to use what is called standard lengths. For example, pike, of 550 millimetres, use that standard length, and mercury concentrations with a length standardized to that fish length.

Each species has a specific standard length, so that will produce less bias when comparing fish mercury concentration means over time, or between water bodies. Because otherwise, also because of the heterogeneity of the data, the early data were merely from commercial catches, which tend to have a preponderance of large fish, and the more recent catch have a more even length distribution of fish. So to be able to make comparison between historic and more current data, it was necessary to do this.

In addition to temporal and spatial comparisons over time and between water bodies, we also compared mercury concentrations to the only available benchmark, which is the Health Canada standard of .5 PPM for retail fish. And that's important; it only pertains to commercial fish

that are sold in Canada, off the shelf. It doesn't pertain to fish that are used for domestic harvest purposes.

Okay. Limitations -- and I will preface this by saying that the main findings regarding the effect of hydroelectric development on fish mercury concentrations are very well established, not just from Manitoba but from other Canadian locations, particularly in Quebec, and they remain unaffected by the existing data gaps. The data gaps that the previous speakers have alluded to are mainly concern, the lack -- the paucity and the nature of the pre-development data.

For most water bodies, the sampling frequency is insufficient, and in the early years it was quite often every three years, or at larger intervals, and the fish sampling size -- by that I mean how many fish were collected and analyzed for mercury to feed into a particular sample, yearly sample -- they are often too low to reconstruct the timeline of mercury concentration that includes the onset and the duration of maximum mercury concentrations.

What that means, I will explain using

the next slide.

I won't go into the different areas. I won't present data for individual lakes. We are fortunate that the pattern of the rise and fall of mercury, due to flooding in reservoirs or lakes in the CRD sequence, is well established; it follows a very predictable pattern. The only differences are mainly the level of increase, the maximum mercury concentrations, and the duration, how long high mercury concentrations persist in the system. And by "high," I mean concentrations that are higher than -- if we have pre-project data or otherwise, we compare them to reference lakes that hopefully will represent a long-term average concentration in the region.

So this graph will be shown on the next couple of slides. What is shown here, the muscle mercury concentration -- and I should mention, muscle represents a long-term storage tissue for mercury in fish. Other tissues were analyzed, but our focus was on muscle concentration, which also is a part of the fish consumed by humans.

Over time -- so this is a generalized timeline of changes in fish mercury

concentrations, not from any particular lake, but sort of a summary, how things went for most water bodies, or for all water bodies that we have sufficient data to come up with some timelines.

So what is difficult is the pre-data, if you have some more, you can extrapolate from lakes, even from other systems that have data. And as soon as flooding starts, within one or two years for those larger-bodied fish that we looked at, mercury levels start to rise quite dramatically, to reach a maximum concentration. Then they decline fast first, and then more slowly later. And this time period of decline can be between 10 or larger than 30 years, depending on the particular lake and the species that we look at.

And this pattern here, the increase, as you see, up to 2 PPM, this is typical for predatory fish or piscivorous fish, fish that feed on other fish. We have other species of fish in our system, so when you are lower on the trophic level, meaning lower on the food chain, these P concentrations will be quite a bit lower, but the general pattern of increase and decline would still be the same, just at a lower level. This

graph is typical for pike, walleye sauger, some of the more important commercial fishes, as well, in Manitoba.

To go into a little bit more detail, what we found -- and I've mentioned it already -- the piscivorous fish here, some even reach maximum levels above 2 PPM, but 1.8, shown here, is the average over many lakes.

Maxima of other species, particularly whitefish, did not exceed .6, and for whitefish .3 PPM, so you have a fairly flat curve, with a slight increase here and a long time of recovery. But these maxima here, indicated for pike, sauger, and walleye, represent an increase over pre-project levels of between 1.4 to 8.7 times those baseline levels.

These maxima, as I mentioned, were usually reached within three to nine years post flooding; usually a little bit longer in the predatory species, a little bit shorter in whitefish and other omnivorous species, fish that feed on a variety of sources, mainly benthic invertebrates.

And the mean, jumping into more recent data, the mean for 2002 to 2014 were mainly below

the .5 PPM standard for Health Canada, but they were still generally higher than in off-system lakes.

Okay. We were just going -- one step -- I deliberately put here this little increase, and this also reflects post -- these 40 years sort of takes you to 2005, if you take 1970 as starting point. And that reflects things that actually happened in real lakes.

Now, the next slide will show data from real lakes, focusing on the time period from 1998 to 2015, and those are some of the newer findings that I found quite interesting. We heard from Brian and from several other speakers that -- the increase in flows and water levels in most of the lakes in the region of interest, and that's also reflected in the fish mercury data.

What you can see here is that the tail end of that decrease, quite well exemplified by the data for Split Lake, but in all four of those lakes -- and there are several other examples I could use, but those are some of the best data, and they're from different areas. I wanted to represent different areas as well.

You can see around 2005, we hit a

minimum; and after that, when the higher water levels were reached in 2005, we would see quite a substantial increase, in some cases -- above .5 for Threepoint Lake, however it's not as constant, but it's a bit of up and down, but there are at least nine, ten lakes which quite clearly show that fish mercury levels have increased over the last 12 years now.

And this corresponds quite well with what we know about environmental mercury, the sources of methyl mercury -- and I should mention that we use total mercury as our metric, but we know that methyl mercury is actually the newer toxin that's important from a human health standpoint. But in fish, larger-bodied fish that we talk about here, between 80 and 95 per cent of total mercury is represented by methyl mercury. So we use total mercury as a source for methyl mercury.

So what I'm showing here in some detail is the hydrographs for Split Lake, water level from the years 2002 to 2005. As we all know by now, 2005 was a very high-water year, and what is shown here are the long-term minimum water levels, the long-term maximum water levels, and

the water levels during a particular year.

So the hydrograph of 2004 would be that red line here, and you can compare it to the maximum and to the minimum values that were ever recorded over the period from 1954 to 2014.

For fish mercury concentrations, it is important to note it's not only this high-water year, 2005, but also -- and Brian mentioned the drought year, 2003, which is sampled here for Split Lake as well. But there are several years, 2002, '03, and '04, of water levels during the summer, and that's important too, because methylation happens during the summer months, when temperatures are at least at 15 degrees or higher; preferably around 25.

So water levels were 1.5 to 2 metres lower in those years than 2005. So what most likely happened was that shoreline area that hadn't been exposed to water for several years became flooded, inundated, in 2005, and the process of methylation set in. And just like flooding a reservoir, on a smaller scale, this inundation of shoreline areas resulted in environmental methylation and availability of methyl mercury to the fish. And that's why I

think we have seen these increases in mercury over the last 10, 15 years.

Okay. The last point is the importance to communities of fish mercury. As a result -- in the early years, and we were talking about the very first reports of elevated mercury that came out in 1969 from Saskatchewan. And the province really reacted incredibly fast. They put up a lab within three months, analyzed 10,000 samples, and concluded, yes, we have a problem in some of the lakes. And Lake Winnipeg, Sipiwesk -- a number of lakes were closed for fishing, which meant that fish were no longer accepted by the Freshwater Fish Marketing Board for marketing.

So there were about 15 lakes altogether where at least some fish -- and the exact criteria are not known, why fishing closures happen, but I think the government was under quite some pressure to make sure that the health of consumers was protected. So even if 20 per cent of the fish were above .5, the fishery was closed for a number of years.

There also was pressure to open the fishery again, of course, because fishermen were put out of work. But what was important for

northern indigenous community, that mercury -- which was translated as "metal poison"; there was no word in their language, really, to describe it. And on top of it, they heard the message, "Don't eat fish." And there were consumption advisories posted at many lakes.

So these people were partially confused. They didn't really know what was happening. Mercury is not something that you can see; obviously, the fish still looked good to them to eat, but they were advised not to eat them.

So even today, this is -- part of this dilemma still exists in today's First Nations community, and they have reduced their consumption of fish, and they are still expressing anxiety about eating fish from many water bodies, and this has contributed to a change in diet that is certainly not contributing to increased health in those communities. Okay.

Yes.

MR. DAVIES: I might have missed it on Slide Number 7. One more back.

Just to be clear that -- we are talking about the rates in recent years that has happened on both on-system and off-system lakes?

MR. JANSEN: Oh, I am sorry. Yes.

MR. DAVIES: The bullet -- third bullet.

I'm just saying that there was a third bullet that was missed, and the third bullet says that the increases in mercury that were experienced in 2005 occurred both on-system and off-system, because the process is the same, of reflooding land that had been dried out in the past. But we missed that bullet.

MR. JANSEN: It is pertaining to data that has been published in the literature. It is a bit unfortunate that we have two reference lakes that we compare data from on system, but unfortunately, over the time period between 2002 and 2007, the sequence of data is quite sparse. So we can't really compare it to off-system lakes in the region of interest.

But we know from the literature, this is not a phenomenon that only pertains to lakes that are affected by hydroelectric development. Even rivers that have experienced drought periods then have high flows years later, have seen the same pattern, and it corresponds completely to what we know about the biogeochemistry of mercury.

So Stuart is quite right in pointing out that this is not a phenomenon specific to the region of interest. It has been observed all over North America, and some places Europe. And we are -- through CAMP, we are building now the top of it, I think; we are monitoring the situation quite well. And there are some studies being done that address the mechanism, the underlying mechanisms in more detail as well. Manitoba Hydro has funded those studies.

MS. ZACHARIAS: Now we are going to shift to seals and belugas, and Chandra Chambers will present that.

MS. CHAMBERS: Thank you. I am a little short, so please let me know if you can't hear me.

Okay, so I'm just going to jump right in here.

The sources of data relevant to seals and belugas in the ROI --

MS. JOHNSON: I can't hear you.

MS. CHAMBERS: All right.

The sources of data relevant to seals and belugas include existing information such as population data, commercial harvesting data, or

traditional knowledge, as well as data collected during project-related aerial, land, and boat-based surveys, and interviews with local residents, as well as with tourism or tour operators in Churchill.

In addition to the lack of pre-project data, inconsistent sampling methods precluded a determination of impacts to marine mammals. Multiple task base of effects, both past and present, further complicated this task of separating out hydroelectric effects on both groups. As a result, potential effects were identified and assessed based on available information.

Potential effects of regulations on seals in Area 2 primarily relate to the displacement of haul-out sites along the lower Nelson River in response to increased discharge and flow. However, the occurrence and magnitude of any impacts are unknown.

While it is not possible to determine whether or not LWR- or CRD-related changes have affected beluga distribution in the estuary, or that of its prey, it is important to note that estuaries are not considered to be an important

foraging habitat for beluga, and that the Hudson Bay population has remained stable.

Potential CRD-related impacts to seals in Area 4 include possible increase in available haul-out sites along the Lower Churchill River as a result of declining water levels and flows. Despite the minor displacement of seal haul-out sites along the Lower Churchill River, no noticeable changes in seals have been reported as a result of the weir.

The effects of regulation on beluga use of the Churchill estuary are unknown. However, abundance does not appear to be have been affected.

Monitoring studies conducted by Manitoba Hydro, including those based on residents' concerns, found no noticeable difference in pre- and post-weir beluga distribution or abundance in the estuary. However, one tour operator did express concern about weir operation and its effect on beluga use of the upper estuary near Mosquito Point.

No new findings were reported for seals and belugas, as no additional information could be found for those groups.

While domestic harvest of seals and belugas are minimal in both Areas 2 and 4, belugas are important to the tourism industry out of Churchill. Although beluga-based tourism could potentially be affected by changes in beluga use in the estuary, these activities do not appear to have been affected by hydroelectric development.

Thank you.

MS. ZACHARIAS: Okay. Next we are going to move to land, and we are going to have James Ehnes come up and give us an introduction to the land section, and then terrestrial habitat and intactness.

MR. EHNES: I'm going to start off with the introduction to the land portion of the RCEA. And to start off, an ecosystem-based approach is taken to the land assessment, as there was with the aquatic, but I just want to highlight some elements that are specific to the land assessment.

One element of the ecosystem-based approach was to look at regional ecosystem health, and how cumulative impacts from hydroelectric and other developments in the region of interest have affected the regional study components.

And we are looking at the combined effects of all development, because it is often very difficult to separate out hydroelectric development from other impacts.

So we are looking at regional ecosystems. The region of interest was subdivided into 17 ecological regions. These are areas that are roughly similar in terms of their climate, surface material, wildfire regimes, things that are important for ecosystems.

And the way that these regions were delineated were based on those factors, and the size of the areas was giving consideration to how large of an area was needed to maintain the characteristic species, and the biodiversity, and the ecological processes.

So what I mean by that is -- let's say you harvest 1, 2, 10, 15 moose, or you flood 10 square kilometres of land; is the moose population going to disappear? Have you seriously affected biodiversity in an area?

The only way you know that is by looking at the moose population. Is that population still able to sustain itself over time? And over time, habitat changes in the boreal,

because there are wildfires; so what is new moose habitat is constantly shifting from one place to another.

So the size of these terrestrial regions were based on looking at the characteristic processes in these boreal ecozones, and then also the species there.

The regional study components for the land RCEA were terrestrial habitat, intactness, birds, furbearers, caribou, moose, and polar bear. And some of these RSCs were also subdivided into other subcomponents.

Another element of the ecosystem-based approach was looking at pathways of effects. And this figure here, on the left side, we see the different kinds of hydroelectric development impacts; and then in the second column, the types of effects or impacts that each of those project types creates. And then we look at how they directly and indirectly affect the regional study components.

As I already mentioned, hydroelectric development is not the only thing out there that affects the regional study components. So on the right side of this figure we have some of the

other factors that are important to consider, and were considered.

So with that, I'll head into the first RSC, which is intactness. And intactness essentially means the degree to which a natural area hasn't been adversely affected by human infrastructure and other types of development activities.

The approach to assessing effects on intactness were to map the existing human infrastructure in the area. And that was essentially done from satellite imagery, air photos, and other types of remote sensing and data sources, such as topographic mapping.

I already mentioned that the region of interest was subdivided into terrestrial regions. And then we reported on how the human footprint changed over time. And using several indicators which are outlined in the report, the size of the human footprint, the length of linear features in the region of interest -- sorry, within each terrestrial region, and then, also, how many large intact blocks of habitat were still there, and what proportion of the region did they comprise.

In terms of major limitations, there

really were none at the regional level, for intactness, because these human footprints were fairly easy to map, even going back to pre-hydroelectric development period. As far as information coming from local people and Aboriginal sources, there was very little available relating to intactness effects.

The key conclusions and findings. Regional cumulative effects of hydroelectric and other development on intactness are low in the region of interest. Human infrastructure footprint is small, and this is out of 2013, comprising about 1.2 per cent of the land area in all 17 terrestrial regions.

Hydroelectric development contributed 82 per cent of that human footprint, and much of that was from flooding.

Linear density is low, overall; 0.08 kilometres of linear feature per square kilometre of area. And to put some context to that, our magnitude, or our range for low-magnitude effects for linear density is from zero to .4 kilometres of features per square kilometre. Core areas larger than 1,000 hectares still account for 99 per cent of the land area.

Regional effects on intactness to date have been low, and that's basically for two reasons. The size of the human footprint itself is quite small, and then also subsequent features tended to be located near other features, so if you have a large natural area, you weren't putting a road or a transmission line straight through the middle of it.

In terms of new findings, these are really more details, because of the mapping that was done. Cumulative effects on intactness are low in each of the 17 terrestrial regions, and that's not just looking overall. Total human infrastructure footprint range from 0.2 per cent to 3.8 per cent of regional land areas.

Core area loss was highest in the south and central terrestrial regions, and the effects were much higher in localized areas, such as around generating stations.

Some things that were noted regarding the importance to communities. There is a quote in a report from Fox Lake Cree Nation:

"Specifically, our lands and waters should be whole and healthy, both of which are the prerequisites of a peaceful existence. This

concept of wholeness is expressed in one simple sentence, 'everything is connected.'"

And that is really the ecological perspective, and also the concept of intactness and reductions to intactness.

Hydroelectric development was seen to increase stresses on plant and animal populations, and possibly increasing resource harvesting by outsiders, because access was improved.

Although fragmentation in the region of interest is relatively low, the areas affected are generally those that were most extensively and are most extensively used by the resource harvesters.

That's it for the presentation on intactness. Any questions?

THE CHAIRMAN: Yeah, I would ask one about your linear -- the effect of the linear developments on intactness. I know you said, because the -- I assume you meant the Hydro lines -- tended to be close to other linear facilities, the impact was low. But if you took them together, would you still conclude that the impact was low?

MR. EHNES: Those numbers that are

being reported include hydroelectric transmission lines, roads. They include all types of linear features. They would even include winter roads. Often, the transmission lines, portions or segments of those routes would be next to or close to an existing road, and part of that is -- at least in recent projects -- a component of routing process.

THE CHAIRMAN: So when you conclude they are low, you are concluding that on the basis of the impact of the sum of those linear developments?

MR. EHNES: Yes. And even if you take all human linear developments combined, and look at them over the entire region, the effects are low at a regional perspective. But of course if you go into some local areas, you will have a concentration of transmission lines, roads, and other features.

MR. SOPUCK: Yeah. Given the terrestrial regions you have chosen, estimates of the impact on intactness almost automatically are low in each situation, given the size of the region in which you are comparing the impact. And you've had your reasons for selecting the zones

that you did.

But, you know, there is also a biased opinion, I would suggest, that these large systems have their own sort of uniqueness, if you will. And I would be interested in seeing an analysis of intactness against something like hydraulic zones, which would tighten it more, to kind of provide an estimate of impact that's -- I would say a little more relevant than that larger route system.

MR. EHNES: Yes, I agree with your point about the large river systems being more highly affected and considerably affected. In the terrestrial habitat RCEA, we actually devote an entire subsection for each terrestrial region to local effects and effects on large river ecosystems.

So, like, to look at this in ecological perspective, we could have started off saying we'll take the entire region of interest as one large area. And because the northern two-thirds of it is almost all wilderness, except along the large rivers, the degrees of -- or the reductions to intactness would be variable, and our metrics -- and those would be the ones that are recorded in the first slide, when we look over

the entire region of interest -- were very low.

But you know, when you bring them down to the terrestrial region level, they still stay quite low in most of those terrestrial regions. I think the highest percentage of regional area in the most impacted region was 3.8 per cent.

But again, if you bring it down to a river corridor, it would be much higher than that for some portions of the river systems. But then, again, if we are looking at -- and I hope I'm not going to stretch myself out on a limb with the Wildlife guys over there -- but as an example, beaver: Maybe all of the beaver on the large river systems were affected, but looking at beaver populations, it likely -- and someone jump up if I'm getting this wrong -- beaver populations in general weren't affected, because the larger system is only a small portion of their habitat in the area.

No one is jumping up.

MR. DAVIES: I think you have a point.

One of the things that really hurt negotiations between the three parties, four parties, in the 1980s and early 1990s, was the fact that Manitoba Hydro would take a look at the

area and say, "We affected 2 per cent of this area, and we really don't think it is all that significant, because beaver populations are fine."

And of course First Nations are looking at it and saying, "Well, all of the beaver populations that we trap, along the river and along the inlets, are gone; they are finished."

So there is a real disconnect between the two of them, because the area that was being harvested was the area that was really impacted; and the area that wasn't harvested, beaver populations were fine, because they weren't harvested, and they weren't being affected by Manitoba Hydro.

And it took a long time before the parties sort of came together on that. And I think that's one of the reasons, when we looked at the terrestrial portion, that we looked at the area as a whole; then we looked at what we call the local. And those are the areas that were essentially being affected by Manitoba Hydro that were used most by the First Nations.

That's why that split was made, because it was less controversial during the '80s and early '90s.

MR. EHNES: Any other questions on intactness?

Okay. I will move on to the second regional study component, which was terrestrial habitat.

Terrestrial habitat is ecologically important. It is also an umbrella indicator of ecosystem health and components of the ecosystem that were not directly assessed by the RCEA. And also most of the wildlife RCEA assessments are largely based on terrestrial habitat changes, because there is limited population and other important data for the wildlife species.

The Regional Cumulative Effects Assessment for terrestrial habitat focused on ecosystem diversity, wetland function, and shoreline ecosystems, and generally evaluated the combined effects of hydroelectric and other types of development, since these often cannot be separated.

In terms of limitations on the results, there is little published Aboriginal traditional knowledge or local knowledge regarding effects on terrestrial habitat. There were numerous data limitations, given the enormous

overall RCEA mapping area. In order to provide habitat mapping for caribou and some of the wide-ranging wildlife species, habitat data sets were created for 585,000 square kilometres of area. Roughly 30,000 kilometres of shoreline was mapped, and that's the combined pre-hydroelectric development and the existing environment conditions.

Now, while these limitations do not affect the overall conclusions, they reduce what can be reported for specific regions.

The key conclusions or findings over all of the terrestrial regions, the cumulative effects of hydroelectric and other development on terrestrial habitat have been low for most indicators. About 1 per cent of all native habitat in the region of interest has been lost.

Regional effects are generally higher in the southern and the western portions of the region of interest, and the reasons for the low effects on total terrestrial habitat are the same as the ones that I mentioned for intactness. Essentially, it is a very small human footprint to date. And of course, in localized areas, the effects are much higher.

Another key conclusion is hydroelectric development dramatically altered large river shoreline ecosystems, and those effects are ongoing in many areas.

In terms of a bit more detail on that, compared to what was there before Hydro, native habitat loss ranged from .02 per cent to 3.6 per cent of total historical habitat in each of the regions, so that's the range of habitat loss. And the hydroelectric development contribution to that loss ranged from none up to 99 per cent, depending on which region we are talking about.

Several habitat types had high-magnitude effects, or were completely lost, and this was due to the effects on the large river systems, so these are habitat types that you typically find along large rivers.

Effects were dramatic on three large river ecosystems, and that would be three of the four that flow through the region of interest. Some of those changes were highly altered bank and beach characteristics; much less marsh and riparian peatland; wide bands of tall shrub were less frequent, or are less frequent; shoreline

debris became widespread and heavy in places. And these effects, again, varied considerably by reach and by river.

Some things are noted about importance to communities in this section of the report. Hydroelectric development effects were much higher in some local areas than regionally, and this is particularly for the larger river systems, and this also varies within a large river system.

There is a strong sense of dislocation and disorientation, as areas that had been well known to local people became unrecognizable. And the dramatic changes in the shoreline conditions and flooding were contributors to that. And resource harvesting areas became lost, or have been lost.

And that's it for terrestrial habitat. Any questions?

MR. SOPUCK: All I've been doing is throwing out negatives, so I want to start with a positive here.

An amazing amount of habitat mapping seems to have been done under this project, the terrestrial habitat mapping. I was blown away by the amount of work you did.

In the summary section of this document, you have estimates of the direct and indirect habitat loss. And since you only -- you had a limited area in which you analyzed, I'm assuming that's an extrapolation? Or is that what you actually measured for the areas that you examined?

MR. EHNES: It would depend on which metric. Some of the metrics would be based on assumptions about zone indirect effects, based on studies conducted in the region of interest. In other cases -- I would have to look at the specific detail there, but in terms of, let's say, indirect effects of flooding on terrestrial habitat, that was based on taking the direct amount of habitat loss or alteration, and then applying a buffer to that of -- I think it was about 50 metres. So anything that was affected by hydroelectric development was buffered by 50 metres. And studies that have been done in a number of those regions have shown those indirect effects typically are closer to 15 metres on average, so that large buffer was used to estimate the total area of indirect effects on terrestrial habitat.

MR. SOPUCK: If there is no -- I have one other question.

MR. EHNES: Okay.

MR. SOPUCK: I noticed that some of the areas -- I was quite struck by some of the areas that did not seem to have data, post. The northern two-thirds of Southern Indian Lake, or South Indian Lake, and Notigi Lake, it looks like they weren't analyzed. And those are pretty significant areas, where there were very significant impacts on terrestrial habitat.

MR. EHNES: Yeah. I think most of Southern Indian Lake -- for example, the shoreline, was -- the pre-hydroelectric shoreline was mapped, based on historical air photos, but we didn't have any high-resolution satellite imagery, or other type of imagery for any recent period, and that's largely because it is outside of the commercial forest zone, or the areas that were evaluated for recent project environmental assessments

So we just had no data to do the mapping. And for some areas, we just -- given the time we had for the RCEA, there was just a limit to how much mapping we could do. And the areas

that were done were often -- criteria for dropping an area often was, do we have both pre-Hydro and existing environmental data, so we can actually quantitatively talk about historical change?

And on your previous question, I could answer in more detail, but it would vary by component, and I would have to go back into the reports and refresh my memory.

MR. SOPUCK: Thank you.

MR. EHNES: Any other questions?

MS. ZACHARIAS: Thank you, Mr. Ehnes.

We are going to have Rob Berger, from Wildlife Resource Consulting Services, come up and talk about some of our wildlife regional study components.

MR. BERGER: Can everybody hear me okay? As Allison said, my name is Robert Berger; I am with Wildlife Resources Consulting Service. Good afternoon.

My compatriot, Doug Schindler, and I will be tag-teaming the wildlife portion of this presentation. And the order in which we will go through it, we will start off with waterfowl, with the other components to follow, will include caribou, moose, beaver, and then there is two of

the RSCs which we are not going to speak about very much, and they would include polar bear and colonial waterbirds. But if there are any questions regarding the latter two, we would be happy to answer those as well.

So for the approach and limitations for waterfowl, we were really focused on the regional and local changes, as James described in his presentation. And we've really focused on the amount and distribution of habitat, because quite often, when we are studying wildlife populations, we may not have access to really good wildlife numbers. Unlike the Fisheries folks, of course; they real always have really good data. And our approach was also to look at that on-system, versus the regional effects that could be identified for this RSC.

Now, some of the limitations for waterfowl were that population data were not available at the local scale. However, at the regional scale -- for example, Canadian Wildlife Service and the U.S. Fish and Wildlife Service often does strata-based survey. So there's phenomenal regional population data, going back to the 1950s for waterfowl; but to translate that, or

transcribe that down to the local level is actually quite difficult, because the aerial surveys that were conducted weren't actually built for local effects. There was very few published ATK or local knowledge reports in some of the areas, and there was very little information on waterfowl in general before hydroelectric development.

There were some difficulties in consistently mapping waterfowl habitat. And finally, some monitoring data from nature projects is not available. So, for example, we are monitoring the effects from the recently completed Wuskwatim generation station. And there is some interim data that we managed to use to understand potential effects from hydroelectric development from that, as well as the ongoing construction of the Keeyask generation project.

We were also privy to information on the various transmission line projects throughout Northern Manitoba in the region of interest.

For some of the key conclusions and findings, the bottom line is that the overall impact on waterfowl populations is low to moderate, and it just gets into the low end of the

moderate magnitude scale. But certainly one of the take-homes to really remember concerning waterfowl is that local waterfowl populations were certainly affected, and that we particularly got that from the few First Nations and Metis reports that we were able to review. So there were certainly localized effects.

And we could also quantify some of those localized effects, based on some of the wonderful habitat information that James described for me. There was information on shoreline quality, marshes, et cetera.

Another thing that was a key finding is that many of the regulated rivers in the North were important staging areas, but they weren't necessarily good breeding habitat and brood-rearing areas, so that's something to keep in mind, from a larger scale.

And then finally, the amount of regional habitat in the overall region of interest declined about 2 per cent.

I'm not sure if they are exactly new findings or not, but some of these are.

Effects on waterfowl habitat have been largely described in previous ATK. For the most

part, the broader waterfowl populations also matter which species you may consider appear to be stable, and quite often a lot of populations have been increasing in trends over time. You may have noticed more Canada geese in your backyard lately; well, that same trend is going on in Northern environments. But there are some species in decline, like scaup, which have been declining in Northern environments where they predominantly breed.

As I mentioned before, there has been a shift in habitat use by local waterfowl populations, and that shift may be away from hydroelectric developments, where there were decreased habitat, such as marshes, which the water regulation affected; but there certainly is much waterfowl in the back bays and in the back country, in landlocked areas that waterfowl use.

Reduced water-level variation continued erosion, and reversed seasonal flows reduce that potential for marsh habitat revegetation. What is going on in the longer term is that waterfowl which may have traditionally used these larger river systems can no longer find some of these more sheltered areas. But it also

depends on the water regulation, and how much water is in fact coming down the system that year. So there is some seasonal variation that can go on there in addition to what the water regulation entails.

And over time, there are some areas, such as North Indian Lake on the dewatered Churchill River, that actually have become better waterfowl habitat. Fiddler Lake, Dillard Lake areas, especially for moose, in addition to waterfowl, have become better, but this is not maybe the norm. For the most part, there has been a decrease in waterfowl habitat quality.

How does this connect in importance to the communities? Reduced habitat has caused a shift in some of those local populations of waterfowl that are being harvested. For example, in Southern Indian Lake, the harvest opportunities -- it used to be a really good migration staging area, where people who would go out and harvest at the time, and sometimes subsistence harvesting consisted of more than just going out to waterfowl hunt; they may be fishing at the same time, or possibly moose hunting. They weren't seeing birds as much any more and were

harder to take.

And this has been a common theme in some of the Northern communities, where the birds appear to be tending to fly over, and not staging in a way which was historically documented by First Nations.

Overall, however, the regional waterfowl populations do appear to be stable in Northern Manitoba, as a broader concept, population-wise.

So with that, I'm open to questions.

How about moose? Maybe there will be some moose questions.

Moose is a hot topic in Manitoba. And certainly a lot of good work has been done in Manitoba on moose, and as a general concept, I'm sure that most of you are aware that moose are in trouble, in big trouble, in the province of Manitoba.

One thing that I'm going to talk about here, in our region of interest, is a little bit further north, and they give you an added perspective, because really it is the southern and maybe the central moose population that are most in trouble, but our northern moose populations are

doing a little bit better. So I'm just going to provide that comment from the get-go.

So the approach for moose is that we used five different indicators that were assessed, and the dominant one, again, as James presented, is habitat. But we did look at population size and fragmentation, disturbance, and disease and parasites. So we had different indicators and metrics that we did measure for this assessment.

And we also looked at it, at those two different scales; we looked at that on-system, close to how hydrologic water regime has been affected, and we looked at off-system effects as well.

Now, limitations for this assessment weren't overly onerous. There were some limitations in Northern Manitoba, in game hunting areas 1, 2, and 3, which literally were never assessed by Manitoba Conservation. Their moose populations are generally quite low, and there is not a lot of effort in looking at those moose populations.

And there is limited quantitative information on moose harvest itself, and it is more limited towards recent years, as opposed to

the historic records that can truly quantitate what that harvest was. And in addition to that, there were a few published ATK or local knowledge reports.

Now, when I say that the moose populations in the region of interest are generally stable, unfortunately I don't have a map to go back to, but if you remember what that region of interest is, starting with boreal plains towards the central southwest, and moving on up to the northeast, to Churchill, those particular populations, and overall in the region of interest, are more or less stable.

Now, when you think of the ones in the south, there have been, certainly, recent declines in some of the southern game hunting areas and the central game hunting areas for moose. But if we look at -- oh, the Split Lake resource management area, as a whole, which I have been looking at for the past 17 years or so, the information that we have over a broader area, starting with Elliot's work in 1993, where they estimated about 1.600 moose, and where we have done surveys in 2010 and again in 2015, that particular moose population, about the size of Switzerland, if you think about

that size, is stable to increasing. And in fact, as hydroelectric development has occurred recently at Keeyask, in the last five years, that moose population has increased significantly.

So there are differences in Manitoba. There are glimmers of hope, but the overall message is, I think we'd better carefully watch and monitor moose, because there is different things going on in that population.

Overall, in the region of interest, only 1 per cent of the moose habitat has been lost, and that's mainly because of hydroelectric development. But it is quite small overall, compared to what -- it's a low-level, moderate, low-level magnitude effect on habitat change.

Disease, harvest, and predation, certainly in southern and central Manitoba, are being considered as dominant drivers, and they contribute to the population changes in moose.

But one of the things that we truly have to remember for our region of interest and the hydroelectric development is that shoreline habitats have changed in the large river systems, and that has reduced moose habitat, and there are things such as debris loading, and other things at

the local scale, along shorelines that are affecting those local moose populations.

Some new findings. Well, on-system habitat changes -- "revised" may be the wrong word, but the on-system habitat changes for the Rat, Burntwood, Nelson River, James mentioned a couple of things with respect to habitat. So the tall shrub band has been reduced, or there has been a change in distribution, which is a prime moose food.

Not everywhere; as a matter of fact, I believe it was the Cross Lake area where the report suggests that moose -- the tall shrub layer is so bad and so thick that the harvesters who would prefer to harvest along the shorelines either can't see the moose or have a really difficult time getting to the moose, because of that dense shrub layer.

So there are pockets of suitable habitat, but the consequence of that is harvesting is being affected. But in most cases, the shorelines and the tall bands of shrubs have been reduced, so those areas have had reduced food for moose.

In addition, of course, moose love

marsh plants, so all of that aquatic resources and minerals they need have been reduced for major rivers, so there has been an effect there.

In the southern areas in particular, one of the key things to remember for moose is that fire suppression and access are very important influences, because harvest pressure is certainly a very substantive concern for moose and moose populations.

Finally, for importance to communities, the overall message that we have for RCEA is that the northern moose population is mainly okay. But we have to watch them carefully, especially as we look at different terrestrial regions, and as we go from south to north, because there are differences.

The shorelines and -- of course I tried to find a good picture that in some cases may exaggerate the debris loading along some of the shorelines, but as James would have mapped some of these shorelines for moose, you can't imagine a moose traveling along that shoreline quite easily; nor is there a lot of vegetation or shrubs for it to consume, or it couldn't get access to the water or move along shorelines.

There are many areas with moderate loads, and many more areas with low debris loads. And there are some good mitigation programs that clean up those debris loads. So all of those things have to be considered when we look at moose.

Changes in habitat use and movement patterns were covered. And finally, increased harvest pressure and loss of harvest opportunities.

One thing I think that we learned for moose, reviewing all of this information, is that when we say "increased harvest pressure," there has been an increase in access with respect to roads and roads development. There has been some increase in access with respect to transmission lines. But certainly, you know, it is more limited to winter, when we actually travel down transmission lines in Northern Manitoba. Maybe not so much so in the south; there may be an opportunity for an ATV there.

But the loss of harvest opportunities is that there has been a switch from hunting and harvest along the river systems, which now have certain things that make moose hunting more

difficult, to a switch to -- you know, road hunting and other linear features. So the traditional use of some of these lakes in northern Manitoba, these rivers in northern Manitoba, have changed.

And with that, I will open it up to any questions.

THE CHAIRMAN: Serge Scrafield, CEC.

In addition to changes in habitat and changes in numbers, are the moose in different areas? Do you know if there has been any change in the areas they are occupying?

MR. BERGER: With respect to the long-term historic -- if we were to dig back around 200 years, moose have been expanding their range from south and central into northern Manitoba. So there have been recent historical pushes in mid to late 1800s, and even pushing into (inaudible), and now there is the odd moose that can be seen around Churchill.

So there is that long-term distributional change. On a seasonal and by decade change, wherever fire, as James mentioned, changes patterns over time, you know, moose prime habitat, from about 5 or 10 to 25 years, and once

that overgrows, moose are going to change, themselves.

An example of a hydroelectric change, I think Daryll Hedman, now director of the Northeast Region, mentioned that at Southern Indian Lake -- and we can see it from the habitat and debris, and the lack of marsh and tall shrub now around the periphery -- the moose have been moved, or are now moving towards the back ponds and lakes.

So instead of being able to harvest and see moose around Southern Indian Lake shoreline, you've got to go three, four, five kilometres into the back country before you start hitting moose.

So moose are still there, but they are certainly not using the habitat that's been affected, as much.

THE CHAIRMAN: Thank you.

MR. BERGER: You're welcome.

MR. DAVIES: I have one thing. In the past projects of Hydro development, the areas around the communities were usually fairly depopulated of moose, because the majority of the hunting took place fairly close to the

communities. When roads came in, and other forms of access came in, whether it was transmission lines or roads, there was sort of a double-edged sword; it let other people come in to harvest the resource, but it also expanded the range of the people who live in the communities to hunt in other areas and take the pressure off the moose that were closer to the communities.

So some of the populations I think have changed a little bit in regards to harvesting that way.

MR. BERGER: Okay. Thank you.

All of them together. Thank you very much, Allison.

So, coastal caribou is my third major one, and then two minor ones. Doug will be talking about boreal woodland caribou, and also barren ground caribou, but I'm going to cover coastal caribou briefly.

So the approach for our coastal caribou, which is an eco-type -- forest tundra eco-type, and I have some maps coming up, and they are located in northeastern Manitoba.

We used three indicators to assess effects of hydroelectric development and other

forms of human-caused disturbance. They included population size, fragmentation, and disturbance.

Now, one thing that was different about species with -- you know, more cohesive populations, we actually assessed them by range, as opposed to looking at them by terrestrial region and breaking them down that way, because they certainly moved through those boundaries quite readily.

And in addition to other large home range species, like polar bear, we also looked at range, as opposed to examining effects by terrestrial range.

Limitation is somewhat in the pre-hydroelectric period, with certainly lower certainty in the population estimates that came out from the two populations I'm going to talk about, the Cape Churchill herd and the Pen Island herds. And natural disturbance, the further you go back, maybe the less predictable or the less accurate historical fire perspective is. So that's a limitation when you look at natural disturbance.

It also, I believe -- James, correct me if I'm wrong -- as you move out of the

commercial forestry region, some of the fire mapping, and then level of detail collected for it, tends to diminish.

Some of the key conclusions and findings, and here is the example of the Cape Churchill range in the north. I will just orient you: Up here is Churchill; the green line is the transmission line to Churchill. I believe the orange line is the dreaded railway to Churchill. And there may be a winter road and some other roads towards the southern area.

Now, the cumulative effects for this particular herd appear to be quite low. You can imagine, if we were looking at the different metrics, there are certainly low levels of fragmentation and disturbance in both the RAAs, and by both RAAs -- here is the Pen Island herd; I will back it up for a second after this, but the Pen Island range goes from about Split Lake, or east of Split Lake, well in to Ontario. So about half the range is in Manitoba and half the range is in Ontario. It is a huge area; I think it is, like, 170,000 square kilometres. So these caribou move over a vast range.

The low level of fragmentation and

disturbance in both, roughly around 1 to 2 per cent of fragmentation -- or, sorry, in disturbance. Natural disturbance goes into the range of about 20 per cent, and that is fire-driven, of course. So the relative contribution of fire plus human disturbance, you know, is in the order of 22 per cent, if I recall correctly, subject to check. And hydroelectric development contributes roughly half of that disturbance in the northern areas, and the other half would be probably railroads, predominantly.

The Pen Island herds, in the new findings, are exhibiting some changes in range-use characteristics; I think some of the Commissioners may have heard or have read previous reports indicating that the Pen Island animals had moved away from the coastline, where they calve en masse, and they were moving inland, so they're actually changing some of their calving behaviours. So that's one recent event that's occurred and had been noted since about 2012 or so.

But as I already indicated, most of the range disturbance is due to fire.

Importance to communities. For at

least the coastal herds, the caribou populations remain available for harvest. Now, in the report, you will see that there has been an increase in Cape Churchill herd from when they were known in the 1960s, through to today, from about two to five thousand animals. They call that an increase, or stable, in the worst-case scenario.

And similarly the Pen Island caribou, since they were known in also the 1960s, when they were first studied by people in Ontario, have increased to about fourteen to fifteen thousand animals. So there's a licensed harvest and there's a domestic harvest that goes on with these animals.

Now, there is information in peer-reviewed literature, and knowledge for monitoring Keeyask, that there is some avoidance of hydroelectric generating stations. That's to be expected. Caribou are sensitive to sensory disturbances: Smells, sights, sounds, visual, that sort of thing. So there is some minor avoidance, minor being two kilometres to four kilometres. I would call it less rather than more.

Finally, there is a little group of

caribou we named the summer resident caribou, which occur in the Keeyask area, that have characteristics of both boreal woodland caribou and Pen Island caribou, that are at some increased risk of habitat loss in among the Pen Island animals.

That's my talk on coastal caribou. Are there any questions? Or you may want to save all your good questions for boreal woodland caribou, of course.

Two more slides. Other RSCs.

Colonial waterbirds is an interesting one, and we are currently working with (inaudible) up at Keeyask, as part of the monitoring that Manitoba Hydro is doing. Really nifty project in itself.

But cumulatively, and in northern Manitoba, similar to the spread of some more common species, you know, gulls have really spread; especially, in particular, ring-billed gulls. They have actually moved quite a ways into northern Manitoba, and are commonly found in Keeyask and areas further north.

And how we measured effects on colonial waterbirds, we had virtually no

population to say -- no quantitative population information, so we got James to look at island size. He had a lot of fun with that, mapping islands that have been present prior to hydroelectric development and then after hydroelectric development. And we looked at the number of islands and the area of those islands, and for the most part -- not everywhere, in all terrestrial regions, but for the most part, on average, the number of islands actually increased as a result of hydroelectric development. And you will find the specific numbers in the report.

So potential gull nesting habitat has increased. I'm not saying that these islands, just because they were formed, are used by colonial waterbirds, but at least there are more islands to potentially use as one of the metrics that we looked at.

Colonial waterbirds are very abundant in the regional area of interest. And as I said, some nesting colonies, there is habitat that has been flooded and other habitat that has been created. So that's colonial waterbirds, in a nutshell.

Polar bears, finally. The take-home

message for polar bears is that despite our best efforts, we could not find a link between the change in polar bear populations or the fluctuations of the western Hudson Bay polar bear population and hydroelectric development. There's certainly no appreciable effect on the population.

We looked at some potential drivers, or population indicators, which included harvest. For example, directly related to hydroelectric development, Manitoba Hydro has a record of one bear that was destroyed as a result of Limestone being constructed, in the town of Sundance, but there are no other records of those types of direct effects. So it's thin.

We looked at denning habitat, of course which is very well known in northern Manitoba, and we looked at the relationship between linear features, how close they were to the dens and nesting areas, and there are certainly precious little or no appreciable ill effects that we could come up.

So, thank you very much for your attention. Any final questions?

Yes.

MS. LEWIS: I have a question about

colonial waterbirds, specifically in the Churchill region. Are there any of those birds -- are any species at risk, populations in the Churchill region?

MR. BERGER: It was certainly pointed out in one of the questions provided to us that Ross's gull are certainly present in the town of Churchill; pardon my naming of the marsh, but the Akudlik marsh. I'm going to stop trying to pronounce that.

It's interesting to note that Ross's gull was first observed or at least recorded in Manitoba in about the late 1970s, and that was probably just after or at the time of the Churchill River Diversion. So from then until now, there has been -- you know, one to five birds that have nested, frequently or infrequently, in that particular marsh area. So the number is so low, I don't know if we could or could not ever attribute anything to hydroelectric development there.

They are also in the marsh area, as opposed to where the dewater area is. So they are using slightly different habitat. But it's a well-raised point; there are threatened species in

the area that should certainly be considered.

One other tidbit, Manitoba Hydro -- Stuart, correct me if I'm wrong -- along with the Churchill weir, Manitoba Hydro developed a nesting island. It was about one-tenth of a hectare, in that size.

MR. DAVIES: Something like that.

MR. BERGER: And it was monitored for about five, six, seven years, and it was used by mainly waterfowl. I'm not sure if any terns or gulls ever nested there, but certainly it was tried.

MS. LEWIS: So are there any plans to monitor -- I guess the waterbirds -- to see if indeed they had shifted to other habitats, and if the mitigation -- mitigation plans are successful?

MR. BERGER: Right. Very good point, yeah. And you know, current -- Manitoba Hydro's current monitoring activities do include the Keeyask Generation Station gull and tern nesting populations.

The Province of Manitoba and Citizen Scientists ultimately monitor some of the other gull populations. Churchill is a very well-covered area. So formally, no, Manitoba

Hydro is not doing some broader-based IBA-type monitoring.

But yeah, Manitoba Breeding Bird Atlas, and other recent entities, have done a lot of good northern Manitoba monitoring, that we in fact rely on that information to use for reports like this. Thank you.

MS. ZACHARIAS: So if everyone can hold on for another ten minutes or so, we have one more land presentation, and then we can take a break. Is that okay with everyone? It's a hard afternoon, sorry.

Doug Schindler, from Joro Consultants.

MR. SCHINDLER: Thank you very much. Good job, Rob. I will carry on here with the boreal woodland caribou as one of the RSCs.

Boreal woodland caribou are a threatened species under the Federal Species at Risk Act. One of reasons they are -- closer to the mic?

Boreal woodland caribou in Manitoba and across Western Canada are a threatened species under the Species at Risk Act, as well as the Manitoba Endangered Species Act. So, boreal woodland caribou are under stress; they are under

the Guide to Recovery plans that are being developed. So they are a fairly important and high-profile species in Manitoba.

So if we look here in the region of interest, we've got a number of boreal woodland caribou ranges that are in our region of interest. We have the Wimapedi-Wapisu. There is the Harding Lake range, which is near the Wuskwatim line and Wuskwatim Generation Station.

The Wabowden range, we have the Wimapedi-Wapisu, we have the Naosap, and we've also got the Norway House range. We have a range down in the bottom end of the region of interest, called the Charron Lake range.

So the approach that we used in terms of evaluating the boreal woodland caribou, we looked at the approach that was adopted by the federal government in their recovery strategy, looking at the disturbance values in those ranges, plus looked at the population, looked at core use area, we looked at habitat, both summer and winter. We looked at fragmentation, and also disturbance.

We had a great deal of telemetry data that was gathered through various studies that

were conducted by Manitoba Hydro, and also historical data that was gathered by Manitoba Conservation and other research.

Some of the limitations were that there is not a lot of ATK data or information on the historical occupation or numbers on boreal caribou. There is not a lot of good information from the Province, or scientific information relative to the historical distribution and/or numbers. There is also a lack of data and information relative to the presence of predators on the landscape, which are also influenced by fragmentation metrics and disturbance patterns that result in increased moose populations that do, in turn, affect the predator abundance that in fact affects woodland caribou populations.

So some of the other limitations, we have no telemetry data for the Norway House, Naosap, or William Lake range, and there is little historic and current information on population size, improvement, or mortality.

Some of the key conclusions and findings, the population status indicates that the populations are acceptable, based on some of these Provincial findings, and in terms of the

Provincial recovery strategy; but there is some uncertainty regarding the population trends, whether they are increasing or declining. There is not a lot of good information on what those population trends are.

Linear features seldom transect. Things like transmission lines are not going through what we call core use areas, that we determine through telemetry data; we have identified areas of importance. So there is a very limited amount of transmission line development that occurs through those core areas.

We also noted calving areas. We looked at winter use areas, through modeling, and again, very little percentage of those areas are intersected by transmission lines in particular.

In terms of the Environment Canada disturbance threshold, which has been established that if a range exceeds a 35 per cent disturbance threshold, and that includes fires, forest harvesting, and transmission lines, anthropogenic development that is buffered by 500 metres, if the percentage goes beyond 35 per cent, that range is in -- it could in fact be a declining population because of the disturbance threshold.

So there is a number of ranges -- Naosap-Reed, the Norway House range -- there is absolutely very little hydroelectric development within those ranges. However, they do exceed the disturbance threshold, mainly because of fire. Fire is the driving force in terms of boreal woodland caribou disturbance regimes.

So in terms of hydroelectric developments, across all ranges, it is very, very low. It is a very low contributor to the disturbance level on all of those boreal caribou ranges.

Some new findings: Human development, as a disturbance metric, is pretty low across all ranges studied. Hydroelectric development is a very, very small percentage of that metric, and fire is by far the largest disturbance factor through all ranges. Those ranges that did exceed the Environment Canada threshold, fire was the major driving force, again.

And one of the things with boreal woodland caribou is as habitat grows and ages, it starts to become utilized by caribou, because they do like old-age forest, and they do not like disturbed forest, as do moose.

So in some of these ranges, like the Harding Lake range, for example, that has a disturbance rate of about 40 per cent, more development could create some issues; but again, these are thresholds. But the predominant factor is natural disturbance and fire.

So importance to communities. Boreal woodland caribou have been harvested historically in very, very low numbers, and they are not really a dependable source of food for communities, because they do appear in very low densities, and they have been harvested somewhat opportunistically through the years.

And First Nations do value boreal woodland caribou, and consider stewardship a very, very important component.

Okay. I will take questions on boreal woodland caribou.

MR. HARDEN: I am just wondering, is there any correlation between human-built linear features and, say, fire?

MR. SCHINDLER: The majority of the fires that occur on caribou range, it is quite random, and it is a very natural activity that occurs across the landscape. I don't see -- or we

did not really observe that maybe -- there are human-caused fires. I'm not sure, James, that they've got some percentages, human-caused fires versus natural fires, but it is a -- fairly highly skewed towards the natural fire disturbance regime, and the patterns that occur on the landscape do not correlate well with human development. Like, you won't see areas -- there are some communities where you might see a lot more fire activity near some communities, but general speaking, across the landscape, there would not be that correlation.

MR. HARDEN: Thank you.

MR. SCHINDLER: All good, then?

Okay. So, barren ground caribou. This is the Qamanirjuaq range, and we have outlined the entire range of the Qamanirjuaq herd, which consists of calving areas in the north, and there are winter areas to the south.

The Qamanirjuaq range, the population in the '60s was estimated at about 30,000. In the 80s, it kind of went up to about 200,000. In 1994, it hit a high of 470,000. And as the last number of years, in 2014, the population was estimated at about 264,000.

So the approach we took here, we looked at the disturbance analysis on the winter range and looked at the human footprint and also the disturbance regime, similar to what we did for boreal woodland caribou, to get some idea as to how much disturbance is in that winter range.

Some of the limitations are that there is not a lot of literature on the effects of anthropogenic activity, or on wintering for barren ground caribou. There is a lot of information relative to the disturbance of the calving grounds, but not so much on their winter range.

There was limited fire disturbance data for the pre-hydroelectric development period, and telemetry studies relative to the barren ground caribou relate primarily to the summer range and the use of calving areas.

And there is limited ATK from the region of interest, in terms of -- because they are so periodic in terms of their coming into the area, there is not a lot of really good ATK data on barren ground caribou.

So the key conclusions and findings, the current population estimate, as I indicated, is about 265,000 animals. And again, you can see

that it is fluctuating; these barren ground caribou populations are known to fluctuate through time. And what is particularly interesting, as the population increases, they tend to extend their winter range. So when you have periods when barren ground caribou populations are peaking, that is when you will find that barren ground caribou will come into the region of interest.

So hydroelectric development accounts for less than 1 per cent of the total disturbance within the Qamanirjuaq barren ground winter range. But fire is the big, big driving factor in that area, and it gets burnt a lot. As you can see, over 50 per cent of the area burnt.

So the overall population seems healthy, and little affected by Manitoba Hydro's development. But again subject to those periodic population fluctuations when they do come into the region of interest.

So, I think the new findings are the cumulative effects of Hydro development on the winter range would be very negligible.

Obviously, barren ground caribou are very, very culturally important and significant to people. Winter migrations into the regional

assessment area, through time, have provided valuable sustenance to the communities. So it is when those animals come in en masse, they are a very, very important food source.

There is some concern that hydroelectric development may alter migration patterns, in terms of higher flows on the Nelson River. But perhaps, maybe on the Churchill River, in deep water areas, maybe access and migration patterns would be less impeded by lower water flows and levels.

So that's it on the barren ground.

Now, we did beaver already, so -- oh, here is furbearers.

So the approach -- I think James kind of really described it; he did a good job talking about the beaver there.

So, again, we looked at the on-system modeling in those areas where there was shoreline habitat data, pre and post, so the on-system modeling was very similar to what Rob did for moose, and similar to what James did on the habitat side.

The regional habitat modeling, it was done in the terrestrial region, and as James has

described, looking at before and after, on the terrestrial side of things, off-system, he was predominantly looking at the effects of transmission lines, roads, and those activities associated with Hydro development.

As James indicated, on-system shoreline habitat data for pre and post hydroelectric development were derived from various sources and scales, and as indicated, overlapping data, before and after were limited, so there were some limitations there.

We did have some historic beaver census data from conservation officer reports in the '50s, and we had some of Rob Berger's good work to compare to, to look at the before-and-after beaver populations, based on log sediment.

And there is very little published data or ATK or local knowledge available for beaver. There is not a lot of available information that -- you know, in terms of distribution numbers, et cetera.

So, again, looking at the areas that were evaluated, this would be the on-system, by the reaches.

Here is a bit of a close-up, looking at those shorelines, the before-and-after characteristics of things like shoreline slope, shoreline material, vegetation, marsh habitats, looking at before and after, and the linear amount of habitat that was there before and after.

Looking at the off-system habitat availability, using GIS and James' data, able to look at the effects of the footprint that came across along shorelines or traverse riparian areas, or lakes and creeks and rivers.

That's a just a bit of an example of off-system beaver habitat.

So the key conclusions, findings: Habitat and population status has basically remained stable on a regional basis throughout the region of interest. Off-system, primary habitat showed to be very, very small changes. As you can imagine, at the scale we are evaluating at, the effects overall off-system and inland are quite small.

Overall populations in the region of interest have not been substantially affected by Hydro development. However, it has been indicated that off-system primary beaver habitat modeling,

and again, lower-quality habitat after hydro development, for a lot of the reasons that we have heard from Rob, in terms of the water regime and the shoreline erosion and ice conditions, and things like that, that created not a very good situation for beavers, in communities where water regulation is occurring.

New findings: Some on-system areas contained little primary modeled beaver habitat, either pre- or post-hydroelectric development, and on-system effects do not -- appear to not have to be universally offset by new habitat being created elsewhere. So, for example, just because we have a flood inland doesn't mean that offset what's happened on the on-system. There is definitely some reduction, significant reductions in on-system beaver habitat, but again, they have not been offset by flooding gates. It is just not always that way.

Beaver, obviously, are culturally important to First Nations in terms of food and an income. And they are a measure of environmental health, and an indicator of other aquatic furbearers. While beaver may be common regionally, local on-system effects reduced

numbers near on-system communities.

And I think the land-use people and the resource-use people are going to talk a little bit more about the effects of the water regime on-system in terms of the trapping.

So, yes, there would have been issues in terms of ice conditions and bad opportunities, or reduced opportunities for harvesters to access beavers.

So, that's the beaver.

MS. ZACHARIAS: Okay. Why don't we take a ten-minute break. Is that okay? It is a little short, but this way we will keep moving on.

We'll come back at 3:30.

(RECESS TAKEN)

MS. ZACHARIAS: So this is our last big presentation coming up.

The next topic on the agenda is the RCEA integrated summary report. We have a number of folks that are going to be helping with that. We are going to start with Gary Swanson, from Manitoba Hydro, and he is going to discuss the overall process for the integrated summary report. Don Macdonald, from Manitoba Sustainable Development, is then going to walk through some of

the aquatic findings. And then Rachel Boone, from Manitoba Hydro, will come up and talk about some of the overall land conclusions.

So, with that, I will turn it over to Gary.

MR. SWANSON: Good afternoon. It is a pleasure to be here to talk to you about the integrated summary report from the Regional Cumulative Effects Assessment.

The attempt -- I think Tracey described it as an executive summary, and a more readable version of the RCEA. And it is more readable in the sense that it is shorter. It was an intent to take the state of information, all of the previous information that you've heard in the nine or ten volumes of information that was provided in Phase II, and integrate it, tell a bit of a story, and describe our understanding of the state of knowledge.

And what we did was we went back to basics in terms of -- and I think Tim referenced it, the bigger effects being the water regime and the erosion, and how that plays out through the ecosystem.

So we looked at the Hydro system and

how it was set up, and tried to address the terms of reference and the mandate to -- within the region of interest, describe the Hydro development effects, and at the same time, or in addition to that, describe the state of the environment within a broader regional context.

So the integrated summary describes the on-system effects to the water and the shorelines in the Manitoba Hydro system, using more of a "pathway of effects" approach, and then broadly describes the regional land effects by ecosystem.

So, to start the pathways of effects approach, we looked at the Hydro system as essentially upstream water management, in order to provide for downstream power generation. And that water management is obviously, as I've been told a few times, is focused on control structures at Missi Falls, Notigi control structure, and then Jenpeg, with downstream power generation primarily -- or 70 per cent of the province's Hydro power in these three stations, Kettle, Long Spruce, and Limestone.

So with that claim of framework, we then looked at -- and this is a figure you will

find in the integrated summary report -- we then looked at the specific sort of circumstances in each of these key points, where Hydro structures essentially store water in order to modify or produce an outflow, a water flow context that would optimize power generation on the lower Nelson River.

And this diagram is -- it shows the relative difference in the height of the structures. And it is important to note that the scales are different. This is water-level elevation, and this is outflow.

And the idea here was to show that because each structure is placed in a different geography and serves a different purpose, the effects upstream are actually different at Missi than they are at Notigi than they are at Jenpeg than they are at Kettle. And the outflow is a different outflow, in order to try and optimize downstream power at Missi, where water was largely diverted and controlled by Notigi, to implement -- or input and supplement water from Lake Winnipeg Regulation power generation, and Kettle.

So as a background, what we did was we looked at each of those -- each of those

structures, in order to take all of the information that we had and put it into a bit of a logic where we could describe the pathways of effects, from the structures that existed to the water regime that was associated with that structure, to the physical effects and the effect that that would have on water quality.

Each of the sections -- each of those structures we looked at, at the -- and there's three slides; there's more to come.

Upstream of Jenpeg, downstream of Jenpeg, and the same for Missi and Notigi, and then again for the lower Nelson River, to look at the start -- with the information that we had available from the Phase II report, to look at the project and the purpose of the project in the communities there, in terms of a description, what that meant in terms of water regime, physical habitat effects, water quality, and then the effect that that might have on fish community and lake sturgeon, fish mercury, and fish quality, and then to the fishery, in terms of the physical effects and the access and success of the fishers, and finally, to the shoreline habitat, and to the waterfowl and the beaver and the moose.

So the idea here is that for each of these areas, there is a thread that starts with the project and a description of the project, the water regime that's associated with each project, and the changes to the physical habitat, and how that -- how those effects either were demonstrated or weren't demonstrated in terms of the regional study components in the Phase II report.

And what I'm going to do is I'm going to turn it over to Don, who is going to talk through an example, hopefully give you a better idea of that, and then talk about the overview.

MR. MACDONALD: My name is Don MacDonald; I'm the regional fisheries manager for the Northeast region. I work in Thompson, and I work for Sustainable Development.

I'm just going to run through an example area that's found in the integrated summary report. I realize that of all the material that has been produced so far, this is probably the thing that you are most likely to either have read or will read first. There's probably a limit to the amount that I'm going to attempt to read it to you, but part of it is just -- this is also the document that the average

member of the public is likely to read. We don't really have an expectation that the 4,500-page RCEA is going to hit a best-seller list any time, so this is kind of the distribution material we've got.

So the area that we picked, basically the CRD, picked in part because that's the one I wanted to do. When you consider what the effect of northern hydroelectric development is, especially if you are looking out on the landscape, yeah, flooding makes the water deeper; that's not actually not that big a deal. When you take a look at it, what is really happening where you see it is right on the shoreline. It is the land/water interface, and the most noticeable effect is basically erosion and resulting sedimentation.

We take a look at this section, one of the things that we see is that erosion is physically a localized event. Having said that it is a localized event, that doesn't mean it is not severe in low caliber.

Louder, faster, slower?

MS. JOHNSON: Slower.

MR. MACDONALD: I can't do slower.

So figure 8 is where you really see it, in and around rapids, fast water. Along the rest of the system lakeshore, it really is dependent on what the whole -- the shoreline swills.

You definitely get turbidity and suspended solids increase in areas where you've got the most velocity, which means along the river portions. An interesting thing that was noted right from the start, we talked about Gregory Hall's work, is that most of the material from erosion is deposited near the site where the erosion occurs. I mean, eroded material does grade out, based on size, and it is the finest stuff that will continue on through the system, certainly contributes to colour, turbidity; things like that have an effect. But in terms of where most of the material goes, it actually goes right along the shoreline that it fell off of.

When we talk about sediment loading downstream, it is not necessarily the amount of sediment in the water that is increased that much; it is the amount of water. The same amount of sediment density in it; there is just more water moving, and so there is more water coming into

Split Lake that's carrying the same density of the sediment that it used, but it just totals more.

In terms of water quality, very much what Megan was talking about earlier, there are both permanent and temporary changes. This is an area with one of the most obvious permanent changes, which is that it has completely different kind of water moving through it. The source of the water is now the Churchill River. This used to be the headwaters of the Rat River, and so the chemistry is different, and will be different for all time.

In terms of fish community, we've seen changes in relative abundance, especially immediately post project. It was a lake whitefish totally dominated catch; now it's very much a walleye, white sucker kind of a catch.

A question was asked earlier: Is that the kind of thing that you would predict? When I started as a fisheries biologist, fisheries biologists that were working in the area certainly described it to us that way, is that one of the things that you should expect when you convert to reservoir is there are some things about it that might be quite negative for fall spawners.

That hasn't proved to be correct everywhere, but it was certainly one of the expectations for Cedar Lake, as an example. In fact, the way Cedar Lake whitefish would be described was described to me as, "Hey, they are doing much better than you should have thought."

But you do notice it in other reservoirs. The Hydro Quebec reservoirs actually became better with different water, because it switched so much. But the reservoirs are so much bigger. It was a much bigger switch from River Run to Wakuska.

So we sometimes treat it as a generality. It is not really a great one, but it is something always worth thinking about. You should expect to see -- you should at least be aware that there is potential for community shift to exist.

Wuskwatim, partially based on -- there was a lot of data done during the data collection in the 1980s, under what would be aquatic monitoring program. This was aquatic work that was done under CAMP.

An example of one of the data trends is there is a declining trend in total catch on,

like, three of the more significant water bodies near NCN, so Footprint, Three Point, Wuskwatim. The rest of the system is fairly constant.

When we are working on this kind of stuff, we are using a fairly coarse metric; it's, like, the total catch of all species. We're not really getting that fixated on one species or another at the level that's being presented here. It doesn't mean that the data doesn't exist, and in the RCEA proper, all of that detail does exist.

Right now, on the Churchill River Diversion -- I'm only talking about the area downstream of Notigi -- you would describe that as less flooded than other areas. It is much less flooded than the area above Notigi, which is one of the most flooded areas, just in terms of percentage change from pre and post project.

As a result, there would be less mercury here, just because the flood can thrive in it; there is less of it happening here. Mercury levels have declined over time, and as with all of the areas in the RCEA where mercury was collected, it is still being monitored under CAMP.

In terms of the fishery, in particular the areas close to NCN were very important as part

of their domestic fishery pre-CRD. This is an area where mercury levels did go up enough that people were correct in heeding the advice to reduce their fish consumption.

Concerns about mercury; so even if I tell you not to eat the pickerel and the pike, but I tell you the whitefish are okay, how cool are you going to be with that, really? So what it did everywhere was it caused a dramatic decrease in the act of fishing and the consumption of fish.

And one of the compensation programs under the Northern Flood Agreement was to make Leftrook Lake available as a source of domestic fish. And it actually does a lot more than that. There is a camp on it; people will go into it just to get a break from looking at flooded lakes. But it is one of the preferred places that they would get fish from.

Prior to CRD, there really wasn't much of a commercial fishery around Nelson House. It was fairly small, fairly intermittent. They had no road. The lakes really weren't very big. Post CRD, there are certainly issues with mercury in the lakes that affected what the marketability was. But as mercury levels dropped, the fisheries

increased, and commercial fisheries exist post CRD and appear to be quite stable.

In terms of shoreline effects, this is common, perhaps, to almost the whole system, but one of the things you lose is marsh wetlands and riparian peatlands. Riparian peatlands in particular will either flood, stay sunk and take the rest of our lifetimes to degrade, or will actually proliferate, float off, and many of them became the source for what were called floating islands.

And floating islands were fairly common post project, especially in this area and on Southern Indian. But you get a high water event, something happens, you can actually have something tear loose and do it again.

Main point is that whatever caused the loss of peatland and marsh area, it doesn't replace. What you see instead of it is basically just a large shallow area. It is not a functional marsh. It's certainly not peatland. Again, through the CRD, Nelson and Notigi, what we see for shoreline vegetation is made difficult; it does not look like a wood/rock system.

One of the other things is when

erosion does occur, when it hits bedrock, it stops. There is no erosion anymore, so that's great. But when you've got rock -- and rock doesn't exactly support a lot of vegetation. So you might have stable shoreline, but you don't have the same kind of shoreline that you once had.

Again, narrow, tall shore bands have increased in some areas and been completely eliminated in others. Shoreline debris certainly exists throughout the system. And both of those two, in particular, contribute to the loss of shoreline habitat and wildlife.

In terms of physical effects, I already basically alluded to this. When you have flooding, you get increased shoreline erosion; you get debris accumulating.

The other thing that happens throughout the system is to accommodate -- actually Brian alluded to this earlier -- they need the flow in the winter to generate power when it is needed. And that's not how rivers typically operate; generally flows will peak during the spring. So what you have in many parts of the system -- not all -- is flow reversal, so higher flows in the winter, lower flows in the summer.

This can contribute to problems with slush ice or hanging ice, because even when you say high flows for winter, it doesn't mean the entire winter. And this business of how ice forms and how the thaw occurs is also managed within the system.

And so all of those changes come together, can affect water quality, certainly affects near-shore fish habitat, certainly affects shoreline wildlife habitat.

And on top of that, you have got an aesthetic effect. Like, if you are on-system, you can tell; people that live there will always know that -- yes, this system is altered. All they have to do is go off-system and see what it needs to look like. And yet your use of the shoreline is quite altered. You have seen pictures of large amounts of woody debris along the shoreline, and that's common. That can be fairly hard to get through. In other areas, what has happened is the shoreline may have eroded, the material that eroded is still there, and it tends to form a very shallow -- by shallow I mean a very flat angle -- clay flat. Technically it is being called a beach, but frankly it is like no beach you would

ever want to walk on.

And to a degree, if you have to boat up and hop out of the boat; don't expect to get your boots back. You'll be lucky to get yourself back.

So people notice that. Right? It's a big impact, and it is one of the things that you would hear cited fairly often when people are describing the things they like the least.

Now we are into overall study findings. So we have just talked a little bit about CRD downstream Notigi. Now I'm going to look at basically how the integrated summary report summarizes everything.

So there is a couple of specific -- actually, we aren't doing that one. We need to put a better transition selection in there.

So that last slide, that's for everywhere.

A couple of specific spots where there is something very noticeable going on that isn't occurring throughout the rest of the system is lower Churchill River, substantially dewatered. I mean, the big thing Churchill River Diversion did was it diverted the Churchill River. The lower

Churchill River doesn't get to have water most of time. That is a significant change for water quality, shoreline, fish habitat, fish access to tributaries. One way of looking at it is it did turn it into wildlife habitat, but it basically did that by undoing -- the loss of it is fish habitat.

Just throwing out there, there still is functional fish habitat there, but it's a really altered and highly variable system.

In the Lake Winnipeg Diversion, probably the most noticeable thing are the diversion channels themselves, 2-Mile and 8-Mile, where basically you have a new path for not just water, but for what the water carries. So sediment, even debris generated in the north basin of Lake Winnipeg, that never was a stable shoreline, historically. It is made out of material that erodes.

What 2-Mile does, though, is give that material a path straight into Playgreen Lake that did not use to exist. Then even 8-Mile changes the path the water takes. Kisskittogisu Lake was just a blind -- it was an appendix; it was a tributary. Now a huge portion of the flow is

going through it. And here, as material silt goes through it, it changes the water colour. So those are kind of the two most obvious features in that area.

In terms of water quality, when you flood a reservoir, you get an increase in nutrient in that area, just from all the flooded material. That will eventually end, over time. In many cases, that time has already passed.

The other common note you have is in terms of water quality, and just the guidelines, the protection of wildlife. Those guidelines are met almost everywhere. There are some exceptions. For example, here is aluminum and phosphorous exceed PAL, but the fact is that that happens throughout almost all Manitoba anyway. That's not really a result of the project; that just reflects what the guidelines are.

And the other one is the eroding shorelines and changes with TSS and turbidity.

In terms of the fish community, depending on where we are on system, there are different processes that result in different changes to the fish community. So in some areas we have created reservoirs, and in particular,

when you switch from riverine to lacustrian, you see a few changes in species.

And so, just an example, long-nose suckers are known to prefer the riverine environment, and that will basically convert to white sucker and to walleye. Walleye have done fairly well in a lot of the system and a lot of the lakes. Whitefish and tullibee or cisco are reduced.

When it comes time to look at what the fish stock is doing, again, the founding factor is that most of the larger lakes are commercially fished. I will attest to the fact that it is more difficult to manage a reservoir fishery than it is a normal lake, because there's more things happening; it's more complicated. Which means, in turn, that you have to be aware that sometimes the fishery may in fact be the single biggest cause of the change to the fish population.

Some of the other things that happen is favoured species, because of changes in price, changes in market demand, reduces the stress on some species, adds to it on others. Rainbow smelt, throughout the whole Nelson system, not found at all on the CRD or the Churchill River,

but rainbow smelt on the Nelson appear to have a very significant effect in both of which fish do well, and the condition of any of them.

And the other is climate change. It seems fairly obvious the water has gotten slightly warmer over time.

In terms of lake sturgeon -- my personal favorite here, so I'll try not to go on and on, but I might.

Certainly hydroelectric development altered sturgeon habitat. There is no doubt about that. On the other hand, the single biggest thing that happened to sturgeon, in North America, largely, is they were overfished everywhere, and that includes here. So you are coming into -- northern hydroelectric development occurred in a world where sturgeon population in the Nelson River were already substantially reduced, and in fact had already been a fishery that had already opened and closed four times by the time hydroelectric development started. So it is almost like we don't have enough fish to know what the habitat loss might have been.

However, we've certainly got enough habitat that we can have more fish than we've got

now. So if it is limiting, we certainly haven't reached that limit yet.

The exception to that would be, again, the lower Churchill River, which is substantially dewatered. One of the things that was not anticipated when CRD was planned was that the population of sturgeon would actually survive in the lower Churchill River. Yet at the confluence of the little Churchill and the Churchill, there is a fairly significant population of sturgeon there. So it is a pleasant surprise. That population, however, does not extend along the entire lower Churchill; it is found in a localized area.

In terms of fish mercury, Wil covered that one really nicely. So flooding of soil and vegetation basically causes mercury to accumulate in the food web, and the amount and timing of that basically depends on the degree of flooding and the trophic level of fish you are talking about.

So in general, mercury levels peaked three to nine years after project, and generally declined since. Many of the areas that we are talking about, by now, mercury levels have declined to something approaching background, or

the flood level surrounding water bodies.

Basically, we are still seeing some fluctuation. Wolfgang, again, was talking about some of the fluctuation that has been observed lately. But overall, it's way lower than it was back when it was originally flooded.

Almost all -- well, not almost; I think all the large commercial fisheries in northern Manitoba are on water bodies that are regulated by Manitoba Hydro. There is certainly -- there is certainly changes to the shoreline, changes in the water level.

One of the lines I have often used is even if hydroelectric development isn't that hard on fish, it can be very hard on fishing. So some of the impacts we are talking about don't necessarily impact fish populations so much, as -- like, fish don't care if there is debris in the water that much, but a gillnet really cares a lot. And that's basically almost the simplest way to look at it.

Within all -- across the whole system, fish populations generally appear to be quite sustainable. Fish are generally healthy. And the variation that occurs, occurs for a variety of

reasons. As a generality, that's true. There are specific areas that we are aware of where it is much more complicated than that. Southern Indian itself is -- certainly doesn't fit into that generality.

Along the shorelines, so shoreline wetlands were lost, large acreage of just large, shallow, open-water areas. And either the peatlands have disintegrated or they just lie on the bottom, sunk, and not going away particularly fast. It certainly has an impact on wildlife.

And with wildlife, one of the things we've seen is generally -- even if the populations don't change, it's a redistribution that occurs, where -- "I'm not going to live here anymore; I'm just going to go over here, just a little bit, and be happier."

So you still see all the same wildlife; you just don't see it where it was.

And I think this has already been talked about many times, but where it was is actually where most people lived and went. So that makes it particularly noticeable for them. It affects their access to it, and it also affects their sense of loss.

Now, I won't talk anymore, because we are done here. Any questions?

Any questions?

MS. LEWIS: In terms of the plant communities along the shorelines, are there any that would be considered a significant loss because they are uncommon, not commonly found?

MR. MACDONALD: I think at this point in the RCEA, most people would share my comment that that's one of the things that really shows up that is understudied. Over the 40 years of those projects, some things have been studied and monitored extremely well, and other things much less so.

I'm truly not a riparian plant specialist. I do the fish thing, really, really enthusiastically, and at times when I'd like to really yank my colleagues' chain, I refer to trees as having two kinds; Christmas trees and the other kind.

Having said that -- yeah, I know. It hurts, doesn't it?

MR. DAVIES: It doesn't have to do with the specific species of plant. One of the effects of hydroelectric development is -- don't

the loss of shoreline plants -- because the ones that are in the water, stay in the water, have a lot of invertebrates on it that the fish eat, provides cover for the fish. And when you have water levels fluctuating up and down, those plants generally die off, so it is a fairly important habitat in some of the reservoirs that gets lost.

MR. MACDONALD: Again, I may have overinterpreted your question just a bit in answering it. I don't know if I would say that there are certain rare things that disappeared; I would say there are just certain types of plant habitat that don't exist, or don't provide the same functionality they once did.

One of the more noticeable things is that transition that you get with an eroding shoreline. If it erodes back to rock, it's not going to become shoreline marsh; it is not going to have -- well, it's not going to have any plant life on it, really. But even if what it did was erode back, continues to erode, produces one of those shallow clay banks that I was talking about, one of the things that's quite noticeable is that you do not have -- you don't have macrophyte beds on it, or anything like that; you don't tend to

have emergent vegetation along it. It doesn't form into marsh land unless it is sheltered, somehow, from wind reach.

And if it is sheltered -- and this is a generality, more based -- on at this point we are getting into too much detail for something on the scale of the RCEA. In some places you do see it come back, and when that happens, it's almost noticeable, or notable, as an exception: Like, "How did that happen?"

You could really get into a lot of detail on that, especially if you talk to somebody who is a collector of traditional medicines and plants. Their observations become quite interesting. And it's not just where it is; it has a lot to do with some of the timing.

Again, it is something that we are certainly aware of. It would be very interesting to get into more detail, but you are not going to find it in the RCEA.

MR. SOPUCK: First comment: Really good presentation, Don, and not just because you are a funny guy.

MR. MACDONALD: It's all I got.

MR. SOPUCK: There was a lot of meat

and a lot of synthesis in it.

The northern parts of South Indian Lake, the whitefish, in a nutshell, what happened there with those old, stunted whitefish that seemed to develop there?

MR. MACDONALD: We can talk about the symptom very well, and causality much less well. The basic symptom is the whitefish don't grow fast enough to reach commercial size. And so, although there is whitefish there in substantial numbers, they are not big enough to make any money off of. Actually, they are not big enough to catch in commercial-size gillnets.

MR. SOPUCK: But pre-development, that was the core of the Southern Indian Lake fishery.

MR. MACDONALD: It was the core of the whole fishery, and it was the core of the whole fishery for a variety of reasons. It was both where whitefish were most abundant, and where whitefish of high quality could be found. And Southern Indian Lake, the quality question has driven the fishery almost more than abundance.

And when you are talking fish quality for commercial fisheries, consistency matters more than anything. And what I mean by that is that if

I'm consistently producing a high-quality product -- maybe the best example would be oysters. If I give you all of the raw oysters you want to eat, for free, but every once in a while there's going to be a rotten one in it, are you still going to trust it?

So that's what happens when you have cysts in whitefish, but it occurs only intermittently. On average, the whitefish can be fantastic, but consumers eat them one at a time. And if the one they got was full of cysts, the market is done.

So what that means is that Southern Indian Lake, at times when it couldn't guarantee that the product that it was shipping was good, it is mixed in with all of the supply and goes down to the States, and somebody gets that; that affects everything that's sold out of Manitoba.

And so at times, a lot of what is happening in production in Southern Indian Lake fishery has occurred basically because their product has become too unpredictable for the market.

That was true throughout most of its history. But the last decade, decade and half,

that has not been the biggest problem. The biggest problem has been the fishermen noticed a change in their catch. They just weren't seeing big fish anymore. Generally, when you are dealing with a fishery that's being impacted, and it is under stress, and you look at the catch index, and you go, "Wow, there is a lot of fish here" -- or small fish here, that's great news, because they are growing up.

Except they didn't. Although they grow enough, they don't grow in weight very well; the condition is fairly low. What that really means is that when you take a look at the percentage of the fish that are out there that are available to be caught and sold commercially, it is very tiny. So commercial fishing in the North Basin has largely become untenable.

If you want to talk about reasons and hypothesis, give me another day, and we can have a great time. A lot of hypotheses on what would happen there are not what I think has happened there.

MR. SOPUCK: Okay.

MR. MACDONALD: It doesn't mean I'm right.

Anyone else? Thank you.

MS. BOONE: My name is Rachel Boone, and I'm with the Environmental Licensing and Protection Department here at Hydro. And I was involved on the land assessment for the RCEA.

So, just in continuing where Don left off, I'm going to talk about some of the regional or land effects that were summarized in the integrated summary report.

So in addition to the shoreline impacts, which Don summarized for one of the example areas, as per the integrated summary report, as well as providing an overview of some of the general findings, hydroelectric development can also result in physical impacts of the land in off-system areas.

So, some examples of this would be vegetation clearing for transmission lines, borrow area development, access road construction, as well as some of the permanent infrastructure.

The regional land assessment included both the shoreline areas, the non-system areas that were affected by development, as well as the other off-system land areas.

And as we heard from some of the

biologists earlier, like in the presentations on the land assessment, basically the assessment was focused on terrestrial regions, which basically were subdivisions of the ecozones, and within those, some of the local on-system impacts were highlighted. There were also some ranges used for species like caribou and polar bear that are a little more wide-ranging.

And that was how the assessment of Phase II was done. Basically what we did for the integrated summary report is we gave an overview by ecozone, and we tried to give a bit of a broader picture of what was going on the landscape, and talk about some of the overall trends that were observed, and then also overall, across the entire region of interest, what we saw.

That's what I'm going to go over now. And again, just to highlight what we did do, based on the importance of some of the on-system shoreline impacts, we did sort of pull those out of the land assessment and highlight them within the water and shoreline section, and then the section that I will go over now really just talks about more the high-level overview or conclusions on the broader regional basis.

So, in general, there were other developments in addition to hydroelectric developments that impacted land in the region of interest. Some examples are municipal infrastructure, forestry operations, mining development, material extraction for road construction.

And in general, development was more densely concentrated near communities in the ROI, and also there was a general decrease in development moving from the southwest portion of the region. So basically the lower three ecozones: The boreal shield ecozone, the boreal plain ecozone, and then, as we moved northeast towards the Hudson Bay, development generally declined.

Just some other general study findings. Effects to land were both on the shoreline areas and also in some of the inland areas. The inland areas, some of the impacted areas were also shoreline, but they were just off-system areas, as well as upland habitat.

As has already been discussed today, the effects to the shoreline tended to be more pronounced than some of the impacts to the land

and the surrounding off-system areas.

The shoreline impacts have been concentrated along the large river systems, which have been historically used by First Nations community members for transportation and resource use.

I am noticing now -- being one of the last presenters, I'm noticing how a lot of other people have used the same pictures that I have. I apologize for -- that's what you get when you are the last.

I'm going to give a high-level review of the terrestrial RSC, and try to provide some overall conclusions from the very detailed base to assessment. And I'm just giving a summary of basically what we've provided in the integrated summary report.

So in terms of terrestrial habitat, overall, the cumulative effects of development on terrestrial habitat have been low. And as we saw in Jamie's presentation, there's about a 1 per cent loss of habitat overall in the region. And as of 2013, when the mapping was done, there were nearly 170,000 square kilometres still left undisturbed in the region.

Obviously noteworthy, though, that there were considerable changes to most of the shorelines along the affected rivers, and there were quite large effects on some of the shoreline marsh wetlands in certain areas.

In terms of fragmentation, overall, it was low across the region of interest, with the exception of the land region surrounding Thompson, where you generally saw an increased concentration of highways and roads and cutlines. So there was sort of more development in that region, which was one of the exceptions to the overall fragmentation.

As touched on earlier by James, some of the fragmentation was kept low, as some of the features sort of were along pre-existing linear features. So it didn't fragment new areas or affect other large core areas.

In terms of waterfowl, regionally, there was about a 2 per cent loss of waterfowl habitat across the region of interest. The overall effect on waterfowl populations was low to moderate, with some local populations being affected. But overall, there doesn't seem to have been an apparent effect on the regional waterfowl

population.

And this, in part, was due to the fact that many of the large river systems in the area were important staging areas for migrating waterfowl, but not necessarily important breeding or brood-rearing areas.

Colonial water birds; again, some of this was touched on by Rob earlier. While some of the nesting habitat was lost following hydroelectric development in the ROI, there was new habitat or new island areas that were created, and there were also other suitable nesting areas that remained abundant in the region.

So overall, cumulative effects in the region were low, and there doesn't appear to have been an effect on overall populations.

Some of our recent environmental monitoring that continues in northern Manitoba, including for the Keeyask Generation Project, does show that colonial water birds, including gulls and terns, are still fairly abundant in the region, both on and off the regular system.

In terms of beaver, there was quite a variability in terms of suitable habitat along some of the major river systems prior to

development. And in part this was due to the fact that not a lot of these areas provided suitable habitat prior to development.

For instance, fast-flowing rivers with steep banks don't actually provide suitable habitat for beavers, and they are more often found in the more inland tributaries that might feed into some of these reach systems.

There was a small amount of habitat loss across the region, but again, there were large amounts of alternative suitable beaver habitat present in the surrounding areas, in many cases which the beaver likely moved into.

So in conclusion, there was a loss of habitat, and we do have some limited population data that suggests that there were some local impacts due to development, but overall, the populations in the region of interest have not been substantially affected.

In terms of moose, Rob gave a very good overview of this topic, so I will just summarize it at a high level.

In general, populations do -- have remained stable across the ROI. There are some areas where we see a decrease in population, and

others where we actually see a stable increase in population, but overall, they are doing well.

Regionally, there has been a 1 per cent loss of moose habitat. A lot of this has been on non-system areas. And changes to the shoreline, due to development, definitely reduced valued moose habitat, and it also limited shoreline access, due to debris accumulation in many of the areas.

So what we are seeing is that moose activity has shifted to other inland areas, where there still appears to be plenty of suitable habitat available.

For caribou, for boreal woodland caribou, as we talked earlier, there are eight ranges that intersect the region of interest. Within these, there seems to be a lot of habitat availability, and use of the habitat within these ranges doesn't appear to be affected by Hydro development within them.

Regionally, the overall fragmentation was very low, and a lot of the disturbance that we do see within these ranges tends to be from fire. And about 6 per cent of the disturbance in the ranges, that would be directly attributable to

Hydro development.

Coastal caribou: The two herds are Pen Island and the Cape Churchill herd, and overall they use a very extensive land area and move back and forth between Manitoba and Ontario. In their winter range area, there are very low levels of fragmentation and disturbance. Most of the -- about half of the linear features in this area are due to hydroelectric development, but overall, the fragmentation is very low. And currently, both the coastal caribou populations have stable to growing populations.

And the last group of caribou we looked at was barren ground caribou. We heard from Doug that the latest Qamairjuaq herd population survey does show a downward trend in the population, but in terms of any effects due to hydroelectric development, there is about -- I guess less than 1 per cent of the disturbance in the winter range can actually be attributable, in the mapping, to Hydro development.

And lastly, this slide is almost identical to the one that Rob had, basically for polar bears; there don't appear to be any links between the fluctuations of the western polar

bear -- sorry, the western Hudson Bay polar bear population and hydroelectric development. And as such, there hasn't been any appreciable effect on this population within the ROI.

And that's it for the land summary. Any questions?

MS. ZACHARIAS: This was the point in the agenda where we were going to open up the floor for general questions and discussion. So if there are some additional questions or discussions that anyone wants to have at this point, this would be a great time.

Carrying on -- okay, we have one. Go ahead, please.

MR. JOHNSON: I would just like to ask Hydro, through the Province, if you had a magic wand to wave going forward, what would you be looking at and assessing in advance of another time when you will come before a regulatory body like that, asking for permission to put another generating station or control structure around there?

And what would you -- if you had the time and the money and stuff, what would you be monitoring and assessing for some future

recommendation?

MS. ZACHARIAS: I won't get into a lot of specifics, and anyone else can pipe in at some point. But we have committed to a "next steps" approach to the RCEA. And Shelley is going to speak to that in just a moment, but what we are planning on doing is taking the results from Phase II, the outcomes from public outreach, as well as data that we are collecting as part of our current monitoring program, and any other licensing initiatives, and take all of that information as a collective, and start to look at what makes sense moving forward.

So where are the financial gaps? Where should we be doing initial monitoring?

I don't know if anyone wants to add specifics.

MR. BARNES: In the general sense, I hope you have noticed there's an evolution in the way we approach these projects, an improvement over time.

One of the big benefits now is we have compiled this massive data base for this region, so if there was a project, whether it was generation or transmission planned for this area,

we have a giant step up in terms of understanding the past, to move forward.

MR. DAVIES: Is that enough for future projects -- the government usually dictates what Manitoba Hydro needs to study in order to get the licence for the next facility. And I think some of the proactive steps that are being taken are things like the coordinated aquatic monitoring program, which is getting a better idea of system-wide effects, and the information in the RCEA is giving us a retrospective look at what was happening.

So we have something going forward, and something that's looking back. And I think the government will give us very specific directions on what we would need, or what Manitoba Hydro would need, to develop the next facility.

SPEAKER: I know, through the Lake Winnipeg Regulation final licence hearing, one of the things that we heard about was shoreline. "We will work on shorelines, wetlands"; that sort of thing. And that's sort of acknowledged in terms of going through RCEA and looking at the results, that there is more work that could be done in that regard.

When you are looking at the water, and that's where a lot of the focus was, but the shorelines, and how that's changing, and what that means, that is something that's already been mentioned through the ROC finalization agreement.

MS. ZACHARIAS: Any other questions or comments?

SPEAKER: Just following up on a question that was asked of me, so many hours ago, related to loadings where sediment is coming in and being potentially deposited, and that sort of thing. I forgot to mention, the coordinated aquatic monitoring program is doing a lot of additional monitoring in different areas of the system. And we've got a lot of monitoring that goes on with things like Keeyask and Wuskwatim.

So CAMP has been trying to work to look at some more of that recent data, to try and understand a few of those things better than we have so far. But that's ongoing work. So that's sort of stuff that is in process right now. And we are also -- I wanted to add, we are also doing some additional studies now, making progress with working with some of the First Nations on South Indian Lake, potentially something with Sipiwesk

Lake, working with Norway House on Playgreen Lake.

So there's things that are ongoing that are not necessarily reported in the RCEA, that are following on -- potentially on the map work and things that we are trying to dig down into some of these things in more detail.

MS. ZACHARIAS: Anybody else?

Okay. So if not, I will turn it over to Shelley Matkowski, from Manitoba Hydro, and she can do our wrap-up and next steps.

MS. MATKOWSKI: Okay. So -- it's been a lot of information and a long day.

We started with Tracey, talking about the background and the terms of reference for the whole RCS, and then Allison gave us a little bit of information on the overall approach to the RCEA, and each of the technical experts gave us more detail on the approach and limitations to each of their study components, as well as, of course, key findings and new findings resulting from the Phase II assessment. And finally, the integrated summary report and the approach that we presented there.

I just wanted to make a few key points, and they have been mentioned before.

Number one is, of course, we had to do a retrospective assessment here. We haven't been able to do a classic regional cumulative effects assessment, just because we are looking back, and we were limited by the available data and our ability to compare that pre and post data.

And we had limited time available as well. We had deadlines to present our reports to the Minister of Conservation and Stewardship at the time.

So I feel that we have done a thorough job, and we have addressed the Clean Environment Commission's recommendation, the intent of it, certainly, and the result has been the consolidation of a huge amount of data and a very comprehensive collection of information that will be very, very useful for all Manitobans, as Tracey said, in the future.

Our next step, of course, is that the Clean Environment Commission is carrying out a public outreach for us, that was identified in our terms of reference. In the terms of reference, it didn't say exactly how we were going to do our public outreach, but we've decided, of course, with the Clean Environment Commission, and we are

in the middle of that right now.

And following public outreach, we are committed, again, in the terms of reference, to the next steps. And as Allison said, we are going to take the information that we have gathered in the RCEA Phase I and II reports, and as well as the information that the CEC provides to us from the public outreach, and information we have from our current monitoring program, CAMP, as well as any planning initiatives that we have ongoing. And we will use all of that information to consider what our next steps should be.

Certainly we haven't decided what those are, but we have a commitment under the terms of reference our RCEA will not be complete until we have the next step done, and we will actually have to report on what our next steps will be.

And I think that's it. I would like to thank Allison very much, and the RCEA team as well, again, for all their work. It is a massive amount of work that they've been doing, and thank you very much, everyone.

THE CHAIRMAN: I think, on behalf of the Commission, also I would like to thank the

study team. And those that are still here, of course, you can pass it on to all those who were here and have left, and to probably many, many times as many people who have worked on this that were here today.

So, if you could pass on our appreciation to them. It is obviously a huge undertaking, what took place here, and it is an amazing job they were able to boil it down for us today. I can speak for myself, and I think for the others, that it was very beneficial to our understanding of the reports.

So thank you, and now we have some work to do.

MS. MATKOWSKI: You're very welcome. And we do appreciate what you are doing for us.

(Concluded at 4:35 p.m.)