MANITOBA CLEAN ENVIRONMENT COMMISSION

KEEYASK GENERATION PROJECT

PUBLIC HEARING

Volume 5

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Transcript of Proceedings
Held at Fort Garry Hotel

Winnipeg, Manitoba

MONDAY, OCTOBER 28, 2013

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Monday, October 28, 2013
Upon commencing at 9:30 a.m.

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THE CHAIRMAN: Good morning. Welcome back to week two of our Winnipeg hearings, same building, new room. We're here for this week only, I believe, and then we're back up to seven next week and the remaining weeks.

One very important bit of knowledge in case you don't know, the washrooms are on the far side of the lobby down a couple of stairs right by the gift shop.

I heard some sounds coming out of that sound system a few minutes ago that made me think that perhaps the ghost from room 202 had got out. I hope not. The sound technician is shaking his head, so I take it that it's his creation and not an escape.

We are dealing this morning with physical environment assessment. I believe there are a couple of people on the front table who will need to be sworn in. So Madam Secretary?

MS. JOHNSON: Could the two of you

please state your names for the record?

MS. KOENIG: Kristina Koenig.

MS. JOHNSON: And Mr. DeWit as well?

MR. DEWIT: William DeWit.

(Kristina Koenig: Sworn)

(William DeWit: Sworn)

THE CHAIRMAN: Thank you. I'd also ask Mr. St. Laurent, are you the chair of this session?

MR. DE WIT: No, I am, sir.

THE CHAIRMAN: Mr. De Wit, could you introduce those at the back table? They don't need to be sworn in, we'd just like to have them introduced for the record.

MR. De WIT: Okay. On the far left we have Lynden Penner, beside him Rajib Ahsan, Habib Ahmari, Dave Morgan, Susan Collins, Kevin Gawne, Phil Slota, and Bill Hamlin.

THE CHAIRMAN: Thank you. And you may proceed.

MR. De WIT: All right. This morning, we are continuing on in the series of presentations related to the regulatory assessment. I believe this is the fifth presentation. And what we'll be looking at today is the physical environment.

So good morning, Mr. Chairman, Commissioners, participants and members of the public. The panel here would like to thank you for the opportunity to meet with you today and present and discuss the physical environment section of the Keeyask Environmental Impact Statement.

So I'd like to take a moment to introduce our panel members. For myself, my name is William or Wil DeWit. I am a water resources engineer at Manitoba Hydro. I had been involved in managing the physical environment studies and have been involved in aspects of the physical environment studies including water temperature, dissolved oxygen and debris.

On the far right of the table we have Ms. Kristina Koenig. She is a water resources engineer at Manitoba Hydro. She lead the development of the future climate scenarios for the climate change sensitivity analysis in the environmental assessment.

Beside her is Dr. Jarrod Malenchak. He is a hydro technical engineer at Manitoba Hydro specializing in hydraulic design, hydraulic modeling and river ice engineering. Jarrod has been working on the Keeyask project since 2009, with preliminary engineering and physical environment teams, and is currently a hydrotechnical design lead for the project.

Beside me on my right is Mr. Marc St. Laurent. He is a hydropower planning engineer at Manitoba Hydro. He has been involved in Keeyask since 1999, first as a hydrotechnical engineer carrying out hydraulic design and water regime studies. He spent four years coordinating physical environment assessment for Keeyask, and since 2009 had been the lead planning engineer managing the stage four preliminary engineering studies.

To my left is Mr. George Rempel. He is a water resources engineer and is a principal at Stantec Consulting. He has extensive experience conducting environmental assessments for a variety of projects. He assisted in the overall coordination of the physical environment studies, and was more directly involved in the air quality and noise component.

And to the far left is Dr. James Ehnes, a terrestrial ecologist and president of

Ecostem Consulting Limited. He lead the assessment of the peat land disintegration component of the physical environment studies.

So for introduction, the physical environment section of the EIS describes predictive physical changes resulting from the construction and operation -- sorry, about that, apparently the batteries were dying on the lapel mic.

All right. So the physical environment section of the EIS describes predictive physical changes resulting from the construction and operation of the project. As Ms. Cole noted last week in the EA approach panel, there are no valued environmental components identified in the physical environment studies. However, the changes to the physical environment form the pathways for effects to the valued environmental components that are assessed in the aquatic terrestrial socio-economic resource use and heritage components of the Keeyask EIS.

The environmental assessment considers the past and existing environment, the future environment without the project and the future environment with the project.

I won't read through the outline, but the physical environment topics that were considered in the study will be reviewed through the presentation and we'll have a description of these on the following slide. So this slide gives an indication of how the different physical environment topics are interrelated and connected to each other.

Excuse me, I have to organize myself for working with a mic. Sorry about that, I just had difficulty reading my notes where the other mic was.

So first we have the physiography section, or physical geography, which deals with the study of the physical features of the earth's surface and describes the physical setting in which the project takes place. The project will affect the physical landscape through activities such the construction of dams, dykes, clearing for roads and camps, and use of borrow areas and borrow materials.

Climate, air quality and noise. Climate deals with the normal or average weather conditions in the area, implications of climate change from the local climate conditions and the implications of the project in terms of its greenhouse gas emissions. Project activities can have effects on air quality through things like vehicle exhaust emissions, while the use of equipment and other activities during construction will also create noise at the site. Changes to air quality and noise have the potential to affect people who may be located to the nearest large construction site such as the Keeyask project.

Water regime and ice processes. The project will alter the water regime conditions by raising water levels. So in the existing, with the existing environment, we have existing present water levels with the project. A reservoir will be formed and the water levels will be raised to a new level. And when the project is operating, those water levels will fluctuate as water is impounded or withdrawn from the reservoir during operation.

Changes to the water regime also alter the ice processes that take place, and the formation and breakup of the ice and the type of ice that forms.

Next we have a look at groundwater. In the existing environment, the groundwater is in balance with the current water level. When the reservoir is raised, water levels in the ground will also be raised along the shoreline changing water levels in the ground adjacent to the reservoir. These changes could have potential implications on terrestrial habitats which are considered in the terrestrial studies.

Next we have shoreline erosion processes and peat land disintegration. When the reservoir is impounded and filled, it will result in flooding of lands adjacent to the reservoir. This will flood areas covered in peat and will create a new shoreline at a new location farther back from where the current shoreline is located. These shorelines will be formed in mineral materials and peat materials.

Along the new shoreline, erosion will occur. And within flooded areas, the flooded peat, some of that peat may be able to float up to the surface where it may float up and be potentially transported away. And these processes are important to terrestrial considerations in terms of land lost and also in terms of effects to aquatic environment.

Changes to the water regime and

processes of shoreline erosion and peat disintegration alter the sedimentation processes in the environment. The changes to the water level reduce flow velocities and sediments may be deposited in the reservoir, and erosion processes may also contribute sediment to the reservoir that may be transported and settles to the bottom, which also relates to potential implications on the aquatic environment.

Flooding of terrestrial areas and erosion of shorelines have the potential to add debris to the reservoir, which can impede the use of the reservoir by people for things such as resource harvesting.

And lastly, we come to water temperature and dissolved oxygen. These are important to aquatic life. Dissolved oxygen is important because just like people, fish and other aquatic life need oxygen to breathe and low oxygen levels can be harmful to aquatic life. Oxygen may be removed from the water due to the decay of organic matter present in the water.

So we come to the area that was considered in the physical environment studies. The physical environment study, the overall area encompasses the area from the outlet of Split Lake and Clark Lake at the west end near Tataskweyak Cree Nation. It covers the reach of the river, approximately 50 kilometres from the outlet of Clark Lake downstream to Stephens Lake, which is the area in which the reservoir will be formed, and includes Stephens Lake.

The local study area for the project includes the physical footprint of the project, so where all the construction activities will take place. It matches the largest of the local study areas considered in the terrestrial environment section. Detailed studies in the physical environment section were particularly focused in the vicinity of the reservoir from the outlet of Clark Lake to the generating station where many of the largest effects occur.

So in the general approach to the assessment, the physical environment studies were performed by a team of technical specialists, many of whom you see sitting with me today. They considered information from various sources such as historic reports, recent field studies in the Keeyask area, proxy area studies on other Manitoba Hydro reservoirs, which is field studies of areas that may be comparable to the future Keeyask reservoir, information from technical publications, and local knowledge and Aboriginal traditional knowledge. These data were used along with a variety of analytical tools to predict project effects.

So some of the historic and technical data sources included information from the lower Nelson River, such as Lake Winnipeg, Churchill, Nelson River Study Board Report, Manitoba Ecological Monitoring Program studies, Split Lake Cree Post Project Environmental Review, and historical records such as water level and flow data collected by Manitoba Hydro, and the Federal Government Water Survey of Canada, and weather data from Environment Canada among others.

More intensive field studies have taken place in the Keeyask area since 2001, both for physical environment and other study areas in the EIS. And these included such things as water velocity measurements, sedimentation and erosion monitoring, collection of sediment cores in Gull Lake and Stephens Lake, river and lake bed elevation measurements and surveys, collection of soil profile information at more than 850 sites, and the picture shows an example of people digging a test hole, and more than 840 geotechnical boreholes drilled into the area.

In the proxy study areas on Stephens Lake, over 1,700 soil profiles were obtained. Water temperature and dissolved oxygen measurements were obtained over many years. And satellite imagery, aerial photographs and videos were also utilized, with some information in terms of the satellite imagery going back as far as 1962.

Within the studies, there are a number of analytical approaches that were used to identify the potential effects of the project. And these include more technical computer based models; widely accepted industry standard models, which were used to assess various effects such as water regime changes and sediment transport; empirical and physically based models, for example, the integrated shoreline erosion and peat land disintegration models which relied on information obtained from proxy area studies; and process models such as the transport of floating peat; and simpler mass balance calculations such as used to assess sediment due to in-stream construction.

Due to the interconnected nature of many of the physical environment topics, the Keeyask physical environment study team had a high degree of collaboration utilizing each other's information. The study team also collaborated with the other study teams in aquatic, terrestrial, socio-economic, because the physical effects of the project form the pathways for effects to the VECs considered in the study areas. There was also interaction with partner First Nations, and results were discussed in various meetings to ensure the local environment was understood and that effects of concern were being considered.

Results were presented and discussed at public meetings with members of the partner First Nations as well.

And this gives an indication of some of the activities involved. Partners from members of partner First Nations were involved in many of the field studies. There were -- I won't get into this, Ms. Cole dealt with this more in her EA approach panel -- but various committees that were set up a part of the process where we interacted with the partner First Nations, including environmental study working groups, and the partners reviewed and commented on response to EIS guidelines and initial results, and provided a great deal of feedback through these processes.

Now, we'll move into discussion of more of the physical environment topics. So first up we'll look at physiography. As I noted, physiography or physical geography deals with the study of the physical features of the earth's surface. This section considered the existing physical features of the study area, including bedrock and surface geology, soils and peat lands, which dealt with more extensively in the terrestrial studies, and permafrost. Effects of the project, including the area or footprint affected by the project, which Mr. St. Laurent has already noted in the project description panel. Excavations and use of borrow materials and excavated material not required for construction.

So description of the general geological setting. The study, the overall study area, the geological setting reflects the influence of past glaciation processes associated with advancing and retreating ice sheets, and the presence of glacial Lake Agassiz in the distant past.

The area is underlain by a Precambrian bedrock base, and this is seen in surface outcrops in various locations, particularly along the Nelson River, which I believe the CEC panel would have seen in their visit to Gull Rapids.

This is overlain by thicker layers of glacial deposits called till material. It's an unsorted mix of materials that may include boulders, pebbles, sand and silts. And this would have been laid down during glacial advances and retreats at various times. Overlying the till material is post glacial deposits. These are generally thin and not always present, and they include bolder, cobble, sand, gravel and Lake Agassiz silts and clays which were laid down when this area was covered by Lake Agassiz. These types of materials, the bedrock, till and post glacial deposits are what are referred to as mineral materials or earth materials.

Peat land are the predominant surface material type in the study area and cover more than 85 percent of the local study area. Peat lands are what we refer to as organic material as it's derived from living matter.

Permafrost is present in the area, discontinuous permafrost is present in more than 75 percent of the study area and about 20 percent has no permafrost. Discontinous permafrost means that the permafrost is present, but it is present in a patchy distribution.

So if you take a look at the project footprint focusing a bit more down to the site level, where the generating station would be constructed and located. So the project footprint will cover approximately 14,000 hectares. This includes altered water areas, which are areas of existing waterway, including Gull Lake and the Nelson River in which water levels are affected. It includes planned disturbed areas.

So these are areas where we know that construction will take place where, for example, the dam and generating station and dykes are located, we know those areas will be disturbed. And it includes potentially disturbed areas which are areas that may not be required for the construction of the project, but there may be some disturbance occurring. For example, along the dykes, there may be space required to operate and maneuver machinery, and some additional footprint area may be cleared along those dykes, but it's likely that not all of the potentially disturbed area would be used.

We also note that the planned disturbed area includes borrow areas likely to be used during construction. However, it is expected that in some borrow areas, only a fraction of the total borrow area will actually be utilized. However, for the purpose of the assessment, it is conservatively assumed that the entire area, an entire borrow area will be disturbed if only a small part of it is likely to be used.

And looking at material quantities, a large amount of earth fill will be required to construct the project. So this is the rock and granular and impervious material, or mineral -- earth materials, so approximately 8 million cubic metres. There will be approximately 3 million cubic metres of rock excavations and some of this material will be used for the earth fill. And there will be excess excavated material, and this is material that is not required for construction, and this will be placed in material placement areas which were described in more detail in Mr. St. Laurent's project description panel. And approximately 4 million cubic metres of excess material will need to be placed in the placement areas.

Next we have climate. Climate considerations within the EIS include current climate conditions, effects of the environment on the project, effects of the project on the environment, and this relates to greenhouse gas emissions, and sensitivity of conclusions to projected climate change.

So regarding effects of environment on the project, the project is designed for the environment and environmental conditions in which it will operate. Some of the considerations included design of cofferdams used during construction to withstand flood flows, capacity of the dam and generating station to pass an unlikely extreme flood during operation, design of dams and dykes to withstand rare high wave events, and design of dykes to accommodate permafrost conditions. Risks to the public and the environment are minimized through the design and ongoing monitoring and maintenance of project infrastructure.

A lifecycle assessment was performed for the Keeyask project to quantify the amount of greenhouse gas or GHG implications over the life of the project. These GHG implications were compared with other alternative forms of electrical generation. The assessment was carried out consistent with the ISO 14,040 2006 standard for lifecycle assessments, and include a consideration of factors such as the manufacture and transport of components and construction materials, construction activities and equipment operation, clearing and other land use changes including the reservoir, operation and maintenance during the life of the project, which would include things like replacing components during the life of the project, and decommissioning at the end of the project life.

So this chart depicts the primary sources of greenhouse gases from the project. Approximately 46 percent of the emissions of greenhouse gases are related to construction and relate to building material, the manufacture of the building materials such as steel and cement, the transportation related to construction, so transportation of building materials to site, and on-site construction activities.

Approximately 51 percent of the total emissions result from land use changes, such as clearing for roads and transmissions and creation of the reservoir. Most of the emissions due to land use changes are a result of the reservoir.

A small amount of the total emissions is attributed to maintenance and refurbishment during the life of project, and decommissioning activities, which account for about 3 percent of the total.

So this chart shows a comparison of Keeyask emissions to other generation options, and on the left side of the chart we see that the comparison scale is the amount of greenhouse gas emissions, or the emission intensity for a given unit amount of power generated. And it related to the amount of CO2 produced to generate that amount of power.

So for Keeyask, the emission intensity is about two and a half tonnes of carbon or CO2 per gigawatt hour, which you may see as much lower than the emissions from an equivalent sized coal plant and natural gas types of plants.

So, in the end, the project would

result in fewer greenhouse gas emissions over its life than an equivalently sized gas-fired station produces in half a year, or the amount a coal facility produces in less than a hundred days.

Air quality and noise. Air quality considers the likelihood of exceeding the air quality guidelines, particularly for people residing off site. Airborne emissions are primarily due from exhaust from gasoline and diesel engines, vehicle traffic on roads. Noise considers the likelihood of impacts, particularly with respect to people residing off site. Noise will be produced due to project activities such as equipment operation throughout the footprint area.

Currently there are no major sources of airborne emissions or noise near the project site.

The sound of flowing water in Gull Rapids is a notable feature of the local environment.

So regarding air and noise emissions during construction, the sources of emissions will be more concentrated near the main construction area in the vicinity of the dam and generating station at spillway. But overall, many activities will be intermittent and distributed across the large project footprint. The project does not have any large single sources of continuous noise and airborne emissions.

During operation, there are minor sources of air emissions, and much of the operating noise is contained within the powerhouse.

Another consideration related to the project is there are no permanent residences or developments near the dam site. The closest cabins are at a commercial fishing camp which is used about 10 weeks of the year and is located about four kilometres away. And the nearest community is Gillam, which is approximately 30 kilometres away. And to provide some perspective on those distances, from this room, four kilometres south would put you near the Pembina and Jubilee overpass. To the west, you'd be near the Portage and Empress overpass by Polo Park. And 30 kilometres away from here would put you at about the south side of the Town of Selkirk.

Airborne emissions will be detectable near sources at the construction site and in areas of increased activity, but are unlikely to exceed

Manitoba objectives and guidelines in the broader local study area, or where people are residing off site. For noise, it will be elevated at the site, but attenuating with distance, it is unlikely to affect people residing off site. The sound of Gull Rapids will be lost. And consideration of this is, this is considered further within the Partner First Nation individual assessment environmental reports and in the socio-economic sections.

Environmental protection plans that will be in place during construction include provisions for things like dust control to reduce dust emissions, and timing restrictions on certain activities to reduce effects of noise on animals.

Surface water regime and ice processes. The surface water regime and ice processes section considers project effects that include river flows, water depths, water velocity, water levels and fluctuations, and ice formation. Changes to these characteristics are a primary driver for many other effects considered in the Keeyask Environmental Assessment Studies. Although on land, project activities are also important for the terrestrial assessments as well.

Effects on the water regime start at the beginning of construction when structures are placed in the river. This figure depicts stage one diversion activities that will be in place from 2014 to 2017. And to help orient people, if you see the curser on the screen, this shows a close-up of the Gull Rapids area. Flow in the river is from left to right, from Gull Lake downstream to Stephens Lake. In the upper area we have the north channel of Gull Rapids. In the middle we have the centre channel of Gull Rapids. And near the bottom we have the south channel of Gull Rapids.

During stage one diversion, which lasts about three years, cofferdams are constructed in the river so that work areas can be dewatered to allow for construction of the powerhouse, spillway and other activities in the approach and discharge channels, and so that these activities can take place in the dry. This diversion, these diversions will result in the flow of the river being diverted entirely to the south channel, and part of the south channel will be cut off.

At the end of stage one diversion, the

cofferdams for the spillway, which is located at the south channel, are partially breached, and flows begin to be diverted through the spillway. At that time, once flow is moving through the spillway, a dam, cofferdam will be put across the south channel and close off the river, and all of the river flow will pass through the spillway, through the partially completed spillway structure.

This stage of diversion, it lasts for approximately two years. And at the end of stage two diversion, the reservoir water levels will be brought up and raised to the full supply level.

This figure depicts, indicates the initial flooded area associated with raising the water levels up to the full supply level. In this figure, the light blue areas represent areas of existing water, and the darker blue indicate the future water surface. So in the upper figure, the darker blue indicates the initial flooded area. So when the reservoir is impounded to full supply level, it's raised to a level of 159 metres, and during operation it would fluctuate within a narrow one metre range between the full supply level of 159 metres and the minimum operating level of 158 metres.

The initial reservoir area is approximately 93 square kilometres, comprised of approximately 48 square kilometres of existing water surface, and 45 square kilometres of newly flooded area.

The bottom figure indicates a horizontal slice through the study area. The brown area indicates the river bottom. Above that we have a lighter blue area for the existing water level surface. And the darker blue indicates the water level surface with the project in place. And we can see that water levels are increased more at the dam within the Gull Rapids area. On Gull Lake, the water levels are raised approximately seven metres, and the effect of water level increases diminish moving upstream, so that the change in water level is less further upstream from the dam.

Approximately 43 kilometres upstream of the dam, the effect on water levels is diminished so that there's no longer an effect beyond that. And that's what we refer to as the upstream end of the open water hydraulic zone of influence. And that's the area where the effect

of raising the water level in the reservoir, where
the formation of the reservoir affects the water
levels upstream.
Upstream of the hydraulic zone of
influence into Clark Lake and Split Lake, open
water levels are not expected, not predicted to be
affected by the project.
The open water hydraulic zone of
influence also extends to about three kilometres
downstream of the dam. In this area, there would
be potentially small fluctuations in water levels
associated with changing flows and variations in
flow velocities due to changing operations from
the powerhouse and potentially from the spillway
when it's operating.
And this is a zone in which many of
the physical environment studies was focused, as
this is where many of the larger effects, most of
the larger effects occur.
The project assessed water velocity
changes in the study area. In these charts, in
both the existing and project environment, the
higher velocities are associated with areas in the
river sections and rapids area, so indicated by
the yellow and red colours. And lower velocities

occur in the lake and reservoir areas, indicated by the blue and green.

With the project, due to increased water levels upstream, velocities in the upstream hydraulic zone of influence will be reduced. And downstream of the project, velocities and patterns will vary during operation, and during a peaking mode of operation may vary throughout the day.

Looking now at ice conditions. Again, like the figure on the previous slide, this depicts the water levels in the darker blue and it's showing the existing ice surface in the lighter blue. So in the existing environment, there is a large hanging ice dam that forms downstream of Gull Rapids. On Stephens Lake, a smooth ice cover will form and the hanging ice dam forms as ice moving from upstream gets piled up under the Stephens Lake ice cover.

The hanging ice dam can be quite thick, it can reach a thickness of 10 metres or more, or 30 feet or more, and causes water levels to increase upstream to Gull Rapids. And increases of seven metres or more, or more than 20 feet have been observed to occur. These increases and redirection of flow that it causes along shorelines may cause erosion of the downstream shorelines.

Upstream of Gull Rapids, a smooth ice cover forms on Gull lake. But towards the upstream end of the lake and to Birthday Rapids, a thicker, rougher ice cover forms in the river. And this ice cover may extend upstream of Birthday Rapids or it may stall at the bottom of Birthday Rapids, depending on ice conditions.

Now moving to the project environment. With the project in place, the large hanging ice dam that currently occurs below Gull Rapids will no longer form at the entrance to Stephens Lake. A smoother ice cover similar to that which forms currently on Stephens Lake will form there instead.

Upstream of the generating station, a more stable, smoother ice cover will form on the reservoir, and that will extend farther upstream than currently occurs. Upstream of the reservoir in the more riverine section, a thick, rough ice cover will still form, and that ice cover will extend upstream of Birthday Rapids. There will be open areas of water between further upstream, up to the exit of Clark Lake.

Model results indicate there is a potential for Split Lake level increases in the winter of up to 20 centimetres, but this would only occur, would only be expected to occur during infrequent winter low flow conditions that may occur approximately once every 20 years. This would result in a winter lake level closer to the average winter level.

Might I ask what time the panel typically likes to break for coffee, so I have an idea of where to break off if I need to?

THE CHAIRMAN: About 11:00 or so.

MR. De WIT: Shoreline erosion and sedimentation. Shoreline erosion considers two distinct but interconnected processes, the erosion of shorelines comprised of mineral materials, and peat land disintegration, including peat shoreline breakdown.

The sedimentation study considers sediment concentration, sediment transport and deposition.

These studies predict project effects on shoreline recession rates and amounts, and which relates to reservoir expansion, amounts of mineral and peat material released to the reservoir, changes in shoreline composition, and sedimentation processes due to changes in the water regime and shoreline erosion processes.

So, first a brief explanation of what mineral shoreline erosion processes are. There are three main processes by which mineral erosion occurs. So this is, again, related to the mineral materials referred to in the physiography part, the bedrock, the till, and the glacial deposits.

Riverine erosion occurs where you have, in the narrower river sections where flow velocities along the river banks may result in erosion of the shorelines. Lake erosion processes mainly relate to where shoreline erosion is primarily due to wave action at the shoreline. In the future environment with a Keeyask reservoir, wave erosion would be the predominant process affecting erosion. And ice processes, where ice can scour material from shorelines, and as noted in the water regime component, formation of ice dams may cause water level increases and redirection of flows along shorelines which may also erode material.

In the future reservoir, this depicts how erosion of a mineral shoreline may occur. We would have an initial shoreline profile indicated by the lighter dashed line. You would have a new shoreline form there with the increase in water level. Erosion causes this bank of the shoreline to recede inland from the initial position as shoreline material is removed. Initially, the rate of recession is higher, and the rate decreases over time as the near shore area gets larger and flatter.

The rate of shoreline recession declines over time because the wave energy that causes erosion gets spread out over a larger shore area and less energy is focused at the bottom of the bank.

Going to peat land disintegration, for this process, in this, in the existing environment indicated by figure number one, you would have mineral materials overlain by peat lands. And we have an existing water level that is along the bank, and you would have some existing, some erosion taking place along those mineral banks.

When the reservoir is formed, moving onto figure number 2, the water levels are raised, as indicated by the light blue. And a new shoreline is formed at the new, at a new location, which may be located in a peat area, and peat lands above the previous water level would be flooded.

Looking at figure 3 then, some of the submerged peat that is present within the flooded area may resurface, and it may then break down, or it floats up from the surface, and peat along the new shoreline will be broken down and eroded.

And then on to figure 4. As these processes take place, these floating mats may be transported and they are broken down over time. At the new shoreline edge, the peat that may be disintegrated may be eroded back until it eventually exposes mineral shorelines and a new mineral shoreline is formed over time. The process of peat disintegration is counteracted by the ongoing formation and expansion of peat lands as these are formed from living matter.

With the project, the rate of expansion will partly depend on the net effect between peat disintegration and formation.

So the physical environment studies considered potential effects of sediment due to in-stream construction activities, which involve the placement of materials, mineral materials into the river to construct cofferdams and permanent dams, and also the removal of these cofferdams from the river when the cofferdams are no longer required.

These in-stream work activities introduce sediment into the river which may increase suspended sediment concentrations downstream from that work. The stage one and stage two diversions will also increase water levels within Gull Rapids, which may cause shoreline erosion, adding suspended sediment to the river. Potential project effects on suspended sediment were assessed for each in-stream construction activity.

So the chart on this figure provides an indication of predicted suspended sediment increases downstream from in-stream work activities. In the larger background chart on the left-hand side, we have a scale that shows daily average increases in suspended sediment in milligrams per litre. So this would be the predicted increase in concentration, which would be added to whatever the background concentration is coming into the area from upstream. And on the horizontal or bottom axis, it shows the construction timeline dates starting in 2014, in stage one diversion, and then onto the final activities in 2019, just prior to the time the reservoir is impounded.

So minimum and maximum changes in suspended sediment were estimated, and for most activities the downstream increases in suspended sediment are less than 5 milligrams per litre increase. The inset chart shows the project activity that causes the largest downstream increase in suspended sediment. This occurs during construction of the south dam stage two cofferdam, and that's when the south channel is closed off and all flow ends up diverted into the spillway.

For this activity, the increases, the range from minimum to maximum predicted increases were from five to 15 milligrams per litre of increase. The highest increases occur over a period of a number of days, and for much of the activity, the increases are less than 5 milligrams per litre.

So when in-stream construction is taking place, and during the construction period, a monitoring plan will also be in place to measure the effects of the work on suspended sediment concentrations. This is the sediment management plan for in-stream construction. The purpose of the plan is to verify that changes in suspended sediment remain below target levels.

The plan involves the use of real time monitoring upstream and downstream of in-stream work activity, and will use electronic probes that are placed in the river to measure turbidity, which is the measure of water clarity, and data from the probes will be transmitted to an on-site environment office where it will be monitored for effects of in-stream activity on the suspended sediment.

Three monitoring locations will be monitored during this process. The first site, referred to as SMP-1, is upstream of the construction activity and provides a measure of the background suspended sediment concentrations upstream of the in-stream work. The second site is called SMP-2, and that is a location just downstream of the in-stream work activity. Measurements from this site will be compared with data from the upstream, data from the upstream site to identify a suspended sediment concentrations increase between the locations, which could indicate a potential effect due to in-stream work. If increases exceed specified action levels, then mitigation actions would be initiated to reduce the input of sediment to the river.

The third site, called SMP-3, is monitored to determine, to identify if actions -- to ensure that changes in suspended sediment due to in-stream work remain below target levels for this site, and to ensure that mitigation actions taken in response to observations at the SMP-2 location are reducing the suspended sediment in the stream.

THE CHAIRMAN: Mr. De Wit, what is real time monitoring as opposed to just straight up monitoring?

MR. De WIT: By real time monitoring, we mean the probes that are in the river continuously transmit data back to the office, to the environmental site office on site. So it's continuously wirelessly transmitting that data there, so they can check it as that data is being measured.

THE CHAIRMAN: Thank you.

MR. De WIT: That would be as opposed to say someone going out and taking a hand measurement or a water sample, which might then need to be brought back. And it takes time.

So moving into the operation phase. At the end of stage 2 river diversion, the reservoir again is impounded, raising water levels to the full supply level, which for purpose of the assessment begins what is considered the operation phase.

Physical environment predictions indicated approximately seven to eight square kilometres of reservoir expansion will occur in the first 30 years. Much of this expansion occurs earlier -- or the rate of expansion is higher in the early years of operation and declines over time. Approximately 75 percent of this expansion occurs in the first 15 years. And the rates decline over time because, as noted, for example, for the mineral erosion, the rates of shoreline recession decrease as those mineral shorelines flatten out and stabilize.

A lower more stable annual expansion rate is attained by year 30. It's anticipated a gradual decrease would occur -- would continue to occur after year 30.

So the annual expansion rate declines as peat disintegration rates decline and as the mineral shoreline recession rates decline, to near the rates currently observed in the existing environment.

With the project, there will be less erosion immediately downstream of the project along the shorelines where the large hanging ice dam currently forms. Without that ice dam, those shorelines will not be as exposed to higher water levels and diversion of flow along the shoreline.

Looking at peat resurfacing and mobile peat, approximately 15 to 16 square kilometres of peat is expected to -- of the flooded peat is expected to float up and resurface. Two-thirds of this occurs in the first year. Resurfacing decreases over time and is not expected after year 10. Observations from other reservoirs indicate that resurfacing ends at some time between the fifth and tenth year of operation. And by year ten, it's likely expected that peat that's likely to resurface will have done so. Also over time, over that time, the settling of mineral sediments upon the flooded peat weighs that peat down and lessens the likelihood of it resurfacing.

Resurfaced, non mobile peat remains near where it floats up. And this would be material, for example, that floats up in shallow water and is held in place. Mobile peat or resurfaced peat that floats up may be transported to other areas of the reservoir, and this is due to wind and flow driven currents. The mobile peat may become immobilized and is reduced due to disintegration. So as that peat is transported across the reservoir, it may be blown into shallow areas or other areas where it's less likely to move, and may get stranded and hung up along shorelines, for example.

Mobile peat could only move downstream if the spillway is operating. However, a boom upstream of the spillway would be anticipated to catch much of that during operation.

Most of the sediments, the disintegrated peat, both the disintegrated peat and the mineral material from shoreline erosion originate in shallow, near shore and back-bay areas with low water velocities.

Most of the peat that disintegrates is expected to accumulate near where it originates in back-bays because it originates in the shallow, low velocity areas. Due to peat, transport of floating peat, there's an expected net accumulation of mobile peat on the south side of the reservoir due to prevailing winds. Prevailing winds are generally from the north towards the south and would tend to move mobile peat towards the south side of the reservoir.

Mineral sediment deposition rates are lower in offshore areas. So generally in the, for example, the lighter blue area of the former -- of the existing river area. Rates in deeper water areas are generally a centimetre per year less in the first year and following years. Deposition rates are higher in the first year in near shore areas, and depending on the area, may range from about one to two centimetres per year in less affected areas, and up to four to six centimetres in that first year in some of the back-bay areas.

Mineral sediment deposition rates stabilize at a lower long-term rate after about year 15, corresponding with a stabilization in the rates of mineral shoreline recession over time, and by that time generally range from about zero to one centimetre per year throughout the reservoir.

Looking at suspended sediments, mineral sediment concentrations in the reservoir area with the project will have a similar overall range of about five to 30 milligrams per litre as is observed without the project. Without the project, average concentrations typically range between about 13 and 19 milligrams per litre, but with the project, due to increased water levels and reduced flow velocities, sediment will be deposited such that the -- with the project, the average concentrations are expected to reduce by about two to five milligrams per litre at low to average flows, and by about five to 10 milligrams per litre for high flows.

Organic sediments entering the water. The highest loadings of organic sediment to the reservoir occur in year one. In that year, estimated organic sediments in the water peak at less than 3 milligrams per litre in the main reservoir area, so generally, the area indicated by the existing river area. And in some of the more affected back-bays, the concentrations may range up to 10 to 20 milligrams per litre.

Peat land disintegration reduces

substantially in following years, and by year five concentrations of suspended organic material would be expected to be about a milligram per litre or less.

Suspended sediment due to deposition of some of the suspended sediment from upstream in the reservoir, there would be reduced concentrations of suspended sediment discharged downstream, and concentrations will be reduced for about 10 to 12 kilometres below the powerhouse into Stephens Lake. Beyond that, there would be no anticipated effect on concentrations in Stephens Lake.

Similar conditions would be anticipated upstream of Birthday Rapids with and without the project. And this is because the water level increases in that area are not as large, and these areas, typically for the most part, have shorelines that are controlled by non-eroding bedrock.

Taking a look at debris. Debris may be present in the reservoir due to flooding of terrestrial areas, shoreline erosion, and floating peat. Early in the process of developing the Joint Keeyask Development Agreement between

Manitoba Hydro and the Partner First Nations, debris was identified as a key issue. And for this reason, the development agreement includes two planned mitigation programs, the first being the reservoir clearing plan and the second being a waterways management program, which you have already heard about in the project description presentation.

With the reservoir clearing plan, areas that will be flooded will be cleared before the reservoir is filled. Clearing will be implemented using mechanical and manual methods to remove standing woody material and fallen trees. Clearing the reservoir area prior to impounding greatly reduces the potential for woody debris in the future reservoir, as well as the effort that might be otherwise required to manage woody debris if clearing did not occur. Cleared vegetation will be accumulated in piles and will be burned in the winter.

This map indicates general areas in which the different types of clearing will take place. It will be either by hand or by machine. For example, a number of the islands being cleared by hand.

The waterways management program is also a component of the Joint Keeyask Development Agreement, and it is an important component. The objective of the program is to contribute to the safe use and enjoyment of the waterway from Split Lake to Stephens Lake.

The program commits to a number of activities that will be implemented during construction and operation after the reservoir is impounded. The key activity in the program is the management of debris in the waterway to reduce hazards to navigation, which would include identifying and removing debris from navigation routes that will be established on the reservoir. Debris management will also involve proactive removal of trees from eroding shorelines to prevent woody debris. And both crews would also communicate with waterway users to share information on waterway conditions and help identify concerns of waterway, those using the waterway.

A number of additional activities are included in the plan, such as protecting and preserving important spiritual or cultural heritage sites, both during construction, operation, maintaining safety cabins, trails and portages and safe ice trails during construction operation. It would assist with the reservoir clearing during the construction phase. During operation, it would be responsible for preparing reservoir depth charts and installing staff or water level gauges at different locations, and marking safe travel routes and maintaining landing sites.

On to ground water. The study considered potential effects related to ground water levels and flows and the likelihood of effects to groundwater quality. A major purpose for this study was to support the assessment of potential project effects on the terrestrial environment. The study used a broad-based regional model to identify terrestrial areas where groundwater effects could potentially have implications for terrestrial habitats.

Without and with the project, groundwater flows from higher to lower groundwater elevations and continues to be directed from the groundwater system into the Nelson River and local water bodies.

Groundwater quality is not expected to

be affected by the creation of the reservoir because there would not be a reversal of flow of water from the surface to the groundwater system. As noted, the groundwater continues to flow from the groundwater system to the surface water system.

Environmental protection plans protect groundwater quality. The main risk to groundwater quality is identified to be potentially small spills of, for example, petroleum products like gasoline or diesel fuel over small areas. The risks of such accidents occurring is likely small and are mitigated through the protection plan, through the implementation of measures such as storage and handling of hazardous materials or petroleum products, use of spill containment measures and meeting applicable regulations, dedicated refueling and maintenance areas and availability of spill equipment and requirements to clean up any spills.

As noted, an analysis on groundwater is used to identify areas where groundwater changes could potentially influence terrestrial habitats. The predicted changes are generally localized along the reservoir shoreline and within islands, both existing islands that will be flooded and new islands that will form from flooding of terrestrial areas.

Along the reservoir, average in groundwater increases are predicted to be approximately two metres. And within islands, the increases are variable, rising up to, increasing by up to four and a half metres within, for example, here at Caribou Island.

The effects on the groundwater and the identification of the potentially affected areas were then further considered within the context of the terrestrial habitat studies.

So looking at surface water temperature and dissolved oxygen, the study considered water temperature conditions, particularly the potential for thermal stratification to occur. Stratification refers to a condition where there is a less dense layer of water in the upper part of the water column. So in summer, this would be a warmer layer of water. And then below that is a denser layer of water at the bottom or in summer which would be a cooler layer of water. Stratification, if it occurs, indicates a lack of vertical mixing in the water column. And the study also looked at the potential for low dissolved oxygen concentrations to develop in the reservoir. As noted, dissolved oxygen is required by aquatic life and higher levels of oxygen are desirable.

Results were considered then further in the aquatic environment assessment of overall water quality and effects on aquatic life. Manitoba has water quality objectives for minimum dissolved oxygen concentrations for the protection of aquatic life, and there are several different criteria.

So the surface water and dissolved oxygen process. Dissolved oxygen may be removed from the water due to the decay of organic matter such as peat. During the process of decay, it utilizes water that is contained, or utilizes oxygen that is contained in the water and reduces the concentration of that dissolved oxygen. Dissolved oxygen in the water is replaced by a couple of processes. Inflowing water with higher levels of dissolved oxygen replace oxygen that may be consumed and oxygen enters the water from the atmosphere. Flow and wind mix dissolved oxygen through the water depth.

The occurrence of stratification as noted would indicate a lack of vertical mixing through the entire water depth which would have implications for the replenishment of dissolved oxygen.

So the results of the study indicated that for water temperature, there is little change in water temperature as the water flows through the reservoir from its upper end to the generating station. The more isolated back-bays off the main channel are warmer in summer by several degrees, being shallow and less mixed with the main flow. And we did not find any indication of stratification occurring along the main reservoir area.

Dissolved oxygen shown in the two charts. In these charts, the green indicates higher levels of dissolved oxygen exceeding the most stringent of the guidelines. And then the yellow, orange and red indicate lower levels of dissolved oxygen. So the upper chart is all green and is for typical summer conditions which indicates that dissolved oxygen in the reservoir would meet the most stringent guideline under typical weather conditions.

During periods of low wind, the dissolved oxygen may be reduced in back-bay areas below the most stringent guideline level. But these occurrences are typically of short duration of several -- one or a few days. And would return to above objective, the most stringent objective when more typical conditions return, more typical wind conditions.

The back-bay areas would have reduced dissolved oxygen levels in winter largely because you have an ice cover which prevents reiteration and wind mixing in those areas. However, much of the reservoir and the main reservoir area remains above guideline.

Dissolved oxygen levels in the water discharge downstream, meet the guideline levels under all conditions.

I was thinking maybe this might be an opportunity to break?

THE CHAIRMAN: Or you could just --

MR. De WIT: Plow through?

THE CHAIRMAN: -- run right through. You don't have that much left.

MR. De WIT: All right. I apologize if I'm keeping people from their coffee.

THE CHAIRMAN: They will survive.

MR. De WIT: I'm not sure I will.

So now we look at Interactions with Future Projects. Future projects that were identified within the studies. Again I believe this was addressed by Ms. Cole in her presentation and the projects identified included Bipole III, Keeyask Transmission Project, Gillam Redevelopment and Conawapa Generation Project. These projects are not located close to the Keeyask reservoir where most of the physical environment effects occur. In fact, much of the activity is downstream of the reservoir.

Potential overlap of sediment, the assessment identified a potential overlap of sediment released from Keeyask and Conawapa due to in-stream construction if there are instream construction activities occurring at both sites simultaneously. The effect is likely to be small and of short duration, as sediments released from the Keeyask area are reduced as they settle in the Stephens Lake area.

Operation of the potential projects is not expected to cause an interaction with the Keeyask physical environment effects.

And now we come to the Sensitivity of Effects Assessment to Climate Change. So the conclusions on residual effects were reviewed to determine if they would be likely to change as a result of climate change. The assessment focused on the operation period because this corresponds to the long-term time horizon as due to the climate change scenarios. Average projected changes in temperature and precipitation were identified based on global climate models developed from the current internationally accepted greenhouse gas emission scenarios from the intergovernmental panel on climate change.

At this point, I'd like to ask Ms. Koenig to present some of the slides on the rather involved topic of climate change scenarios and projections.

MS. KOENIG: Thank you, Mr. De Wit.

Good morning, Mr. Chairman, Commissioners, participants and members of the public. My name is Kristina Koenig. I am the section head of the hydrologic and hydro-climatic study section at Manitoba Hydro.

This morning, I'm going to review how we developed the future climate scenarios that were used to conduct the climate change sensitivity analysis on these physical environment components.

The Intergovernmental Panel on Climate Change is the leading international body for the assessment of climate change. It was established by the United Nations Environment Program and the world Meteorological Organization in 1988 to provide the world with a clear scientific view on climate change. They provide guidelines, assessment reports and climate model data for conducting climate change assessments.

They recommend when conducting a climate change assessment to develop a number of future or possible climates termed climate scenarios. The climate scenarios are not predictions of the future, they are plausible representations of what the future may look like under various potential greenhouse gas emission scenarios.

We followed these internationally accepted guidelines to develop the climate scenarios in this EIS. We also received additional support from the Ouranos Consortium on both our methodology and obtained climate model data from them.

Manitoba Hydro is an affiliated member of the Ouranos Consortium. Ouranos is the consortium dedicated to climate change impacts and adaptations to climate change. They are an internationally recognized organization with experts that have considerable experience in climate change adaptation projects as well as providing a variety of climate change data and information.

So to assist in modelling future climate, the Intergovernmental Panel on Climate Change prepared scenarios of future greenhouse gas emissions. These emission scenarios look at how future population grows, energy generation, technology, economy, land use, and agricultural practices will change globally into the future. They are not intended to be exact predictions of future emission scenarios. They are intended to provide a wide range of possible scenarios that will encompass some of the uncertainty related to these future trends. All emission scenarios that were available were used in this EIS.

These emission scenarios are used as input into global climate models. Global climate models are complex computer programs that simulate the earth's climate on a course grid which covers the entire globe. Many research institutes around the world have developed and maintained their own global climate models. While each of these global climate models are similar in many ways, there are subtle variations that exist with respect to the grid characterizations, so the shape and size of the grids, as well as with the prioritization schemes with inside the model.

So an attempt to coordinate the analysis of these models, international and two comparison projects have been conducted. The most recent one that was available during the preparation of the EIS is known as the Coupled Model Intercomparison Project Phase 3. And the output from this project form the basis of the Intergovernmental Panel on Climate Change 4th Assessment Report. So all global climate models were used in this EIS.

These global climate models can be used to force regional climate models. Regional climate models simulate the climate on a finer grid at approximately 50 kilometres by 50 kilometres for a smaller limited area. So now just North America would be modeled. And they require a lot of computer power. So there's not a lot of regional climate models available.

Across Canada, the Canadian regional climate model is available. This model is developed and supplied to us by the Ouranos Consortium.

So in total, 139 climate scenarios were developed from 24 global climate models with up to three emission scenarios ranging from low to high emissions. In addition, up to nine climate scenarios using the Canadian Regional Climate Model forced by three global climate models for all available emission scenarios used in this EIS. Therefore, we had a very very large comprehensive set of climate scenarios available to conduct the sensitivity analysis.

So a detailed analysis was conducted on these climate scenarios at the annual seasonal and monthly time scale.

In general, what we saw, that the models are projecting warmer and wetter conditions into the future with winter projecting the greatest increase in temperature and precipitation. This table shown here shows what the annual average temperature and precipitation changes will be with respect to current climate. So here we can see that temperatures projected to increase by 1.5, 2.8 and 4.1 degrees Celsius. And precipitation is projected to increase by five, 10 and 14 percent into the future.

The graphs below are scatter plots for the 2020s, 2050s and 2080s. Here the horizontal axis represents a change in temperature and the vertical axis would represent a change in precipitation. So anything to the right of zero would represent an increase in temperature and anything above the zero would be an increase in precipitation on the vertical axis. So you can see, as you look at the scatter plots that as the time evolved, so as we go toward the 2080s, the spread or the uncertainty in the model starts to increase. And this is because these projections are substantially affected by the choice of the emission scenario as well the internal model variability. So we have less confidence in the projections as we go further out.

After developing this large comprehensive set of climate scenarios. We then fed them to the physical environment specialists who were then able to do an assessment to see if their conclusions would change as a result of these climate scenarios.

And I'm going to let Will explain what the assessment found.

MR. DEWIT: So the sensitivity first took a look at the water regime as it's a primary driver for many of the physical environment effects. So for Nelson River flow conditions, a sensitivity assessment of water regime effects to climate change was assessed by considering a regionally conservative estimate of both a 10 percent increase and a 10 percent decrease in flow as projections of effects on Nelson River flow due to climate change are not available. So a sensitivity analysis was performed.

Effects in the open water hydraulic zone of influence found that the operating range of the reservoir would not change. It would not be necessary to change that. It would be fixed at 158 to 159 metres. The open water hydraulic zone of influence would not change.

If flows are somewhat higher, there would be more what's referred to as baseloaded operation, which Marc described in his project description panel. And that's a case where the reservoir is held at its full supply level and discharge from the reservoirs is equal to the inflow.

At lower flows, there would be more peaking operation where the reservoir is drawn down and refilled on a daily basis to varying degrees, and there would be less use of the spillway. And projecting into the future, there would be a shorter duration of ice cover in future scenarios.

So the physical environment residual effects were reviewed in consideration of projected climate changes and water regime sensitivity, and found that the residual effects are not sensitive to climate change.

The robustness of the conclusion is largely due to two factors. At first the reservoir operating range is not changed and the water regime within the open water hydraulic zone of influence is not substantially changed when considering climate changes.

Second, the largest effects of the project on the physical environment occur early in the operating period when climate changes are small and would not cause as large a change in this period.

So during construction and operation, a plan will be in place to monitor components of the physical environment. This is a component of the overall environmental protection program that will be in place for the project. And the purpose will be to measure actual effects and identify unanticipated effects. It addresses areas of concern identified by partner First Nations. It supports monitoring of mitigation and compensation measures that will be implemented during the project. It supports the development of additional measures if required, confirms compliance with regulatory requirements that may be identified, and supports other monitoring programs.

Components of the monitoring plan include water regime and ice. Year-round water level monitoring will be performed to verify the project does not affect levels on Clark Lake and Split Lake, which is an important consideration for the partner First Nations. And it will identify changes in the water level regime within the reservoir. The velocity and depth will be measured to support aquatic monitoring, particularly aquatic habitat studies, and would likely be focused on areas identified by the aquatic team where aquatic habitat monitoring is required. And monitoring of ice cover development will take place to identify how the progression of ice sheet development occurs upstream and downstream of the reservoir.

In shoreline erosion, reservoir expansion will be monitored to identify the extent and rate of expansion over time. It will identify our shoreline material classifications along the shorelines and would help to identify where shores transition from peat to mineral materials and the monitoring of reservoir expansion and shoreline material are connected as the conversions from one material to another would affect rates of expansion. And it will also look at the extent and location of peat resurfacing and accumulation and transported floating peat.

As anticipated, some of these programs would work in conjunction with the waterways management program and the collection of some of this information.

On sedimentation, turbidity and

suspended sediment monitoring will be undertaken to identify the range of effects in different areas of the reservoir and actually monitoring will occur upstream and downstream of the generating station during both construction and operation. And this would be in addition to the monitoring performed for the sediment management plan that was described earlier.

Monitoring will be done to identify sediment deposition and to determine rates and types of accumulation. Again, this will occur at locations both downstream and upstream of the generating stations. And this monitoring helps to support aquatic habitat and water quality studies which are components of the aquatic monitoring program.

Greenhouse gas monitoring will take place. This will include seasonal monitoring on the reservoir and a year-round monitoring station will be installed at the powerhouse. This will help identify rates of greenhouse gas emissions due to flooding and expected declines in the rates of greenhouse gas emission from the reservoir over time.

The physical monitoring plan includes

additional support for the aquatic monitoring programs. And this would include measurements of water temperature, dissolved oxygen, and total dissolved gas. The total amount of gas dissolved in the water is a parameter relevant to fish and fish health as too much can affect fish health. The physical program will support the aquatic monitoring work in the collection of this data in the water downstream of the spillway where increases in total dissolved gas could potentially occur. The physical program also includes a component for communicating debris management information to the monitoring advisory committee.

Within the program, monitoring of air quality and noise were not proposed as people residing offsite are unlikely to be affected by those. And groundwater effects will be monitored through the terrestrial habitat monitoring program.

So now we come to a summary. Effects of the Keeyask project during construction and operation have been considered key aspects of the physical environment. The technical studies included and used historic and recent data from the project area, observations from comparable proxy areas both near the site at Stephens Lake and within other Manitoba Hydro reservoirs. And input from partner First Nations, technical studies were performed and these were done in a collaborative manner within the team.

In general, the study results found a key driver for effects is the change in water regime due to the creation of the reservoir. Although project footprints in the terrestrial area are very important to the terrestrial studies as well. The largest effects occur early in the operating phase, particularly the first year, due to the creation of a new reservoir environment. Effects continue during the operating phase, but generally the rates of change decline over time on an annual basis as the environment adjusts to the altered conditions.

After about year 15 of operation, effects such as reservoir expansion decline to more stable rates that may persist over time. The project and predicted effects are robust under current and projected future climate conditions.

Study results were shared with and discussed with partner First Nation and representatives and communities and shared extensively with the aquatic, terrestrial, socio-economic, resource use and heritage resources study teams. Mitigation, monitoring and other plans will be in place to reduce, manage and measure the effects of the project on the physical environment. And the predicted physical environment effects form the pathway for effects to the valued environmental components which will be presented by other panels in the coming days.

And with that, my presentation is concluded, Mr. Commissioner, and we're done.

THE CHAIRMAN: Thank you, Mr. De Wit and Ms. Koenig, for this presentation this morning.

We'll take a 15 minute break and come back with the beginning of questioning. So about just after 20 after.

(11:08 a.m.)

THE CHAIRMAN: Okay. We will reconvene. Mr. De Wit, that concluded your presentation? There is nothing more before we turn to questioning?

MR. DE WIT: Yes, that was it.

THE CHAIRMAN: Thank you.

Mr. Bedford?

MR. BEDFORD: We have one undertaking to answer from last week, and Mr. Malenchak was the chap who was required to develop the answer. So this would be a convenient time for him to put it on the record.

THE CHAIRMAN: Thank you. Mr. Malenchak?

MR. MALENCHAK: During the project description panel, I was requested that we provide the net weight of the Keeyask reservoir once fully impounded, and we have developed that answer, and the answer to that is 386 million metres cubed of water, which equates to approximately 386 million metric tons.

THE CHAIRMAN: I can't even conceive of what that is. I'm sure others can. I'm not much of a scientist. I just know it is a lot.

Okay, we will turn now to cross-examination on this morning's panel. The first up, Manitoba Wildlands, Ms. Whelan Enns.

MS. WHELAN ENNS: Good morning. Making sure I'm audible.

THE CHAIRMAN: You are indeed. Carry on.

MS. WHELAN ENNS: Okay. I have gone to page 5 in this presentation. What is the base line environment for the three main areas considered in the environmental assessment on this page?

MR. DE WIT: The past environment took a look at past studies, for example, like we said the Lake Winnipeg, Churchill/Nelson River Board assessments and other studies, historic studies for the existing environment. We conducted studies that have been conducted since about 2001 when there was more intensive work done for the -- and then the future environment conditions are based on the projections that -- the assessments that were done.

MS. WHELAN ENNS: Thank you. I will attempt a different version of the question, and that is, is the baseline environment for the Keeyask EIS the current environment with existing generation stations and changes we already know about to the Nelson River?

MR. DE WIT: Yes, the baseline was post CRD, LWR regulation.

MS. WHELAN ENNS: Thank you. Which reservoirs in the region, the larger region around the RSA and LSA are then in your baseline environment?

MR. DE WIT: So in the presentation we show the local study area, and that included the Kettle -- Kettle Generating Station, the Stephens Lake reservoir.

MR. REMPEL: I would like to add to that, that we did look at the information that was available from the study board prior to the Lake Winnipeg Regulation and CRD, and the study board did provide some information on the past environment, particular with regard to the reach that we were looking at in terms of hydraulic effects. And they did not predict actually radical changes or dramatic changes in the reach that we are studying, the hydraulic zone of influence, from Split Lake down to Stephens Lake. They predicted modest changes in the water levels and modest changes in erosion, and the prediction seemed to have been borne out, so that environmental setting post LW/CRD, seemed appropriate for us to look at in terms of effects of Keeyask.

MS. WHELAN ENNS: Thank you, Mr. Rempel. Did you just tell us that Stephens Lake was there before CRD and Lake Winnipeg regulation?

MR. REMPEL: No. Actually we looked at -- or the study board looked at -- I should have perhaps been more clear. They did talk specifically about the reach, the low Split Lake up to Kettle Rapids.

MR. EHNES: I would like to add to that as well. Our historical studies that go back prior to CRD, Lake Winnipeg regulation in order to study the effects of hydroelectric development in other areas and use those effects as examples to inform us as to how Keeyask could affect the Nelson River area.

MS. WHELAN ENNS: Thank you, Dr. Ehnes. Then what did your studies tell you about the changes that now are Stephens Lake? And did that advise or inform you on the creation of a reservoir from Keeyask?

MR. EHNES: Yes, thank you. It did, Stephens Lake initially flooded -- maybe to go back a bit, Stephens Lake is the reservoir for the Kettle Generating Station, and when the Kettle Generating Station was built and operation began, it flooded about 220 to 225 square kilometres of land. Over time as the shorelines broke down, if you will recall Mr. De Wit's slide, he showed shoreline erosion processes over time, that reservoir has expanded by about 15 to 20 square kilometres. And in our studies we mapped the flooded areas and looked at which areas were undergoing reservoir expansion, related those to the kinds of peat lands, the terrain, soils, et cetera, in the area in order to be able to use that information to predict the Keeyask project effects.

MS. WHELAN ENNS: Thank you. On page 6 you've listed the key environmental topics considered in the EIS. Will you be monitoring in each of these areas? Again, taking it as a list of primary or top level topics, will you be monitoring them then throughout the construction period?

MR. DE WIT: I think in the -- at the end of the presentation there, on the monitoring plan, that included, just to be clear -- so you have water regime and ice monitoring, so the surface water regime and ice processes, shoreline erosion and sedimentation processes, surface water temperature and dissolved oxygen, and climate as it relates to greenhouse gas emissions. Air quality and noise monitoring was not proposed as there are no likely effects on people residing off site due to the distance that they are aware. Groundwater will be monitored through the monitoring of terrestrial habitat change which will consider a much larger area around the entire reservoir. Debris management will be performed and we would be reporting on that to the monitoring advisory committee.

MS. WHELAN ENNS: Thank you. Did you just indicate then that your monitoring during construction regarding climate change would be greenhouse gases only?

MR. DE WIT: Yes, I believe there would be greenhouse gas monitoring taking place during the construction phase as well.

MS. WHELAN ENNS: Will there be any other factors with respect to climate change monitored during the construction period?

MR. DE WIT: What factors -- do you have examples?

Well, there is, for example, weather data would continue to be obtained from the Environment Canada station at Gillam.

MS. WHELAN ENNS: Thank you. Have you

given consideration to monitoring water temperature during the construction period in relation to a factor or indicator of climate change?

MR. DE WIT: I mentioned water temperature and dissolved oxygen measurement. So when we are measuring those two, you always measure temperature and dissolved oxygen together because temperature of the water affects dissolved oxygen. But also all of the in-water monitoring, for example, when we have turbidity sensors out in the water, most of this equipment monitors temperature as a matter of course. So there would be temperature measurements through all of that as well.

MS. WHELAN ENNS: Thank you. The questions are then in relation to, for instance, data being monitored during the construction period then being taken into account in terms of your climate change monitoring; are we hearing that you would use data that you are collecting in monitoring for climate change during construction?

MS. KOENIG: Could you please clarify what you mean by monitoring?

MS. WHELAN ENNS: We heard a fair bit

this morning about the monitoring plan at different stages in the presentation, so there is an overall question or confirmation sought that monitoring will be thorough during the construction period. So that's one level of the question. The other is whether or not the data that you are collecting and the monitoring that you are doing and the results from it will be taken into consideration in terms of monitoring for climate change during the construction period?

MR. DE WIT: I just want to check with someone in the back row on something here.

MS. KOENIG: We believe that during the construction period that climate change impacts will be very minimal, so they won't be considered.

MS. WHELAN ENNS: Thank you. This is a sort of -- next question is pages 7 and 8 but overarching, and that is it is challenging to tell from your presentation whether your presentation pertains, so please help us, whether it pertains to the RSA, the LSA or the project footprint or a combination of those, depending on topic, in your presentation?

MR. EHNES: In general it would vary

by topic. The areas that are included in the local study area for physiography, was generally included for all of the physical environment topics, and that captured the hydraulic zone of influence of the project as well as the areas that would be affected by roads, borrow areas and other inland features.

MS. WHELAN ENNS: Thank you. The definition in terms of being in the physical environment presentation is that it does vary. The contents then in the presentation will vary depending on topic and whether we are in the regional study area, the local study area or the project footprint. Am I hearing you correctly?

MR. EHNES: The local study area has essentially overlapped for all of the topics, and most of the presentation you were hearing about water regime effects upstream and downstream, and because the hydraulic zone of influence created by the project has a similar zone of influence for most physical environment effects, of course, for some it extends larger than others, but in general the area was overlapping.

MS. WHELAN ENNS: So that our water effects upstream and downstream, beyond the RSA, some of them?

MR. EHNES: No, they would all be inside the local study area.

MS. WHELAN ENNS: How does the zone of influence term you used relate then to the regional study area, the local study area and the project footprint?

MR. EHNES: The project footprint would be, for example, the areas that are flooded or cleared for borrow areas, roads, et cetera. The zone of influence would be the surrounding area that's affected by those project impacts. So the size of the zone of influence would vary depending on the physical environment component that you are looking at. Groundwater effects might extend inland 100, 200, 300 metres, whereas the effects on vegetation might only be 125 or 50 metres.

MS. WHELAN ENNS: Thank you. On page 9 there is a reference to proxy area studies on other Manitoba Hydro reservoirs. Would you tell us then which reservoirs were the proxy for these studies?

MR. EHNES: It varied by study and in terms of the most broad reaching components, that would be the peat land disintegration studies, which considered Stephens Lake, which is the Kettle reservoir, Long Spruce reservoir, which is just downstream of the Kettle reservoir, the Kelsey reservoir, which is at the upstream extent of our, depending on topic, regional study area. Also the back water effects created by the Notigi control structure on the Burntwood River was used as one of the proxy areas, and Wuskwatim Lake, which was reported in the Wuskwatim Environmental Impact Statement was used to show simply the effects of -- or pardon me, the effects of water regulation and flooding as well, but not related to a dam.

MS. WHELAN ENNS: Thank you. The full operation of Wuskwatim generation station is only -- it is less than a year away or a year back when it started; would Wuskwatim Lake in fact be showing us those effects and the complete effects at this point?

MR. EHNES: We were studying the effects of Churchill River Diversion on Wuskwatim Lake and Wuskwatim Lake peat lands and shorelines, so this would go back to the early 70s or mid 70s, pardon me.

MS. WHELAN ENNS: So that's what you were studying rather than the full results of the generation station at Wuskwatim operating, correct?

MR. EHNES: Yes. This had nothing to do with the Wuskwatim generation project.

MS. WHELAN ENNS: The Stephens Lake reservoir has, as we heard last week, has a fairly significant and different variance in water levels, and fluctuations in water levels, than Keeyask will have based on the EIS. That's a significant difference from a non-scientist point of view. So how did Stephens Lake reservoir inform your proxy studies?

MR. EHNES: That's a good question. We looked at a number of reservoirs, and one of the reasons that we did look at a number of reservoirs is no existing reservoir is going to be identical to Keeyask. So by looking at more than one, I listed I think six, just in my last question, and the reason for doing that was to see how different ranges of water fluctuation affected peat land disintegration, in particular, is what I'm talking about here. And we observed similar patterns throughout the range of water level fluctuations. One thing that I will note is, in terms of peat land disintegration, or terrestrial habitat effects, it is not simply the range of water levels that you observe, it is really the normal range. If water levels are only at the certain elevation for one day out of a ten-year period, then that has virtually no effect in terms of the processes that we are studying. So in terms of looking at say from the 5th to the 95th percentiles of water levels, taking what we are calling the normal range, which is still going towards the extremes, the difference between Stephens Lake and the proposed Keeyask Generation Station is much less.

And then again in TAC round two, there was an IR that asked this specific question, and in the response to that IR, we also talked about how water level fluctuations and the water elevation range was only one of a number of factors that determines shoreline erosion and terrestrial habitat effects. And in fact, in terms of looking at the six different proxy areas, it was not the most important driver for the results that we observed.

MS. WHELAN ENNS: Thank you. Would

you give us then the full range, 5 per cent to 95 per cent, regarding the projections for water levels in the Keeyask future reservoir?

MR. MALENCHAK: Jarrod Malenchak. As Mr. St. Laurent pointed out in the project description panel, the Keeyask reservoir will be fluctuating between the full supply level and minimum operating level. The full supply level being 159 metres, and the minimum operating level, 158 metres.

MS. WHELAN ENNS: Thank you. And yes, we all heard that last week. For, again, a non-scientist to process this, that's a one foot difference and, yes, we heard that last week. Stephens Lake is acknowledged as at least a three foot difference.

So, Dr. Ehnes, you are telling us that this basically does still leave the two comparable, in terms of results once the reservoir for this generation station is in place?

MR. EHNES: Yes. And the reason I say that is because we looked at a number of reservoirs with different normal operating ranges, going from I believe it was 20 centimetres up to about 2 metres. So the Keeyask normal range is within that range of proxy areas that we studied.

MR. MALENCHAK: I should probably just clarify a couple of statements in regards to the fluctuations of the two reservoirs. Keeyask would be a one metre fluctuation, so approximately about three feet, and a normal operating range where Stephens Lake would be fluctuating for 90 per cent of the time, so the vast majority of the time, would actually be 1.9 metres.

MS. WHELAN ENNS: Thank you.

On page 9 there is a reference to, I think it is on page 9, yes, in the bold on the bottom bullet. Does the EIS contain an identification of all of the analytical tools that have been used to predict the project effects?

MR. DE WIT: Yes. If you -- in the physical environment section, the models used in the different studies are described. Within the main section you will have overview descriptions, and then in a number of cases you will find some more detail in the appendices.

MS. WHELAN ENNS: Thank you. So your reference is to different models, correct, as analytical tools? Thank you.

On page 11 you've referenced soil

samples again where there is a comparison between Gull Lake, which is the reservoir, will be a reservoir, and Stephens Lake which is a reservoir.

What did these samples tell you so that we can understand -- I was interested, like is Stephens Lake much larger and is that why there is as many soil profiles taken?

MR. DE WIT: James can answer that, he performed all of those studies.

MR. EHNES: There were probably seven or eight different studies that involved looking at soils, depending, because there were a number of different questions we wanted to answer. Some of those related to environment soil relationships.

These particular studies that you are seeing on this slide, there are two different types of studies. One is to characterize the soils in the area that would be flooded, so we could have a very good idea of how deep the peat was, how it varied within that area based on topography, not just how deep is that peat, but how does its physical character change from being pretty much undecomposed at the top to moderately decomposed, to basically being paste at the bottom. Because those different kinds of, or degrees of decomposition really affect things like peat re-surfacing and how the reservoir will develop over the time. So the statement that soil profiles at about 850 sites, and more than 840 bore holes, was all about characterizing the area that would be flooded, so we could have a really good understanding of how it was going to change in response to the project.

The 1700 soil profiles in Stephens Lake was a completely different kind of study. We took several different approaches to develop models to, you know, calibrate these models to predict reservoir expansion for the Keeyask project. One approach we took was to look at historical photos, and using a stereoscope, using these large scale photos, to map how peat lands broke down over time. We had, I believe, eight different photo years for Stephens Lake so we could really map that trajectory.

The other approach we took, or another approach, we had several approaches, was to look at, or go to places on Stephens Lake that were undergoing peat land disintegration still after 30 years of reservoir expansion. So the way that peat land disintegration works is it expands into these back bay areas, and it just goes further back in time until it reaches a slope in mineral soil, or until the peat lands, the peat forming from the mosses and the plants eventually is higher or it is happening faster than the peat is breaking down.

So we went into some of these areas on Stephens Lake and laid out lines starting in inland areas, going out to the edges of where the peat was breaking down and then out into the deeper water. And we used that as kind of a, what in science we call space for time substitution. So it was a way of actually seeing how this process worked and how it, how the shorelines moved back from time. So these 1700 soil profiles were us, you know, digging these holes or going out in a boat and coring the lake bottom to characterize how peat land disintegration happens.

MS. WHELAN ENNS: Thank you.

Were these soil bore holes and profiles also used in establishing the regions that you have used? So last week you told us about how you were using soil, surficial geology, habitat and so on, to define the regions you were using. So depending on when all of this work was done, did the results from this soil work inform the definition of the regions for the VECs?

MR. EHNES: It would not have factored into defining the regions, because the regions were defined, first of all, where is the project footprint, where are the impacts, what is the local zone of influence of those impacts, and then what is the appropriate larger regional context to use for determining the importance of those impacts? So I used the example of animals, the project might affect a few animals in the area, but really how is that going to affect the population for that species in the region?

MS. WHELAN ENNS: Thank you. Did the Keeyask Partnership First Nations, in their evaluations, have access to the historic information that you are describing, including, for instance, the oversize stereoscope photos? That is, were they able to compare what is now called Stephens Lake before Hydro and before it became a reservoir in doing their evaluation for Keeyask?

MR. DE WIT: I think it would be fair to say that any of the information that we had,

had the partners made a request for that, we would have shared that with them. Anything they needed, we would have supplied.

MS. WHELAN ENNS: The partners perhaps would have needed to know it was available. So did the partners then know that you had gone to the trouble, in terms of going all the way back to 1962, in terms of satellite data and having stereoscopic oversized photos available, did they know?

MR. ST. LAURENT: Last week Vicky Cole discussed the process of the environmental studies working groups, which set out a process where the environmental specialists worked closely and communicated results, as well as methodologies that would be employed for the environmental studies. So one of the early meetings that we undertook as part of that process was to give a good description of the field studies that we were planning to undertake, as well as to describe the various data sets that were planned to be used for the assessment.

So we described each of the different studies, what it was, why we were doing it, how we are planning on assessing it, as well as what data sets we were planning on using for that assessment. So in the case of James, he certainly described the process of using air photos, which particular air photos, and certainly gave some good examples of how that would be undertaken.

MS. WHELAN ENNS: Thank you.

MR. DE WIT: I would like to add that, for example, in Ms. Cole's presentation last week, and as we note in CAC round one 101, there were things like bilateral environmental study working groups where we discussed field work plans and such. They reviewed drafts of the EIS, which include descriptions of the studies and information used. So, yes, I would say that they would have been familiar that we had this information.

MS. WHELAN ENNS: Thank you.

Is this panel the same group of individuals who are the working group in terms of the physical environment?

MR. ST. LAURENT: Which working group are you referring to? There was a number of them.

MS. WHELAN ENNS: Well, there is references when we get to page 13 -- I have to find it again, sorry. Study teams, the references on page 13 are to study teams.

So are the members of this panel today all part of study teams for the physical environment? And will the members of this panel and that study team continue to work together through the construction period?

THE CHAIRMAN: Why is that relevant?

MS. WHELAN ENNS: Mr. Chair, it is challenging as a participant to be able to relate who has, for instance, worked with the First Nation Partners on different aspects of the EIS, to this point to get to the EIS, and how the construction period in particular will flow in terms of ongoing monitoring, and who will be, for instance, continuing to work with the First Nation Partners.

THE CHAIRMAN: But I'm not sure, you know, and perhaps you have a different view, I'm not sure why it is necessary to know the "who". To me, I think the "what" is what is important, the product that comes out, and the fact that they will continue to monitor. But whether it is these people or an entirely different group, as long as it is done and done properly, I don't think that the "who" matters.

MS. WHELAN ENNS: Fair enough.

Would -- I was going to ask one before this, but let's move to this. Would you explain how study team collaboration will continue during the construction period?

MR. DE WIT: So this would relate more to monitoring you are referring to? Yes. Okay.

Well, when we -- as we collect information and obtain information, we work with our subject matter experts and share information between the groups. For example, if you have erosion or sedimentation information, that's certainly all available to any of the study groups. Any of the data collected is available to everybody. So, yes, there would be ongoing communication between the groups.

MS. WHELAN ENNS: Thank you very much.

This may be a question for Mr. Rempel, and that is, when does a reservoir become a lake?

MR. REMPEL: Does this refer to the label Stephens Lake as a lake instead of a reservoir?

THE CHAIRMAN: Why is this relevant?

MS. WHELAN ENNS: Well, Mr. Chair, it is almost impossible to find in the public domain any information about the fact that Stephens Lake is actually a reservoir.

THE CHAIRMAN: Again, why is that relevant to our study, what they call it, as long as it is doing what it is designed to do? I mean, we can differ and ask questions of whether or not it is being properly monitored, but whether it is called a lake or a reservoir or a pond, I'm not sure is relevant.

MS. WHELAN ENNS: There is a tendency I think, Mr. Chair, to lose track of where the reservoirs are in Manitoba and how they are also all part of the hydro system. But we can pass on the question.

THE CHAIRMAN: Please.

MS. WHELAN ENNS: Okay. On page 12 there is a reference to widely accepted industry standard computer models. May we take that also as a statement or reference to, you know, widely accepted methods in terms of GIS, as in global information systems and mapping techniques?

MR. ST. LAURENT: That slide is referring to the numerical models that are used to develop predictions and run simulations of project effects, not necessarily GIS analysis. Although a lot of the output from these models is processed within a GIS, a GIS is merely a tool for arriving, taking spatial data and arriving at the results. So some of these models are linked with GIS, others are not, but this is really referring to the whole host of different models employed for physical.

MS. WHELAN ENNS: Thank you. Are there, though, then a set of operational standards regarding use of data in a GIS system that Manitoba Hydro fulfills, that you apply to your work when you are using a GIS system?

MR. ST. LAURENT: Manitoba Hydro, as well as the consulting companies that work on this project, employ GI specialists. And those specialists have the credentials required to operate and use these GIS tools. They are indeed specialists. And through that process, protocols have been developed to develop the data, manage the data, as well as to develop the appropriate level of meta data. There are meta data standards that are available and we are employing that on our GIS data throughout the physical environment studies.

MR. DE WIT: And that wouldn't just be

within Manitoba Hydro, those standards are distributed to the consultants working for us as well.

MS. WHELAN ENNS: Thank you. On page 22 -- I just have to check tags while I turn. I want to ask a quick question, if I may, before we leave this section, and I'm looking for a number, I think it is 18, just to confirm that the data numbers and so on regarding project footprint and material quantities on this slide are all within the project footprint? It appears that way.

MR. DE WIT: Yes, the material quantities quoted there are all sourced from in the footprint area. For example, the earth fill rock excavations, those are all -- would be in some part of the darker green areas, although I'm not showing the entire footprint here, so some of those areas are not exactly shown here. So it is all in part of the footprint.

MS. WHELAN ENNS: Thank you. On page 21, and this is, you know, just prior to your getting into your climate change section, was there a sensitivity analysis done with respect to the cofferdams, the dams, and the dykes and the roads for drought conditions?

MR. MALENCHAK: So the design of the cofferdams is as indicated in IR, I think Manitoba Wildlands 48, round one. We discussed a design flow for each of the cofferdam structures, and they are designed to function under that flow and anything under that flow. So under drought conditions, we expect that the dams and the dykes would function perfectly fine.

MS. WHELAN ENNS: Is that a reference to what we heard last week about the one in 10,000 year event calculation?

MR. MALENCHAK: They are both flows, but I'm not totally clear of the length between the drought and one in 10,000.

MS. WHELAN ENNS: Perhaps I need some help then. I believe that was within the context of the safety standards for the generation station itself.

MR. MALENCHAK: That's correct.

MS. WHELAN ENNS: Spillways, turbines, the hardware, if you will?

MR. MALENCHAK: Yes.

MS. WHELAN ENNS: Fine, I will pass then. Turn the page. On 22, you have a reference here to ISO 14040 from 2006. Could you tell us whether any other ISO standards were used in the lifecycle assessment that you commissioned?

MS. KOENIG: No.

MS. WHELAN ENNS: Thank you.

There is a reference here also at the bottom of the slide to decommissioning. Does the Keeyask Generation Station have a decommissioning plan?

MR. ST. LAURENT: I would have to pull up the project description supporting volume, but there is a section on decommissioning. It describes -- it describes project decommissioning. Would you like me to pull that out and read it?

MS. WHELAN ENNS: I agree with you that there is a section that describes decommissioning. Depending on where in the EIS you are looking, there is also some clear statements early on that a full decommissioning plan is not required. So is there a decommissioning plan?

THE CHAIRMAN: I think you just answered your question. I don't think that we need the details of the plan, I think a response to whether or not there is a plan --

MR. ST. LAURENT: It is very short.

What I can read here is that:

"With respect to project decommissioning, a hydroelectric generating station may operate for a century or more. If and when the project is decommissioned at some future certain date, it will be done so according to the legislative requirements and industry standards prevalent at that time."

MR. DE WIT: I will note for the record that that's page 5-1 of the project description.

MS. WHELAN ENNS: Thank you.

So we will have a decommissioning plan when we decommission; correct?

THE CHAIRMAN: Long after we are here.

MS. WHELAN ENNS: Will there be --

THE CHAIRMAN: If it gets built.

MS. WHELAN ENNS: Long after we are finished participating in hearings.

THE CHAIRMAN: Participating in anything.

MS. WHELAN ENNS: Will we have a presentation of the lifecycle assessment from the individuals who did the lifecycle assessment work for Manitoba Hydro?

MR. DE WIT: The lifecycle assessment is reported as part of this presentation, and that's what we've presented.

MS. WHELAN ENNS: We can take that then as a no, that we will not have a presentation in the hearings from the individuals or firm that provided the lifecycle assessment?

MR. DE WIT: That's correct.

MS. WHELAN ENNS: Thank you.

This is just a quick jump back to the beginning of the section, so some questions have to do with several slides, if you will, with the climate section starting at page 19.

MR. DE WIT: Actually, I would like to clarify that. I mean, all of the information that was used for the assessment of the climate change assessment was well provided in the supporting volume and the technical memos that were sent to Manitoba Wildlands and shared with your experts as well, plus at a meeting where we met with them, so...

MS. WHELAN ENNS: Thank you.

Did Manitoba Hydro or your consultants

establish a carbon inventory for the RSA, LSA or project footprint?

MR. ST. LAURENT: Could you clarify the question with respect to a carbon inventory?

MS. WHELAN ENNS: Carbon inventories are basically the identification of the carbon sequestered in all of the elements in a region and/or location where a project is intended. They are becoming -- this kind of an inventory is becoming quite common both in small and large projects with a lot of infrastructure, and some companies and also some countries are beginning to require them.

The second question would then be whether Manitoba Hydro -- if you in fact established a carbon inventory for, for instance, the RSA, whether you then established a carbon budget for this project?

MS. KOENIG: The above ground biomass was calculated.

MS. WHELAN ENNS: Is that information in the EIS, and if so, where?

MS. KOENIG: Yes, one moment we are just going to get the section.

THE CHAIRMAN: Can we come back to

that and move on?

MS. WHELAN ENNS: Certainly, Mr. Chair. We will receive the information later.

THE CHAIRMAN: Yes.

MS. WHELAN ENNS: On page 23 we have over half of the emissions from the Keeyask Generation Project identified as coming from land use change. Does this include the dykes, this 51 per cent?

MR. DE WIT: Land use change would include all of the entire footprint that is shown on the -- I forget the slide number, but on the project footprint in the physiography piece. So that would include dykes and any other structures.

MS. WHELAN ENNS: Does it include the burning after clearing?

MR. DE WIT: The reservoir clearing and the burning of that, yes, it does.

MS. WHELAN ENNS: Thank you.

The 28 per cent here that is identified as building and manufacture includes then all of the residences, all of the external buildings?

MR. ST. LAURENT: It would include all of the principal structures and all of the supporting infrastructures that was described last week in the lifecycle analysis.

MS. WHELAN ENNS: Your 5 per cent for transportation, would you tell me, tell us all whether or not that includes all the transportation materials, all transportation, air and land and water, in and out of site, and for what period of time?

MR. DE WIT: Would you be able to repeat your question, please?

MS. WHELAN ENNS: Sure, certainly. Does that include all transportation by land, air and water, in and out of the site, and for what period of time?

MR. DE WIT: Yes, and for the duration of the construction, and as well there was consideration of it in the operation side, unless it was considered de minimus. It would take a while to check. So, yes, it includes all of the transportation factors for the -- to get the material from its source to the construction.

MS. WHELAN ENNS: The rest of the question I was asking has to do with all of the transportation in and out of the project or the site through the construction period; is that included?

MR. ST. LAURENT: Yes.

MS. WHELAN ENNS: Which greenhouse gases is Manitoba Hydro including in these quantums, in terms of greenhouse gases? Are you including methane?

MS. KOENIG: Carbon dioxide and methane.

MS. WHELAN ENNS: Are you weighting methane in terms of its multiplier and its greater effect than any of the other greenhouse gases?

MS. KOENIG: Yes, of course.

MS. WHELAN ENNS: Thank you.

Did you include -- understanding that this is construction, okay, have you included at any point in your climate change analysis the results of changes in water quality and bacteria and anaerobic changes in the water and the emissions from that?

Mr. Chair, I may have just asked a question that's for the aquatics panel.

THE CHAIRMAN: Okay, then move on.

MS. WHELAN ENNS: Okay.

MR. DE WIT: I think we can probably address that from the lifecycle assessment folks as to what was included regarding their analysis, because they conducted it, not the aquatic folks.

THE CHAIRMAN: Okay. Go ahead, Mr. De Wit.

MR. ST. LAURENT: Yes, that would have been captured in the reservoir emissions component of the lifecycle analysis.

MS. WHELAN ENNS: Thank you.

On page had 24 -- and thank you for the answer to the earlier questions. We are going to assume then that the full range of greenhouse gases included, for instance, in IPCC assessments and scenarios are included in these references to greenhouse gas emissions; is that correct? Page 24?

MR. DE WIT: Sorry, the reference is to greenhouse gas emissions for Keeyask?

MS. WHELAN ENNS: Um-hum?

MS. KOENIG: Could you please clarify the question?

MS. WHELAN ENNS: It goes to the earlier information from the back row that you are including, you know, CO2, methane, the full range of greenhouse gases in your assessments.

MS. KOENIG: Yes, that's correct.

MS. WHELAN ENNS: Is that true then for each of these comparisons?

MS. KOENIG: Yes, it would.

MS. WHELAN ENNS: Thank you.

In assessing and making this comparison in terms of greenhouse gas emissions for different kinds of coal plants, different natural gas plants, nuclear, wind, and then this generation station, was there any inclusion then in the analysis in terms of emissions from the footprint for Keeyask compared to the footprint for wind turbines, nuclear, natural gas or coal?

MR. DE WIT: Bear with me one moment here?

I was going to quote from the supporting document, the physical environment supporting volume, page 2-3, where it indicates that the levelized lifecycle emissions for the project were compared with published lifecycle emissions for other common forms of generation.

So the project was compared to common electricity generating technologies based on the lifecycle GHG emissions produced in delivering one gigawatt hour to the distribution network.

MS. KOENIG: I would just like to add

that ours would have included the footprint, but the other projects would not have.

MS. WHELAN ENNS: Thank you.

So we have some variance because it is a literature review, correct, if I heard correctly from the back row? And this is, the greenhouse gas is, in energy developed production, with more of a footprint showing in your calculations for Keeyask, is that correct? Are we hearing correctly? More emissions from the footprint or more emissions from the RSA or LSA in the Keeyask data?

MR. DE WIT: I would say I think we have already mentioned that the footprint was included for Keeyask, and I believe Kristina said it may not have been for the other ones. And overall the -- well, the footprint may not be the largest component of those projects anyway, those other alternatives.

MS. WHELAN ENNS: Thank you. So the only remaining part of the question then is whether for Keeyask, for this analysis and this data on emissions, you use the project area only leaving out then either the LSA or the RSA? For instance, is the reservoir in this number?

MR. ST. LAURENT: The reservoir is included.

MR. DE WIT: We already said that the entire footprint is included in the analysis, and the reservoir is part of that footprint.

MS. WHELAN ENNS: Thank you.

MR. ST. LAURENT: As well as any activity that would have occurred outside of the footprint, manufacturing of structural components, production of cement at plants well away from the project, that was all included in this lifecycle analysis.

MS. WHELAN ENNS: Thank you.

I just moved to page 28, to air quality and noise. I was somewhat surprised because we did not hear about the workers. So what are the noise quality realities for the up to 2,000 people working on the site?

MR. REMPEL: The workers will be required to wear noise protection equipment and that's governed by workplace regulations. And at the camp, which is about one and a half -- sorry, three kilometres away, we don't anticipate the camp workers will be subjected to disruption during sleep, for example.

MS. WHELAN ENNS: Thank you. There is probably content in the EIS about timing restrictions to reduce effects of noise on animals. This is the bottom of page 28?

MR. ST. LAURENT: That's correct, those restrictions are laid out in the EIS.

MS. WHELAN ENNS: Thank you.

Also approximately page 28, which chemicals will you be using to keep the dust down?

MR. ST. LAURENT: Dust suppression is undertaken using water.

MS. WHELAN ENNS: Water only?

MR. ST. LAURENT: Water only.

MS. WHELAN ENNS: Good. Thank you.

MR. DE WIT: I would like to clarify related to the noise restrictions you referenced. Just for clarification, those aren't listed in the physical section, those are dealt with separately within other sections such as the aquatic, terrestrial assessments on those study areas.

MS. WHELAN ENNS: So the steps to reduce noise effect for certain species are in different locations in the aquatic and terrestrial sections of the EIS, correct?

MR. ST. LAURENT: They are initially

summarized in the projection description supporting volume.

MS. WHELAN ENNS: Thank you.

MR. REMPEL: And also they were answered in an IR called CEC round one, CEC 0042.

MS. WHELAN ENNS: Thank you.

I have had some help and so there is a little bit of moving back and forth here in page numbers and sections of your presentation. I appreciate your patience on that.

Would you give us what your future climate conditions -- your projected climate conditions are, again, RSA wide, in short description for 2020, 2040, 2060, and 20 year periods?

THE CHAIRMAN: What information are you seeking that they haven't provided in this slide at page 65?

MS. WHELAN ENNS: That's temperature, that slide on 65 is temperature, Mr. Chair.

MR. DE WIT: And precipitation.

THE CHAIRMAN: And precipitation.

MS. WHELAN ENNS: Okay. The question is too general, we will pass. Thank you.

THE CHAIRMAN: Maybe we could take

this opportunity to break for lunch. We will come back at 1:30. Thank you.

(Hearing recessed at 12:27 p.m. and reconvened at 1:30 p.m.)

THE CHAIRMAN: Okay. I'd like to reconvene. I'd just like to remind participants who are preparing cross-examinations or conducting cross-examinations, please be a little bit better at self-editing. I think there are a lot of questions that are being asked, and that's not only today but later last week. They got better after admonishment, but still it could use some improvement, or there's still room for improvement. Please self-edit a bit more and don't ask questions that are already on the record or that are clearly not relevant to what is before us.

So having said that, Ms. Whelan Enns, back to you.

And just before I turn it over, we don't want to be here forever, and some of the cross-examinations are taking much longer than we had anticipated or than had been indicated by the participants before we got into this process.

So, Ms. Whelan Enns, back to you.

MS. WHELAN ENNS: Thank you, Mr. Chair.

MR. ST. LAURENT: Perhaps before we get started, I have a response to an earlier question about the carbon stock. It was provided in IR MWL 94, and it indicates that the carbon stock in the reservoir is 20.2 tonnes of dry matter per hectare. And that was also outlined in technical memo 9.5.6, table 1, and that's an equivalent of 11,462 tonnes of CO_2 equivalent.

And I'd also like a clarify a response provided earlier with respect to dust suppression. The question asked, what was planned to be used for dust suppression and the response was water.

Water is planned to be used the vast majority of times, but there could be situations where we may be using other approved products, particularly when temperatures are really high and evaporation rates are quite high and water may not be entirely suitable, so other approved products could potentially be used.

THE CHAIRMAN: Mr. St. Laurent, your first response, that was in an IR, was it?

MR. ST. LAURENT: Correct.

THE CHAIRMAN: I would like to point

out as well, if something was answered in an IR, that is part of the record, it doesn't need to be asked again at this session.

MS. WHELAN ENNS: Thank you, Mr. Chair.

The work on the IRs results in partial answers on occasion. So the information is appreciated. But the question in terms of there being a carbon inventory for the project and then a carbon budget, we haven't quite got to the answers on yet.

Just checking page numbers.

Would Dr. Ehnes let us know whether or not there are climate change ingredients in peat land disintegration and whether climate change can affect pace, quantity, the acidity of peat land and peat products? Thank you.

DR. EHNES: Could you clarify what you mean by peat products?

MS. WHELAN ENNS: I'm sorry, my misstatement. I want to call it plants and that's not very good either. So disintegrating peat is what the question is about. And could you tell us then whether or not climate change is likely to have an effect on the rate of disintegration, how much of the peat drops, as described in the EIS, and anything else that may be affected in terms of peat disintegration?

DR. EHNES: Yes, there is a chapter in the physical environment supporting volume which addresses the sensitivity of the predictions to climate change. And that includes the sensitivity of the peat land disintegration and reservoir predictions. And Mr. DeWit had a slide that was summarizing some of the general conclusions. And the result of that sensitivity analysis was that the conclusions would not be changed. And the primary reason for that is the majority of the peat land disintegration effects, particularly with regard to peat resurfacing, happened very early during the operation phase.

MS. WHELAN ENNS: Thank you. The conclusion, and I think this is 38 -- sorry, did not provide a number. The conclusion overall from the EIS and this presentation appears to be that there will be essentially no net change or loss in peat lands, and that natural ecosystem processes will resume. Is that a correct understanding of the EIS?

DR. EHNES: No. There will be a large

area of peat land loss, I don't recall the amount. In terms of reservoir expansion, it would be six to seven square kilometres. And I may have forgotten the rest of the question, or if there was another question, I am sorry.

MS. WHELAN ENNS: Good, thank you.

This did not land in an IR but was a topic of discussion for our understanding of the EIS. When you refer to peat lands overall in the EIS and in your studies, are we talking about all the different kind of peat lands, as in are we talking about bogs, fens, muskeg, and so on? Do we have specific variations in kinds of peat that we don't know about or are unclear to some of the participants?

DR. EHNES: Yes, we're talking about all kinds of peat land in the Canadian system of wetland classification, there are two types of peat lands, bogs and fens.

MS. WHELAN ENNS: Thank you. On slide 39, do your in-stream work activities include blasting for aggregate?

MR. DeWIT: The in-stream work activities involve the placement of materials in flowing water. Blasting would not be done in the water, it would be done within the cofferdams or outside the river channel.

MS. WHELAN ENNS: And any area blasted would be dewatered beforehand if there is water, correct?

MR. DeWIT: Yes.

MS. WHELAN ENNS: How many monitoring stations have there been in Stephens Lake over time? We're talking about 35 years, I guess? And there seems to be a reference to only two monitoring stations. Is that accurate? And is that the way it's been since it was first a reservoir through to the present?

MR. DeWIT: I would have to -- if you could clarify what you're referring to in terms of monitoring stations? You refer to two --

MS. WHELAN ENNS: I'm on 41.

MR. DeWIT: Well, slide 41 is referring to monitoring stations for the purposes of monitoring in-stream sediment during in-stream work. Other studies, and there's various maps throughout the EIS in physical, aquatic, terrestrial -- probably not terrestrial for Stephens Lake -- that show monitoring locations that had been monitored as part of these studies.

But these ones on page 41 are specifically to the in-stream sediment management plan.

MS. WHELAN ENNS: Thank you.

Was there a slide in your presentation in terms of -- or is this for the aquatics panel -- monitoring stations in both the Stephens Lake and Keeyask Lake?

MR. ST. LAURENT: I think what Mr. DeWit is trying to explain is that there's quite a number of types, different types of monitoring stations. A wide range of stations have been established for physical environment studies, a number of different water quality monitoring stations captured on the aquatic assessment. So there's quite a large number of them. I don't think we have a map that shows every single one of them, if that's what you're looking for.

MS. WHELAN ENNS: Thank you.

In regards to the aquatics panel, we may then ask questions. We have aquatics and terrestrial together, and you, in fact, anticipated the question in terms of being able to ask questions about the whole suite of monitoring activities and monitoring sites. Thank you.

At the early stage of the presentation

on page 11, there's a list of certain technical reports, and an indication that data has been collected since 2001. In going through the list then of the various technical reports that inform this EIS, to use the expression from last week's panel, in some instances it appears the data is already 10 years old. Okay. I'm going to make some general observations, not just specific technical reports, in asking this question.

So has the data collection continued in the areas the technical reports are informing, and will the data collection continue through construction to operation? Another way of saying it, are we going to have significant data gaps before we get to the operation phase in the areas you've been studying technically?

MR. DeWIT: Well, as described at the end of the presentation, there will be ongoing monitoring during the construction and operation phase that will be taking place for physical, and in later panels you'll see for other topics as well.

MS. WHELAN ENNS: So that would include VECs and sub topics?

MR. DeWIT: You would have to discuss

with the specific panels what their monitoring is for any VECs or their sub topics.

MS. WHELAN ENNS: Okay, thank you.

A general question, if I may, that happened at about page 45, but it's noticeable in the language that you were using that you were using the present tense as in "are" for a variety of things that you are describing that are theoretical or do not exist yet. So was there a decision made to use the present tense, as if the generation station is in place?

MR. DeWIT: Sorry?

THE CHAIRMAN: I don't understand why that question is being asked.

MS. WHELAN ENNS: Well, fair enough, Mr. Chair. It's odd because this is a future project and a potential project and we're listening to --

THE CHAIRMAN: I think the information that is presented on the slide as it's written is pretty clear. I don't understand what the tense of the modifying verb has to do with it.

MS. WHELAN ENNS: Thank you.

I'm just checking questions previously asked.

Did this team for this panel participate in the cultural, and I hesitate to say cultural awareness, but the cultural sessions that were described to us last week?

THE CHAIRMAN: And what's the relevance of that?

MS. WHELAN ENNS: The understanding and application of the traditional knowledge and the knowledge transfer in the partnership.

THE CHAIRMAN: Okay.

MR. ST. LAURENT: Not everybody on this panel has attended the cultural awareness training that you are referring to.

MS. WHELAN ENNS: Thank you. The EIS in your presentation indicates that you do not anticipate any effects on the quality of groundwater. Is there a plan or an intention in terms of what you would do if there is an effect on groundwater?

MR. DeWIT: The primary risk to groundwater seem to be the potential for things like accidental spills. As noted in the presentation we mentioned, for example, if you have a small fuel spill affecting an area, then there are certainly spelled out requirements for cleaning those sorts of things up, which would include, for example, remediating any soils that are affected, and which would be subject to testing. You would test the ground to determine that it's all been removed and taken out of the area.

MS. WHELAN ENNS: Thank you. Perhaps we could ask Dr. Ehnes if there's less or greater risk to groundwater on the islands in the reservoir? Do the steps in terms of the lake becoming a reservoir have a specific effect in terms of the groundwater on the islands?

DR. EHNES: Yeah. In the slide here that's shown, we have indicated the areas in which there's the potential for -- there are terrestrial areas potentially affected by groundwater. I'm not quite clear on what you mean if there is greater risk related to groundwater. There's certainly groundwater changes along the shoreline and in islands. I wouldn't classify one as more risk than the other.

MS. WHELAN ENNS: Thank you. The question was because of the information on 54 about islands. Thank you for the answer.

MR. ST. LAURENT: If I might add,

though, what that slide is showing is the aerial extent that would be, we would expect groundwater to be affected by the reservoir. The supporting volume has a number of other maps that shows the magnitude of the groundwater change, so how much groundwater would be predicted to increase, including within those islands.

MS. WHELAN ENNS: Thank you.

MR. ST. LAURENT: So there's a lot more information with respect to effects on groundwater within the supporting volume.

DR. EHNES: And I would add that this is not the area where terrestrial effects will occur. This is the area where there may be effects based on where the groundwater actually becomes elevated. In many of these areas, it's still going to be way too far below the surface to affect soils or vegetation.

MS. WHELAN ENNS: Thank you. With respect to page 58, there was a comment made in the oral presentation that's not on the page, and that is, it was a reference to under typical weather conditions. So are your predictions then, in terms of dissolved oxygen, based on typical weather conditions, and/or did they take climate change into consideration?

MR. DeWIT: We conducted, I mean, here we're only showing a small amount of what we did. In the EIS and the supporting volumes, you'll see there's a lot more different simulations that were done. And included in these are conditions where we got elevated water temperatures that might be more typical of what climate change might do, that we're using temperatures above what we'd consider typical for this area.

MS. WHELAN ENNS: Thank you. Did you also then run those variances or increases in temperature against scenarios, for instance, in 20-year intervals for climate change?

MR. DeWIT: Sorry, I didn't catch the last?

MS. WHELAN ENNS: Did you run then those variances in increased temperature against, or with your climate change scenarios, for instance, in 20-year intervals, 2020, 2060, 2080?

MR. DeWIT: The dissolved oxygen studies looked at modeling periods considering different weather conditions, for example, typical and what we called a critical week with low winds, high temperatures. And they also considered scenarios with elevated water temperatures that might be potential representation of what future climate change would be. And moving into the future, the looking at oxygen demand and that, that some of those decline over time. But we have characterized when the largest effects would occur in the first few years.

MS. WHELAN ENNS: Thank you. On page 60, can we assume then in terms of this short list of future projects in your presentation, that all of the other future projects in the region and that were identified last week are, in fact, included in your analysis? New converter station, variety of roads, future transmission, increased size of town sites?

MR. DeWIT: Well, the Bipole III and transmission projects are on there, and the Gillam redevelopment.

DR. EHNES: There were other projects that were considered, as listed in the presentation last week. This slide is focusing on the key ones.

MR. REMPEL: We're really focusing on those that might interact or overlap with the effects of Keeyask in terms of the physical environment.

MS. WHELAN ENNS: Thank you. On page 62, moving into climate change, there was a reference then in the oral, and it's in the last bullet here on this page, okay, to the current internationally accepted greenhouse gas emission scenarios from the IPCC.

So will Manitoba Hydro be reviewing and updating your results on climate change for the Keeyask Generation Station project based on the IPCC fifth assessment and results?

MR. DeWIT: I'll ask Kristina to address this.

MS. KOENIG: We answered this in an IR, I am just looking it up.

THE CHAIRMAN: Is this a Wildlands IR?

MS. KOENIG: No, it was Peguis First Nations.

Okay, there's multiple ones. So different versions of it were asked through Peguis First Nation 007, Peguis First Nation 0011, Peguis First Nation 0051, Peguis First Nation 0048, and Peguis First Nation 0074.

So we had a couple of IRs that kind of dealt with that issue. I'm just going to pull up one so that we can read kind of what we're talking about in them.

We used the intergovernmental panel on climate change fourth assessment report, Coupled Model Intercomparison Project Phase 3 data in the preparation of the Keeyask EIS. That was the most current climate model data available. The new IPCC assessment report is going to be released in stages throughout 2013 and 2014.

The first version of the report came out in draft form on September 30th, so less than a month ago. The second working group report is coming out in March. The third one is coming out in April of 2014, and the final synthesis report isn't coming out until October 2014.

So at the times when each one of the working groups reports are released, we will be reviewing the documents and the information provided, and then we'll be incorporating them into our ongoing climate change studies that we are conducting inside Manitoba Hydro.

MS. WHELAN ENNS: Thank you. In arriving at your scenarios then for this project and this region, did you arrive at or use scenarios that are the conservative climate change effects scenarios, or did you combine scenarios then from the range of worst case scenario to least impact?

MS. KOENIG: So I tried to explain how we went through the process here. We used the Intergovernmental Panel on Climate Change emission scenarios that were provided by the scientists. They range from low to high carbon emissions, so the B1, A1B and A2 emission scenarios. So these were all the emission scenarios that were available and we used them all in our studies.

MS. WHELAN ENNS: And your results then, are they a 50 percent median or mean, is that where you arrived?

MS. KOENIG: No, the results that are shown in the tables are ensemble average. So as you saw, we had 139 climate scenarios. Each one of those dots shown here on the slide would represent a climate scenario. And your confidence actually increases when you go inside the inner ellipses. So you'll see that there's three bands shown on these scatter plots. So the inner band is a 50th percentile, followed by the 75th percentile, followed by the 95th percentile. So as the models start to collide together in the middle of the scatter plots, that's where we have the most confidence in the results. So it's the average of the ensembles.

MS. WHELAN ENNS: Thank you. On precipitation and temperature?

MS. KOENIG: And temperature, yeah.

MS. WHELAN ENNS: Thank you. The precipitation increase you identify, I think it's on page 75 and referred to elsewhere, is it a combination of rain and snow? Does it have a particular time of the year where the increase is projected to happen?

MS. KOENIG: Precipitation would be rainfall and snowfall, depending on the temperature. That's when you would have rainfall or snowfall.

MS. WHELAN ENNS: Yes. In your analysis, though, did you identify the greater likelihood of rain or snow, and did you identify time of the year that the precipitation was more likely to happen? I'm asking that question in relation to baseload, resource load, and energy production. Did you look at --

MS. KOENIG: We looked at everything on a monthly scale, annual scale and seasonal scale.

MS. WHELAN ENNS: Thank you. I may not be able to pronounce correctly the name of this organization that Manitoba Hydro works with in terms of climate change analysis, Ouranos.

MS. KOENIG: Correct.

MS. WHELAN ENNS: Manitoba Hydro is an affiliate?

MS. KOENIG: That's correct, affiliate member.

MS. WHELAN ENNS: And the membership is made up of?

MS. KOENIG: Other hydropower utilities, federal organizations, provincial organizations, lots of universities across Canada, and Environment Canada is the major funder.

MS. WHELAN ENNS: Are you likely to be working then through this consortium and with the affiliates in terms of the IPCC fifth assessment, in the updating of your climate analysis as you were describing?

MS. KOENIG: So are you asking if we're working with them on the IPCC report, or are they providing us information?

MS. WHELAN ENNS: I asked you if

Manitoba Hydro is likely to be working with the affiliates in this consortium in terms of what you described for the IPCC?

MS. KOENIG: Yes, it's ongoing. We are constantly interacting with them.

MS. WHELAN ENNS: So that would also apply then to what you were describing in terms of the IPCC fifth assessment?

MS. KOENIG: We will be getting the data, like working with them and reviewing the reports, correct, yes.

MS. WHELAN ENNS: Thank you. On slide 67, it is a challenge to understand when climate change, in the stages of analysis you have done on a range of things to do with the physical environment, when climate change is taken into consideration. So by that I mean, is climate change a late ingredient in your analysis or is it there at the early stages of analysis in terms of different components in the physical environment? This is a challenge in the EIS also.

MR. REMPEL: If I understand your question correctly, you're asking whether we considered climate change sensitivity later in the game as opposed to earlier?

MS. WHELAN ENNS: Um-hum.

MR. REMPEL: The approach we used was to look at the effect of the environment on the project, and that was done early. And Marc St. Laurent has talked about and will have talked about that. Then we looked at the effect of project on climate, which is the greenhouse gas emissions scenario. And then having done our initial assessment on the effects of Keeyask on the physical environment, we then cross-checked the sensitivity of those conclusions to climate change. So it was done later in the game.

MS. WHELAN ENNS: Thank you. Passing on questions that are related. Thank you, Mr. Rempel.

We have information on temperature and on precipitation. Did you adjust, update or learn changes in your approach in terms of climate change effects from the analysis in the Bipole III EIS?

MS. KOENIG: The approach would be the same, no matter what the project.

MS. WHELAN ENNS: Thank you. Asking then the same question in terms of eight years ago, nine years ago, and whether there's been any change in the approach by Manitoba Hydro in assessing climate impacts on a generation station, and how it was done in the Wuskwatim EIS to this EIS for Keeyask?

MR. REMPEL: I can respond to advise you that when we did the Wuskwatim assessment, we did not have access to the guidance from the CEA that came out during the hearings actually. It's called incorporating climate change considerations in environmental assessment, general guidance for practitioners. It was prepared in November '03 by the Federal/Provincial territorial committee on climate change and environmental assessment and adopted by CEA. So we had this to inform us in terms of the Keeyask Generating Station, which we did not have in conducting the Wuskwatim EIS.

MS. WHELAN ENNS: Thank you.

MS. KOENIG: And I would like to add that since Wuskwatim EIS, Manitoba Hydro has formed the Hydro climatic study section group which I am involved with. And our prime mandate is to understand the impacts of climate change on hydropower, and particularly the water resources. So we have moved quite leaps and bounds since Wuskwatim.

MS. WHELAN ENNS: Thank you. In your cumulative assessment steps, have you done any analysis in terms of your production of greenhouse gas emissions from future projects in the region?

MS. KOENIG: Could you please repeat the question?

MS. WHELAN ENNS: In your cumulative assessment work, did you include your projection of greenhouse gas emissions from future projects in the region? This would ideally include the additional zones.

MS. KOENIG: So are you referring to the climate scenarios that were produced in the section of the EIS?

MS. WHELAN ENNS: No, it's -- well, I'm going to ask the Chair about that. But this is a cumulative assessment question, so is this the right panel?

THE CHAIRMAN: Well, I'm not sure that it's even a legitimate question, quite frankly.

MS. WHELAN ENNS: We can pass then, Mr. Chair.

THE CHAIRMAN: Okay.

MS. WHELAN ENNS: Getting close to final questions, Mr. Chair.

There is on page 69 a fair bit of information in terms of your physical environmental monitoring plan. And again, thank you for the earlier information about all the range of monitoring sites. It's a similar question then, and it's about the Wuskwatim Generation Station. And that is, have you been informed or made adjustments or updates in terms of the environmental monitoring plan for Keeyask based on the Wuskwatim experience, noting that Wuskwatim has only gone into operation?

MR. DeWIT: Marc and I have both personally been involved with the Wuskwatim physical monitoring, and others involved in the team have experience monitoring elsewhere even beyond that. So I think it would be fair to say that we draw on our experience from that to look at the preparation of the plan for Keeyask.

MS. WHELAN ENNS: Are there any specific lessons or changes made?

THE CHAIRMAN: How is that relevant?

MS. WHELAN ENNS: The questions of this sort have to do with the questions also about the moving from the operation to the construction to the operation phase of this project, and how much time passes overall. And whether we're, in the meantime, whether our utility in the meantime is in fact bringing forward from the time they write an EIS, into construction, into operation, lessons learned from other recent projects. We can pass, Mr. Chair.

THE CHAIRMAN: I think it's obvious, though. It should be an obvious response, so please move on.

MS. WHELAN ENNS: Okay.

Is it your conclusion that there are no emissions produced from daily generation of energy from this intended generation station?

MR. DeWIT: You're referring to air emissions?

MS. WHELAN ENNS: Greenhouse gas.

THE CHAIRMAN: I think they have already described that, haven't you, a number of times?

MR. DeWIT: Yeah. The operation phase is included as noted in the pie chart on one of the earlier slides.

MS. WHELAN ENNS: Okay. I'm going to stop, Mr. Chair, and thank you very much.

THE CHAIRMAN: Thank you.

Peguis First Nation, Ms. Land?

MS. LAND: Thank you, Commissioners. Thank you panel members for your evidence this morning. I'm just going to walk you through a few questions. I don't have that many questions. The first set of questions that I'm wanting to pursue have to do with the issue of hydraulic impacts. And I'm going to take you to a slide, but I was noting that in the volume on physical, the physical environment assessment, at page 4-21, and I'll take to you that. But panel members, I don't think you need to go through this. I'll read it into the record.

So this was the explanation of the Nelson River flows and the hydraulic impacts anticipated. So I'm quoting from page 4-21 of the physical environment volume.

"In the unregulated state, the highest lower Nelson River flows typically occurred in mid summer and reduced to the lowest flows in mid winter. With LWR and CRD, the lower Nelson River flows are still typically highest in mid summer, lower in late summer, and then rising in winter due to increased power demand, but the post project flows during the winter and open water periods are much closer together. Historical water levels on Split Lake were higher in summer than winter, whereas post CRD and LWR, the water levels are an average of about .6 metres higher than summer."

So I'm just trying to make sure that I understand this evidence correctly. So, in other words, the water levels historically were highest in summer, but now they are also higher in winter than they were historically as a result of the ongoing effects of LWR and CRD; is that correct, on Split Lake specifically?

MR. MALENCHAK: So there's actually two separate things within the passage that you describe there. The first being that whether in the regulated or unregulated state, when there's a flood, those are the highest water levels, there's a flood. And that typically will still always occur in the early to mid summer at this location in the river. But one of the purposes of the CRD and Lake Winnipeg Regulation projects was to supplement flow in the winter. So that's why under more normal flow conditions, you could see an elevated winter flow compared to the summer.

MS. LAND: Okay. And that change is due to the water management regime as a result of CRD and the construction of the early projects to manage water levels to ensure that those flow rates are high enough to maximize energy production at peak demand times. Is that correct?

MR. MALENCHAK: Yeah. That was touched on in the PD panel, but that's correct.

MS. LAND: Okay. So this project then is linked to, this particular generation project then is linked to the water management decisions that are made upstream about when to store and when to release water to meet that peak demand. Is that correct?

MR. MALENCHAK: The Keeyask project will be operated within Manitoba Hydro's integrated system, that's correct.

MS. LAND: And then in today's evidence, you testified, you provided information -- I'm going to go to slide 32, and this is the slide on the water regime and operation period. And in your evidence, you said that the open water levels upstream beyond Split

Lake are not expected to be affected by the project. Is that correct?

MR. MALENCHAK: That's correct.

MS. LAND: Okay. So then on that basis, you assessed hydraulic zone of influence of 41 kilometres upstream from the project site, of the dam site; is that correct?

MR. MALENCHAK: That is the open water hydraulic zone of influence.

MS. LAND: Okay. Did you assess any direct and indirect upstream hydraulic effects beyond that 41 kilometre area upstream?

MR. REMPEL: I'd like to clarify your question. Is your question related to, or is your question, will the addition of Keeyask affect water levels further upstream, such as Lake Winnipeg and Cross Lake, et cetera?

MS. LAND: Yes, actually my question goes more to whether you assessed whether it would.

MR. REMPEL: We had looked at the question of whether the addition of Keeyask would affect system operations and would have what we call a system effect on upstream water bodies. And in our review, we concluded that the dominating factor in terms of how Hydro operates its system is the amount of info coming into Lake Winnipeg. And that's by far the biggest factor.

Other factors are things like changes in demand, cold, long winter, for example, and also changes in the supply of energy, which could involve the addition of Keeyask, for example. We also determined that those changes are very small in the context of the variation that occurs on those lakes. Lake Winnipeg and those other bodies of water are affected by the amount of inflow, which can vary greatly.

In 2003, for example, there was -- the flows were about 40 percent below average, and in 2005, they were 70 percent or so higher than average. And so those water bodies vary in quite a large range. Cross Lake, I think the variation is something like 10 feet from the low to high. For Split Lake it's 12 feet. So in the context of those variations, we don't think that you could find or detect changes brought about by the addition of Keeyask.

We also did point out in various IRs, NCN TAC project round 1, NCN 001, and also in CEC round 1 PFN 032. And we responded that water levels downstream of Lake Winnipeg would follow the same general pattern as presently exists, since the main factor is the amount of inflow coming into the system. And the differences in the water levels in the water bodies downstream of Lake Winnipeg associated with the addition of Keeyask are not expected to be discernible or detectable in the context or those variations that occur because of the response to inflow.

MS. LAND: Okay. So I'm going to track this through. So what you're saying is that you did look at what the water flows would be, based on the historic information and the existing regime, existing LWR regime and CRD influences and so on. You considered that when you were looking at what was going to happen at the project site. And you are also saying that this, the project is going to be linked to the flow regulation for the purpose of maximizing energy production at demand time.

So I guess my question is, would you be looking then at the hydraulic effects of those decisions about water regulation at LWR, on how the project is operated, and what the upstream effects of that are when decisions are made about how to vary the water levels and flows on Lake Winnipeg?

MR. REMPEL: I thought I addressed that but I'll try again. With respect to Lake Winnipeg, the regulation of Lake Winnipeg takes place in the context of the overall system, which is primarily driven by the demand for power and also the supply of energy, which is fundamentally related to the amount of inflow. So we examined that. But in terms of how Keeyask will be operated, I think Mr. St. Laurent indicated it will be operated either on a peak or baseload operation within that one metre. And the hydraulic effect of that operation is really confined to the hydraulic zone of influence that is shown on that slide.

MS. LAND: So then you would say, though, that that is an ongoing, that there is an ongoing effect of that management decision in terms of the regulation of water on Lake Winnipeg. So you described it as the management of that water to keep it within that one metre variance. And so that is an existing situation, that is how the water flow is managed now. So that's an existing and ongoing impact. Would you agree with me?

MR. ST. LAURENT: The one metre operating range that George is referring to is the operating range of the reservoir at Keeyask, which is not in place yet, so he's describing how an operating, once Keeyask is in place in the Gull Rapids to Clark Lake area. The slide above shows the extent, spatial extent of that reservoir, and it raises water level in the vicinity of the project up to about the outlet of Clark Lake. So those variations are limited to that.

MS. LAND: That is my error. I understand what you're saying. I guess my root question wasn't so much about the amount of the variance being one metre, but just saying that the existing water management system that controls those flows is an existing and ongoing impact as a result of the construction of those past projects, and that is tied and does affect how this project will be operated?

MR. ST. LAURENT: Those effects that George is referring to, you know, they have occurred in the past as those projects were coming online, and they have occurred in the past and they will certainly continue to occur into the future based on all the factors that George was explaining. And that will happen with or without the construction of the Keeyask project.

MR. REMPEL: And there will be no changes to the Lake Winnipeg Regulation or CRD in terms of their licence conditions and their operation.

MS. LAND: So then if I take you to some of the monitoring evidence that you gave in terms of the scope of the monitoring to test that assumption, that there wouldn't be any impact, you mentioned in the monitoring evidence, I think it was slide 69, you looked at the purposes of the monitoring. And this was the monitoring for surface water and ice specifically that I was interested in. And so I was wondering then, what is the geographic scope of that monitoring that you will be doing, and whether that extends upstream beyond the 41 kilometre area into Split Lake, beyond Split Lake upstream?

MR. DeWIT: The extent of the surface water and ice monitoring program described in the physical environment monitoring plan is from Clark Lake downstream to Stephens Lake, and their existing site monitoring levels on Split and

Stephens that can provide information to the program as well.

MS. LAND: Will there be any monitoring sites for surface water and ice impacts upstream in the LWR area?

MR. DeWIT: Well, there is existing monitoring at stations upstream. They have their own monitoring sites for water levels.

MS. LAND: And are they specifically, are you specifically monitoring to see whether there are any direct or indirect impacts once this project comes on line in terms of variances that occur on those monitoring sites in the LWR area?

MR. REMPEL: The present system, the monitoring on Lake Winnipeg will continue. And as we say, we don't think that that monitoring will show any detectable differences when Keeyask is added to the system. But the monitoring will be in place and continue.

MS. LAND: And does the plan specifically anticipate for monitoring, does it specifically anticipate looking at whether there is any amplified effects on water flows in levels and flooding in the LWR area as a result of the addition of an additional generation into the system?

MR. REMPEL: Well, certainly the results of the monitoring will be available and will be examined. But, as I say, we don't think that there is going to be any detectable effect, but certainly that information is available and is reviewed on an ongoing basis.

MS. LAND: I'm going to move on then to just ask you one other set of questions that has to do with, it just picks up on a question that was being asked to you by Wildlands. It has to do with some of the information about mapping data.

So Ms. Whelan Enns referred to slide 12 when she was asking you about the industry standard computer models that were referred to. And she was asking you about whether those included modeling for mapping, and she was asking about GIS. And you refer to the specialists who develop and employ data to produce these computer based models. And my question for you is, would that data that your specialists are developing include high resolution topography data in order to build the GIS maps that you are using to scope the changes to shorelines, to show the scope of changes to shorelines in inundated areas?

MR. ST. LAURENT: So the physical environment volume in the EIS does lay out all the different data sets that were used to carry out the numerical model studies. And first developed was a high resolution digital elevation model, and that is actually the basis of a lot of the physical modeling that was undertaken for Keeyask, it really starts with that data set. And it is shown in the supporting volume, we don't have it in the presentation, but there's a clear map showing that particular data set.

MS. LAND: Did you allow participants to access the high resolution topography data in shape files that you had developed?

MR. ST. LAURENT: No, that particular data set wasn't posted.

MS. LAND: When my client, Peguis First Nation, specifically asked for the high resolution topography data, was it shared?

MR. ST. LAURENT: As I said, that data set was not provided to any of the intervenors.

MS. LAND: Thank you. Those are all my questions.

THE CHAIRMAN: Thank you, Ms. Land.

I don't believe there's anybody here from the Manitoba Metis Federation. Consumers Association?

MR. WILLIAMS: Members of the panel, our questions are linked to the aquatic and terrestrial evidence, so rather than split our questions, we'll just pose them at the appropriate time. Thank you.

THE CHAIRMAN: Thank you, Mr. William.

Fox Lake Citizens?

MS. PAWLOWSKA: Is it possible that I have somebody come up with me?

THE CHAIRMAN: Of course.

MS. PAWLOWSKA: Good afternoon. I have Dr. Stephane McLachlan who is here with me and he will conduct some of the questioning along with me, more of the technical stuff than perhaps I may have. I will go first and then I will allow Dr. McLachlan to ask his questions.

So the first question I have, would the bottom of the river be impacted, so the river bed?

MR. DeWIT: I believe we have also mentioned in the presentation as well is there will be sedimentation taking place within the reservoir.

MS. PAWLOWSKA: Would the river get deeper? Would there be any specific incisions in the river?

MR. ST. LAURENT: If you go back to the water surface profile -- perhaps somebody can bring that up -- it does show how the water levels will change once the project is constructed. The water level at Gull Rapids will certainly become a lot deeper than it is right now. The rapids essentially will be inundated. And at the powerhouse and the spillway, you're asking if there's any excavations perhaps? Certainly there is excavations upstream of the powerhouse and the spillway to develop channels to allow the water to better flow through those two structures. So the bottom graph here shows how the water levels will get deeper as you move further upstream to the outlet of Clark Lake, and then beyond that point the water level won't change.

MS. PAWLOWSKA: Okay. Thank you. So I will try to go in order of your presentation. So on page 11, the pictures of the individuals, are they pictures of First Nation members?

THE CHAIRMAN: That's not relevant.

MS. PAWLOWSKA: Okay. Is it relevant to ask if there are elders?

THE CHAIRMAN: That's not relevant.

MS. PAWLOWSKA: Okay.

So on page 12, how far in kilometres does the integrated erosion of the shoreline that you mentioned go up the river, upstream of the river?

MR. DeWIT: One moment, I have got to find the slide.

THE CHAIRMAN: I think that was answered.

MR. DeWIT: This slide here shows the flooded area and there will be some amount of erosion that occurs within the hydraulic zone of influence. The bulk of it really occurs within the Gull lake area, and less in the riverine areas upstream. So actually here -- sorry, this doesn't show the entire area, but maps in the EIS do. Most of it occurs around Gull lake. Further upstream the river channels, the water level increases are less and the erosion isn't quite as large. And certainly above Birthday Rapids, it's limited, as noted in the presentation.

MS. PAWLOWSKA: So up to and above

Birthday Rapids, correct?

MR. DeWIT: Likely up to about Birthday Rapids, most of it.

MS. PAWLOWSKA: Thank you. And on page 12, what is the difference between interaction and collaboration that you discussed, because you have collaborations with the others, and interactions with First Nations?

THE CHAIRMAN: Are you sure you have the right page?

MR. DeWIT: That would be page 13.

MS. PAWLOWSKA: Sorry, page 13, I apologize.

THE CHAIRMAN: Isn't that a matter of semantics?

MS. PAWLOWSKA: That's one of the things we'd like to have.

MR. DeWIT: No, I think -- yeah, it's -- we all worked together with, certainly among the team we worked quite closely because we were working with each other's information, but certainly also working with the Partner First Nation people to discuss results, and if they needed any information from us or whatever.

MS. PAWLOWSKA: Okay. Thank you. And

on page, well, both pages 71 and 23, is the greenhouse gas emissions of the reservoir included as part of the chart?

MR. ST. LAURENT: Yes.

MS. PAWLOWSKA: Okay. Thank you.

MR. DeWIT: And it shows right on there it includes the reservoir.

MS. PAWLOWSKA: Okay, thank you. And on page 24, you jumped to greenhouse gas emissions over its life. So what lifetime are we talking about? Is it the lifetime of the project or the lifetime of the construction of the project or --

MR. DeWIT: It's over the life of the project. So as the previous chart showed, it had emissions during construction, operation and decommissioning. So that would be from construction through to the end of life.

MS. PAWLOWSKA: Through to decommissioning.

MR. ST. LAURENT: And for this assessment, that life was assumed to be a hundred years, for Keeyask.

MS. PAWLOWSKA: Thank you. So on page 27, you do mention that there was no noise and continuous noise emissions. Did you also take into account the noise generated by the AC currents from the power lines?

MR. REMPEL: There is audible noise associated with transmission lines, and there are regulations that govern the extent of which that noise can be at the edge of the right-of-way. So we did not consider it in terms of a noise emission for this purpose.

MR. DeWIT: And I'd also point out that the power lines from this station are part of the Keeyask transmission project and not part of the Keeyask generation project.

MS. PAWLOWSKA: Okay. Thank you. The next question I had would be about noise as well. Would blasting be felt in Gillam?

MR. REMPEL: No, we would not expect that Gillam residents would be able to detect blasting.

MS. PAWLOWSKA: Thank you. So would it be correct for me to say that Birthday Rapids would not disappear as per the image that you showed on page 32 and 33?

MR. MALENCHAK: So based on the open water hydraulic zone influence, you can see that it goes past Birthday Rapids. So there will be some water level effects at Birthday Rapids, and they will not exist exactly as they do today, but they will be very swift moving water with a little bit less head drop than exists now. And this is discussed in a fair bit more detail in the physical environment supporting volume.

MS. PAWLOWSKA: Okay, thank you. So will the loss of all the rapids from Clark Lake to Gull Lake be so significant that no other projects can be built on that stretch of the river?

MR. ST. LAURENT: So I think you'd have to go back to the project description presentation where we illustrated the different concepts for developing this reach of river. And one of those concepts was the development of two generation stations, a smaller station at Gull Rapids and another one at Birthday Rapids. And the preferred concept was the development of a single site at Keeyask.

The way that Keeyask is being constructed it wouldn't, it would not prevent another station from being developed there if found to be required. However, there's not a lot of head left. And it would be a question of the economics of the project, and given that there's really not a lot of head left at that site. So, technically, a site could still be developed. But there's a lot of decisions that have to be made to answer that question about whether or not something like that would actually proceed.

MS. PAWLOWSKA: Okay, thank you. So on page 37, you do have a picture of the shore and the shape of the shore. And the question I have, is the future profile of the eroding zone, what future are we looking at? What is the approximate date that would be? Within five, 10, 50 years?

DR. EHNES: That would depend on the location within the reservoir. The upstream reaches are largely bedrock controlled. And in those areas, there would be little change in the Gull lake area, which is where most of the flooding occurs. It would be initially mostly peat shorelines, flatter areas with different kinds of peat lands breaking down over time. And in this -- not in this slide but in the next slide, there is -- could we turn to the next slide -- there is an illustration of how the peat land disintegration process eventually gets to mineral soil. And in the Gull lake area, there are some large back-bay areas which are fairly flat and gently sloped areas. So in those areas, there will typically be low banks. And then when we get downstream, there are some high banks, five, six, seven metres high. And then that area in the current environment, there are ice jams in most years which creates water backup effects and has consequences for the mineral banks and those areas. And those ice jams are not expected to occur once the project is built. So those banks will remain pretty much as we find them today.

And I'm just going to confirm that with my colleague. Yes, that's confirmed, thank you.

MS. PAWLOWSKA: Thank you. In your question of the sediment deposit for the less than five milligrams per litre, did you also include alien erosion?

MR. ST. LAURENT: Can you explain what alien erosion is?

MS. PAWLOWSKA: Alien, it's when the wind blown erosion, when the water levels decrease and you have the dry exposed area of the minerals that would blow in the water?

MR. DeWIT: Well, if you're referring to the erosion during the construction phase?

MS. PAWLOWSKA: And after construction?

MR. DeWIT: No, I wouldn't anticipate that there would be large areas that would be dried out that would be subject to that type of erosion, or that it would contribute substantially to any sediment.

DR. EHNES: In addition to that, many of these banks or shorelines are peat covered which would be protecting the mineral soil.

MS. PAWLOWSKA: Okay. Thank you. And the next question I had is about the management plans. And I hope that this could be part of this panel but if not, we could ask this at another panel, about the Sediment Management Plan for the reservoir. Was that a Two-track approach as well?

MR. DeWIT: So the Sediment Management Plan for instream construction was shared with.

MS. PAWLOWSKA: Partner First Nations at working group meetings and discussed what those plans would entail. And certainly they also had reviewed that document and provided input to us on that.

MS. PAWLOWSKA: So how are the concerns of the First Nations in regards to the physical environment and the physical effects in terms of sedimentation addressed?

THE CHAIRMAN: I am just not sure that we could even expect them to have an answer to that question. We're asking them to assume some concerns expressed by First Nations that they may not be aware of but they have said that they work with their partners in setting this up. So perhaps you could help me?

MS. PAWLOWSKA: I suppose we are wondering if this was a Two-track approach and there was a collaboration, we would like to know how concerns of the First Nations, that may have perhaps been contradictory to the scientific views, been addressed.

THE CHAIRMAN: Okay.

MR. REMPEL: We had a question on that ATK and the physical environment in CEC round 1. It's CAC 0101. And we responded to the matter in which ATK observations were discovered and how we responded to that in a series of steps in terms of interaction with the First Nations.

MS. PAWLOWSKA: Okay, thank you. Next question I had is on sediments and mobile peat. On page 44, you mentioned that sediments and mobile peat will be discharged downstream if the spillway is open. Does that mean that there will be additional sediments and peat in Stephens Lake as well?

MR. DeWIT: Overall, there is, as noted on the slide, there is reduced sediment load discharge downstream. There is a potential for some floating peat in the first year to potentially move downstream. But there will be also the waterways management plan in place to manage this floating material. And a debris boom or safety boom will be installed upstream of the spillway during operation that would retain debris that comes down towards the spillway.

MR. ST. LAURENT: And just to clarify, the boom that Wil is referring to that was described in the project description presentation as a safety boom. And that is the primary purpose of that boom right upstream of the spillway. But it will also be designed and will function as a debris boom and it does span right across the intake of that spillway. So should there be larger peat islands or peat mats, it is a structure or a boom that would impede the movement of those larger islands through the spillway.

MR. DeWIT: And the other thing, I mean there's only so much we can mention in the presentation, is that the spillway, the operation, it's estimated that it would operate in the area of about 12 percent of the time, 10 to 12 percent of the time. So essentially one year out of 10, slightly more frequent. So there would be a lot of time where it is not actually in operation.

MS. PAWLOWSKA: Okay, thank you. And I'm not sure if this is a question for this panel or for the management plans. But for how long will debris be collected from the river after construction?

MR. ST. LAURENT: The Waterways Management Program will be in place through the entire length of the operation phase of the project. The amount of debris that is expected to enter the waterway is expected to be less and less through time, but will continue to have a program in place where boat patrols will be monitoring the area.

MS. PAWLOWSKA: Thank you. On page 50, you mentioned safe use and enjoyment of the waterway. Does this include winter usage?

MR. ST. LAURENT: That's correct.

MS. PAWLOWSKA: Okay. Thank you. And on page 34, you do mention a stable ice cover, that is actually more stable ice cover. Is this at high or low reservoir levels?

MR. MALENCHAK: That would be under all operating reservoir levels.

MS. PAWLOWSKA: Okay, thank you. Am I correct to suggest that when ice cover is formed and water levels go down, there would be an empty space underneath the ice between the water and the ice or am I incorrect?

MR. MALENCHAK: There would be no space between the ice and the water level even when it drops toward the minimum operating level. The ice cover will flex due to its weight and continue to float on the reservoir surface.

MS. PAWLOWSKA: So is it safe to use a skidoo in the winter on the ice?

MR. DeWIT: The Waterways Management Program includes, looking at the table on slide 50, it includes the marking of safe travel routes for navigation and ice trails. So there will be ice trails marked out on the reservoir for that purpose.

MS. PAWLOWSKA: Okay, thank you. And

another question I have would be, would adjoining rivers to the reservoir swell because of the water volume in the reservoir?

MR. MALENCHAK: So in the physical environment supporting volume, the water regime section, we discussed the back water effect on some of the small creeks entering Gull Lake and other areas within the hydraulic zone of influence. The water level at the inlet of those creeks into the reservoir would rise along with the reservoir surface. But the back water extent would be limited to a few hundred metres upstream those creeks.

MR. ST. LAURENT: The figure that is shown on the slide right here, it shows the extent of the flooded area which is mainly around Gull Lake. So it's not entirely clear on this slide here but those creeks that would flow into Gull Lake, larger portions of the creek mouths would be inundated and larger sections would be affected by the reservoir. And as you move further upstream, there are still more creeks flowing into the Nelson River. And you can see that the amount of flooded area is less and less. Those creeks would have less back water or less flooded area, less impact from the reservoir.

MR. DeWIT: And I just point out that the creeks are discussed in this physical volume, page 485.

MS. PAWLOWSKA: Thank you. The final question I have is have you taken into account glacial isostatic adjustments for this project?

MR. ST. LAURENT: The answer is yes, we have certainly considered the effect of isostatic rebound with the project. And based on measurements, the current rate of rebound is between 2.5 and 5 millimeters per year. And based on the size of the project and really the weight of the project, we don't expect that the project won't -- it's not expected to affect isostatic rebound. And actually the isostatic rebound itself is not expected to affect the project.

MS. PAWLOWSKA: Did you also take into account Limestone, Kettle, Long Spruce and potentially Conawapa when you looked at the data?

MR. ST. LAURENT: We considered the area where Keeyask is located and where the new reservoir would be located.

MS. PAWLOWSKA: Is that a no then?

MR. ST. LAURENT: There is no reason

to consider the other generating stations further downstream. It's a very very slow process and the density of the earth's crust won't result in any sort of effect from a project this small. Again this is also described in detail in the physical environment supporting volume.

MS. PAWLOWSKA: Okay, thank you. I will hand over the mic to my colleague here.

THE CHAIRMAN: Could you please introduce yourself for the record?

MR. McLACHLAN: Yep. I'm Dr. Stephane McLachlan. I work in the Department of Environment and Geography at the University of Manitoba. And I'll be partaking in the hearings for the next few weeks.

THE CHAIRMAN: Go ahead.

MR. McLACHLAN: So thank you, panel members, for all your presentations. I appreciate that I'm new to this. I hope I don't make too many mistakes. And I also appreciate it's getting late in the afternoon.

I guess what I'll do is what everyone else is doing and just go through in order. Agnes has asked a number of my questions so I'll obviously avoid those.

But if we go to slide 9. So here you talk about your different sources of data. And I just wanted to confirm what the proxy area is that you make most use of in terms of the physical studies?

DR. EHNES: Stephens Lake, which is the Kettle reservoir, is the proxy area that was used the most in the physical environment studies.

MR. McLACHLAN: Right. And I've heard mention of others like Wapusk and the Lower Churchill Diversion. And so are there others that you make use of in terms of anticipating physical changes?

DR. EHNES: Yes. And some of those included the Long Spruce reservoir, which is the next one downstream from Kettle. We also looked at the Kelsey reservoir which is the next one upstream of the proposed Keeyask project. We looked at the reservoir created by the Notigi control structure which is on the Burntwood River just south of South Indian Lake. And we also looked at Wuskwatim Lake which doesn't have a control structure but it was highly affected by diverting the flows from the Churchill River into the Burntwood River.

MR. McLACHLAN: Okay, great. Thank you. And then you talk about local knowledge and ATK. How do you distinguish those things?

MR. REMPEL: In terms of the information we received, and again it's responded to in that CAC 0042, we didn't attempt to make any direct distinction. What information we got from local people or from ATK was considered in our assessment, but we didn't try to partition them.

MR. McLACHLAN: Right. I guess what I'm wondering is did you also interview long-term employees of Hydro, or scientists retired or still functioning or otherwise, as sources of local knowledge that might have been incorporated into your predictions?

MR. DeWIT: In terms of past data, we looked certainly at past reports and such. And there is other people involved in the projects who have been with Hydro for a time who are familiar with some of the past works that have gone on.

MR. McLACHLAN: But no formal documentation of their own experiences in the past?

DR. EHNES: I might give one example while my colleagues are conferring. In terms of peat resurfacing in Stephens Lake, I had some communications, informal communications with a Hydro employee as to what his, you know, observations were in terms of how much was actually floating up and coming up against the dam. That would be an example.

MR. DeWIT: I wouldn't say there was a formal, necessarily formal process. There are certainly interactions with many of our colleagues who had been in Hydro, some of them for a great many years, in our own departments and other departments involved in the project.

MR. McLACHLAN: Perfect, thank you. I guess on page 12, obviously you have made extensive use of computer-based models and some severe mapping. I guess what I'm wondering, and I apologize if this is in the supplementary information, but what I'm missing from these models is any real sense of standard areas of variance or variability. Did you run multiple models, kind of looking for impacts? And if you had modeling exercises that gave you different results which you had anticipated? As you're managing your different parameters, did you incorporate those formally into your outcomes?

MR. DeWIT: If you read the supporting volume, you'll see in many instances where it talks about sensitivity analyses. I myself being involved in one study on temperature and dissolved oxygen, we ran many different scenarios of input conditions to push the system and see what happens.

MR. McLACHLAN: And if you had differing outcomes, how did you decide which outcome to present, say today?

MR. REMPEL: While my colleague is conferring, I'd just like to correct the IR that I referred to. I referred to 0042, it's actually CEC Round 1 CAC 0101.

MR. McLACHLAN: Okay.

DR. EHNES: In general, the EIS talks about what is expected to happen when we look at or model or predict what is expected to happen. It's not one single point. There's usually a range that is identified through sensitivity analysis or other approaches such as qualitative information available from others. So in terms of that range of most likely what is used in the EIS is a precautionary approach. So whatever the range is, we took the larger effects from that range. So in most cases, you are going to hear in some of the forthcoming presentations we talk about, these are expected to be overestimates of what the effects will be.

MR. DeWIT: I think one good example will be, for example, on the mineral erosion side. It was run, for example, assuming hundred percent baseloaded operation which wouldn't happen. So out into the future, keeping it at full supply all the time. And it also used a scenario where it's running at peaking modes, so where the water level can vary on a day-to-day, week-to-week basis and assumed it operated like that 100 per cent of the time, one produces a higher estimate of erosion, one produces a low estimate of erosion. And the actual operation will be somewhere between those two.

And as noted in the Water Regime and Ice section, the plan would be anticipated to operate roughly 88 percent of the time in a peaking mode potentially, and the other 12 percent of the time in a baseloaded mode. So we feel we captured the range of potential effects and the actual operation is within that range.

MR. McLACHLAN: And so, for example,

if you're looking at dissolved oxygen or sedimentation or changes in water flow, then we could just assume that if you depict data, that you had chosen and reflected the maximum impacts that you found?

MR. ST. LAURENT: Maybe while my colleagues are conferring, I'll just maybe clarify what Mr. De Wit was explaining with respect to how often the project could operate in a peaking or baseload.

As explained, the assessment assumed either 100 percent of the time baseload or peaking whatever possible, which based on historical flow conditions would be about up to 88 percent of the time. How it will operate is likely to be somewhere in between. We don't have -- we don't have an estimate of the duration of the peaking or the duration of baseload. But based on flow conditions, it could be baseloaded up to 100 per cent of the time or peaking up to 88 percent of the time. So that's just to clarify.

MR. DeWIT: I think coming back to your question, we report in many instances a range of effects for the different assessments.

MR. McLACHLAN: Right. But in the

absence of your reporting range, then I can assume then you were looking for the maximum impact in terms of your assumptions around the modeling.

DR. EHNES: They asked me to explain this very simply. I think I have a reputation for something. I'm sorry.

So we don't want to give the misimpression or misunderstanding that the effects prediction that you're seeing in the EIS are a absolute worst case scenario or even a reasonable worst case scenario.

I still have this cold, so I apologize.

The EIS is predicting the expected effects of the project. In general, when we're running models, we're using 50th or median values in order to run those models.

And based on input variability, you were talking about confidence intervals say even around a median, we would be looking at, for example, you know, every modeling approach and every model is different. But when we are choosing a median within that range, we would be choosing something that would produce larger project effects rather than smaller project effects or even the middle of that range.

And I have temporarily lost my train of thought.

Oh, yes. We looked at various scenarios. Wil talked about baseloaded and peaking which is kind of the range in terms of reservoir operation. Reservoir operation is a key input or a driver for the rest of the physical environment effects around the Nelson River. So we looked at two possible or reasonable scenarios in terms of reservoir operation. But then when we did the sensitivity analysis for the models, then we drove model input parameters say from median levels or 50th percentile levels to 95th percentile levels or 99 percentile levels to see how much your predictions change, you know, how much larger the effects get. And in that process, it also helps you develop an understanding of which of those drivers and pathways are most important for producing the changes that are seen.

THE CHAIRMAN: Dr. McLachlan, I'm not cutting you off, but I'm looking to an afternoon break. Do you have more questions?

MR. McLACHLAN: Some, but I'd be happy to take a break.

THE CHAIRMAN: Okay. We'll break for 15 minutes and then return.

(Proceedings recessed at 3:04 p.m. and reconvened at 3:18 p.m.)

THE CHAIRMAN: We will reconvene. We still have a few questions left with this participant, and then another participant to follow, so we will not be starting with the aquatic environmental presentation this afternoon. We will start with that presumably first thing tomorrow morning, if we complete the cross this afternoon. If we don't complete the cross exam this afternoon, I may boot a few people out. But carry on, please, carry on Dr. McLachlan.

MR. McLACHLAN: Thank you.

I guess I have another related question, and we could probably find it most easily by going to page 10. And it is also around methodology here in terms of working with GIS and reconciling different types of data, data collected in different ways, from different years, from different projects.

Did you indicate explicitly anywhere in the EIS in terms of what that process was in terms of the differences among the data sources

and how you reconciled those differences?
MR. De WIT: Well, I would say in the EIS and likely more detail in the different technical memoranda, in the different areas, the studies list the information sources they used, and generally how they've integrated that data into their study, into the different study areas.
MR. EHNES: I will just add to that, if I may, specifically for physiography and shoreline erosion, most of those historical sources of information were of limited use because of the coarse scale of the data. And that was the main reason for the project effects assessment, why we used recent stereo air photos and photo interpreted at a one to 15,000 scale the conditions at Keeyask, and historical photos were also used for mineral bank erosion to look at how far those banks had receded over a long period of time in order to calculate an average annual erosion rate.
MR. McLACHLAN: So when we look at these different historical data sets up here, can you tell me which ones were of greatest use, or were none of them of particular use because of those limitations?

MR. EHNES: I would say that very considerably by the topic, these studies for the most part were focusing on the Nelson River. There were a lot of aquatic studies, so you will hear much more about that in the presentation tomorrow.

MR. McLACHLAN: And in terms of the physical data?

MR. De WIT: Which physical data?

MR. McLACHLAN: Again, let's take a look at those associated with sedimentation say, or in past projects, or water flows, or were any of the data that you reported on today?

MR. MALENCHAK: In regards to the water regime, the water level and flow data that's collected by Manitoba Hydro and then others as published by Water Survey of Canada were our primary sources of information for that particular topic.

MR. McLACHLAN: As a follow-up, are those data generally publicly available or are they kind of restricted access through Hydro or --

MR. MALENCHAK: The Water Survey of Canada data for sure is publicly available on their website, and as well Manitoba Hydro on their external website publishes some water level sites, which is publicly available, anybody can go and check. We also address this with some references in a couple of IRs. I will just double check the number here.

Yeah, that would be PFN round one IR 30 and 31. There is some sources of information there.

MR. McLACHLAN: Okay, perfect. Thank you.

In 21, you talk here about accommodating permafrost conditions. And again, I might have missed it, but there didn't seem today to be much mention of permafrost in terms of either direct impacts, secondary impacts around permafrost associated with operations or otherwise, you know, in terms of construction. Can you talk about that a little bit more, what you anticipate those impacts might be?

THE CHAIRMAN: I think the definition of the range of permafrost was described last week and there was some questioning on it. Whether you can add a bit about what the impacts are?

MR. ST. LAURENT: The discussion last week focused on how the dykes will be designed to accommodate melting, the melting of frozen foundation soils or permafrost, and how over time that design will able to accommodate that. With respect to the assessment, certainly the effects of permafrost are included and considered in various areas. For example, in the groundwater assessments studies, permafrost is certainly considered as an input, as it affects the amount of groundwater flow through the region, and there was sensitivity analysis carried out around the amount of permafrost, as well as the shoreline erosion modeling that was undertaken. The various sites that were established around Stephens Lake as a proxy, certainly some of those sites had shoreline erosion characteristics that were influenced by permafrost processes, so the erosion rates that would have been developed based on those sites certainly include the effects of permafrost.

MR. McLACHLAN: Thank you.

So, kind of with erosion, greater exposure to mineral soils, are you anticipating there will be a domino effect or secondary effects on permafrost in the future?

MR. EHNES: Those were incorporated

into the peat land disintegration and the mineral bank erosion modeling. The mapping of the peat land types includes their permafrost conditions. In the Keeyask area, with the model that was built, incorporates the different permafrost conditions in terms of the pathways that particular peat land patch will follow. And then in terms of the mineral bank erosion rates, those were estimated or calibrated with information coming from Stephens Lake as well, which has permafrost affected banks.

MR. McLACHLAN: So in terms of the monitoring, will that be reflected in the monitoring programs that you set up?

MR. De WIT: Could you maybe elaborate a bit on that?

MR. McLACHLAN: Well, just in terms of any subsequent kind of secondary, kind of melting of the permafrost?

MR. EHNES: Yes, the effects on vegetation and soils will be monitored, and one of the soil parameters or conditions that will be monitored is the permafrost type.

MR. McLACHLAN: Okay, perfect. Thank you.

I guess page 24, I guess the proxy question that we were identifying earlier in terms of greenhouse gas emissions, here you have a number of different sources of emissions, you know, varying across different industries.

Did you create a similar kind of diagram or analysis where you compared greenhouse gas emissions among the different operations that have taken place kind of -- that are comparable in Manitoba?

MR. De WIT: Are you meaning comparison to other Manitoba Hydro generating stations?

MR. McLACHLAN: Other construction sites, or whatever you felt, so rather than comparing across industries --

MR. De WIT: Well, the intent of this is to show the emission intensity from the Keeyask Generation Project versus other comparable methods of electrical generation. So it is a comparison of like to like. If we compare to some other industry, it would be apples and oranges.

MR. McLACHLAN: No, sorry, I'm not being clear.

So there are other generating stations

that are being constructed that perhaps have higher or lower greenhouse gas emissions that were documented, just to get a sense of, here we understand that Keeyask is very, very low, but are there other comparisons that can be made across other comparable projects?

MR. ST. LAURENT: The only other recent project where there was a lifecycle analysis carried out was the Wuskwatim project, and it is very comparable, comparably low with respect to emission.

MR. McLACHLAN: Okay, thank you.

Page 28, and I guess this might actually not be relevant to this panel, but here you talk about the -- sorry, it is the -- with the cabin, that documents the cabin at four kilometres. Maybe it is not 28. Sorry, it is 27. So with 27 you indicate that the closest cabins are four kilometres away and Gillam is 30 kilometres away. What about other kinds of traditional land use -- is there any concern that the noises will affect people who are hunting or trapping in the area?

MR. De WIT: Yes, the socio-economic panel will be discussing the potential impact on resource users.

MR. McLACHLAN: In terms of noise as well?

MR. De WIT: Noise area and whatever the project effects may be.

MR. McLACHLAN: Okay. Thank you.

MR. REMPEL: With respect to noise, I would like to clarify a comment I made. I was asked about noise from transmission lines and I may have given the impression we didn't consider the other projects like the Keeyask transmission project.

On page 320 of the physical environment supporting volume, we do talk about interactions with other projects. And so we did consider it, but we did not consider that there was substantive overlap. So that's just a clarification of what I said.

MR. McLACHLAN: Thank you for that.

Page 41, in terms of monitoring and the different sensors that you have set up for monitoring of sedimentation. Again, this may be reflected in other documentation.

Did you consider kind of additional sensors, say that were further upstream, like beyond the 41 kilometre kind of reach that might get at kind of areas that weren't seen as being affected or, for example, kind of -- you've got the kind of the water, the water bodies that are to the north, for example. I guess what I'm wondering is why you situated the sensors here the way that you did?

MR. De WIT: I guess there is two parts to that question. Then the first part, if I understand, is monitoring beyond these locations and the location of these sensors.

These monitoring sites are particularly for monitoring effects of in-stream work, so they are located close to the site, so the upstream site identifying our background condition coming into the project work area, and then the two downstream sites measuring in the immediate vicinity the downstream effect of the in-stream work. So that's why these sites are located where they are, is to measure that effect from the in-stream activity.

In the physical environment monitoring plan there will also be additional monitoring. And the physical environment is not a component of the sediment management plan, they are separate, but there will be monitoring at this time at other locations upstream and downstream of these sites as well.

MR. McLACHLAN: Okay, perfect. Thank you.

And are you combining this monitoring with kind of people based monitoring as well, or is it just using the sensors with the real time data?

MR. De WIT: What do you mean by people based monitoring?

MR. McLACHLAN: So in the sense of actually going out and having people collecting samples?

MR. De WIT: Certainly, I mean, this is just a very high level summary. There is routine maintenance that goes on of the equipment, particularly as it is real time, if there is issues seen with the data coming in, people go out, do maintenance work, replace equipment, take water samples, and various activities.

MR. McLACHLAN: But these samples will be combined with other sampling efforts that people actually go out and collect data --

MR. De WIT: You mean from the

automated sensors here?

MR. McLACHLAN: Yes?

MR. De WIT: Certainly, it is all combined as part of the sediment management plan information data base.

MR. McLACHLAN: Okay, thank you.

You talk -- let me make sure, 50 I think, but let me check and make sure. Yes, on the waterways management program on page 50 you talk about communicating with waterway users. Can you describe that in greater detail for me, kind of how you have developed this program and how it's effective, how you anticipate it will be effective?

MR. ST. LAURENT: The program will consist of, or it will include boat patrols during the open water season where the function of these boats is to patrol the reservoir, both upstream and downstream, to monitor and identify, or locate any debris that has an impact to safety and navigation and access. This also provides a means for talking to people that are on the waterway. And that certainly is the intent for them to be engaging and communicating with people that are using the waterway resource harvesting and so forth.

Same goes for the winter, in the winter there will be a safe trails program that various teams will be establishing, and there is a component of communicating the safe trails, obviously, to different users, getting inputs, feedback, concerns, in order to shape both of those programs.

MR. McLACHLAN: Now, it sounds like those will be face-to-face, mostly face-to-face initiatives. Are you combining that with other kinds of, say for people who are traveling when there aren't, or there isn't anybody on the river or on the ice?

MR. ST. LAURENT: Yeah. In the presentation last week we provided an example of a navigation map that would be produced for the Keeyask reservoir. And it would show how the depths would vary through the reservoir. It would also show the navigation routes, the main routes that would be established along the main stem of the river, as well as designated travel routes in the more shallower back bay areas of the reservoir, and any access locations. It will also show hazards, it would also show water level gauges. So that would be established as part of the waterways management program. But in addition to that, there is a waterways public safety measures that will have been developed for Keeyask. And again, that was described in the presentation last week, but that will include, or there is provisions for signage throughout the area, including signs at each of the boat launches. So there will be a boat launch upstream and downstream of the Keeyask Generating Station that will have signs that will describe the hazards of the waterway, the public safety measures, and any issues. That will also be established at the boat launch at the Butnau dam or the Butnau marina, as well as the boat launches on Split Lake. So at the communities of Split Lake and York Landing there will also be signage describing the hazards and measures in place at the Keeyask reservoir.

MR. McLACHLAN: Okay, perfect. Thank you.

You had mentioned that around groundwater quality and petroleum spills, et cetera, that the risks were likely small. And I guess, in terms of anticipating that, did you look again at other proxy kinds of operations to see kind of what likelihood, or kind of what the rate of those kinds of spills was in other projects as well?

MR. De WIT: I wouldn't say the -- well, the people who worked on that are familiar with it, and many of the procedures that are used are industry standard methods. Hydro has got a quite rigorous safety environment, atmosphere for things like maintaining safe operations. And there are also certainly specific regulatory requirements that have to be adhered to in terms of say hazardous materials and field storage issues. So these are -- these plans are developed, they are comprehensive to address and minimize any potential for these types of things to happen.

MR. ST. LAURENT: Those measures that Mr. De Wit is summarizing, that's all captured in the environmental protection plans that would be established, or have been developed for the generating station, as well as another plan for the south access road construction. So those have been, drafts have been developed and it has got all of the details and they are available.

MR. De WIT: They are part of the record for the hearing.

MR. McLACHLAN: Perfect, thank you.

On page 66, you talk about -- this is around sensitivity to climate change. I think you talked about this a bit already, but you talk about a 10 per cent, a reasonably conservative estimate of both a 10 per cent increase and a 10 per cent decrease in flow.

I guess my question is, why did you choose the 10 per cent as figures, as opposed to a broader range?

MR. MALENCHAK: So, as you probably gathered from the discussion of the sensitivity analysis that was conducted in the absence of estimates of climate change impacts on inflows to Keeyask at the time of the water regime assessment, which by nature had to come before many of the other assessments, because the water regime drives the physical environment, and the physical environment is the pathway to other VECs, let's say. A sensitivity analysis was carried out which demonstrated the conclusions on the environmental assessment would not change even due to what we considered to be a potentially relatively large increase or decrease in inflow, so that's the plus or minus 10 per cent. This number was arrived at through collaboration amongst the many disciplines, Manitoba Hydro system operations, people experienced in managing the water within our system. And there is a few specific reasons, I guess, that we could use to support that the range of plus or minus 10 per cent is a reasonably conservative estimate. We feel it is quite conservative actually.

The size, diversity and degree of regulation and amount of reservoir storage in the Nelson/Churchill watershed, in which Manitoba Hydro system operates, offers a degree of flexibility to adjust to changes in water supplies and reservoir inflow, which is believed to dampen the effects of climate change on Nelson River flows in the system as a whole. The watershed is extremely large, it is 1.4 million square kilometres. Manitoba Hydro has operated our system for a significant amount of time, and experience that was gained results in a good understanding of how the system operation may vary according to different climatic conditions. And basically, the environmental assessment already covers a wide range of flow, from 5 per cent to 95 per cent, which is much larger than the range in the plus or minus 10 per cent change that was considered. And under all of those flow conditions, one of the key parameters is that the full supply level of the reservoir will not change under any of those flow conditions. And it was found that the flow supply level of the reservoir is what drove a lot of the water regime effects. So if that's not changing, it is reasonable to assume that the rest won't change as well.

MR. ST. LAURENT: If I might add, once we came to that conclusion, what we found is that the choice of that plus or minus 10 per cent became less important. And that even if we had selected plus or minus 20 per cent, it really wouldn't have changed any of the conclusions, because the full supply level would still have been maintained at 150 -- 159 and down to 158. So it shows that the project effects are quite robust, or that the reservoir itself is quite robust, and that a lot of those changes as a result of the reservoir would still be in place regardless of those changing inflow conditions.

THE CHAIRMAN: I just wanted to

bootleg a supplementary in here.

Earlier today, I am not sure, I think it was Mr. Rempel, but somebody talked about 2003 having, was it a 40 per cent less inflow into Lake Winnipeg, and 2005 was at 70 per cent higher than normal into Lake Winnipeg. What effect does that have on this?

It was also in the public record that in 2003, in particular, Manitoba Hydro had a significant deficit because of the lack of water. So how would those inflows into Lake Winnipeg affect this flow in the Nelson River?

MR. MALENCHAK: So I guess the first thing we should comment on is in relation to that 40 per cent below and 70 per cent above, and that's in relation to the average. So actually that illustrates that our existing environment has experienced a wide range of flows already. So while those low flows into Lake Winnipeg in that particular year would eventually make its way downstream to Keeyask, again, the full supply level and minimum operating level would remain the same, so the reservoir would largely look similar to how we have assessed, regardless of the inflow condition.

THE CHAIRMAN: Thank you. Dr. McLachlan?

MR. McLACHLAN: As a related question, you've spoken, and quite rightly focused on long-term climate change, but obviously there is short term variations around climate, and so we have spoken a little bit about that in terms of water flow. So with your modeling exercises, did you try to get at kind of cold winters, and warm winters, and droughts and excessive precipitation or snowfall? That would be my first question. And secondly, what were the implications of those other kinds of variations in your modeling?

MR. De WIT: Are you looking at for the inflow modeling then?

With respect to water regime, the water regime information used in the various studies have generally looked at a range of conditions from 5th percentile low flows to 50th percentile up to 95th percentile high flows, so the range of flow conditions related to the flows in the river have been considered across study areas.

MR. McLACHLAN: So that's focusing on water regime and inflow. And so kind of in terms of the secondary impacts that those kinds of, that kind of variability in climate, the short-term variability in climate might have, did you try and get at that with your modeling as well?

MR. De WIT: I guess it would depend on the modeling. I know, for example, for the water temperature and dissolved oxygen, we looked at what we called the typical week. In terms of weather conditions, we looked at what we called a critical week, high temperature, low wind combinations. But I'm not sure I can mention other studies. Groundwater study considered low, average and high recharge conditions, and different sets of weather information from a dry -- so dry, average, and wet years.

MR. McLACHLAN: And so when you characterized the impacts of manipulating your models in those kinds of ways, what, if any, impacts did you see?

MR. De WIT: Those would be reported in the different supporting volumes. So, again, on the dissolved oxygen and water temperature, the results from the various different model runs or the analysis are reported, and then that information is supplied to, for example, the aquatic environment studies team where water quality and fish are assessed, so that that suite of information is provided down the line to the others who are using it.

MR. McLACHLAN: Perfect, thank you. I'm trying to whip through here, I guess.

When we go down to the end, so pages -- I guess it is the monitoring program, and I was interested in what you've put together in terms of the monitoring. And you talk about communicating, obviously debris management, this was identified as a concern by communities. And in general, do you characterize the monitoring as being solely scientific? And if it is, is it conducted by the communities alongside Manitoba Hydro, or can you talk about that process?

MR. De WIT: Again, there is a number of different monitoring programs that will be implemented. So in here, for example, we have the physical environment plan, which is maybe more of a scientifically based study. There would be Partner First Nations involved, people employed on the program typically. As far as communities, they will be implementing their own, I guess, traditional knowledge programs for gathering information from their communities. And then certainly any of the information collected through the monitoring plans would be available and shared amongst the various groups.

MR. McLACHLAN: Thank you for that.

If we pull that apart in terms of kind of involving community members, in terms of the science based monitoring say, rather than the physical components of this system, is Hydro interested, or does it have plans in terms of building on existing capacity, or training people to do that, and can you talk a bit about that process?

MR. De WIT: I'm not really the correct person to speak to that. That's a bit more of a higher level issue, and I believe the last panel, Moving Forward as Partners, will be looking at more of that aspect of the project.

MR. McLACHLAN: Okay, perfect, I will follow up around that.

You talk about kind of sharing results with communities. And here you talk about the monitoring advisory committee, but more generally in terms of kind of sharing results with the broader community. What are your plans in terms of the physical data that result from the monitoring?

MR. De WIT: Again, I would have to defer that to the panel. Well, I guess one example for how we share information, that I'm more familiar with, would be open houses that are held with the communities. But some more of those details on how that's all implemented amongst all of the programs and the partners would be more appropriate for the last panel.

MR. McLACHLAN: Okay. Thank you. That's it for me.

THE CHAIRMAN: Thank you both.

Pimicikamak, Ms. Kearns?

MR. MALENCHAK: Actually, as we are switching to the next intervenor, if it is all right with the Chair, I would like to clarify a comment that was made previously?

THE CHAIRMAN: Certainly.

MR. MALENCHAK: It was by Mr. De Wit, where he was discussing the spillway operation based on historical records would be approximately 12 per cent of the time, which was equated to once every ten years. It should probably be clarified that that 12 per cent of the time is just as a whole, so that could occur every year, every second year, every third year, every fourth year. It depends on the inflow conditions, so it doesn't necessarily mean once every ten years.

THE CHAIRMAN: Thank you. Ms. Kearns.

MS. KEARNS: Thank you. Stephanie Kearns for Pimicikamak.

So you stated at the beginning that there are no VECs coming from the physical environment. But my question is, did the Partnership consider including the natural hydrological regime of the river as a VEC?

MR. REMPEL: No, we did not. We did not choose VECs in the physical environmental assessment because we felt it was far more appropriate to look at pathways of changes in the physical environment in terms of how they might affect other VECs. For example, erosion in itself doesn't really lend itself to be called a VEC. It is far more important to consider what erosion does to, for example, mobilization of sediment, deposition of sediment, effects on water quality, et cetera.

MS. KEARNS: Thank you.

You referred to air photos that you

used to gather information about the past. Did the air photos help the Partnership to gain understanding of the pre-development, so pre all hydro development water morphology?

MR. EHNES: Could you clarify what you mean by the pre-development Hydro morphology?

MS. KEARNS: What I am wondering is, did the air photos give you an understanding of what the water, the shorelines would have looked like before any hydro was developed on the Nelson River and Lake Winnipeg Regulation?

MR. EHNES: It would have on the Nelson River. I'm just going to confer with my colleague about some other sources.

So those photos would relate to pre-development conditions on the Nelson River and the reaches that we were considering.

MS. KEARNS: So, just to clarify, so then just the local study area for Keeyask?

MR. EHNES: The regional study area for Keeyask.

MS. KEARNS: Thank you. In the 1962 air photos you referred to, would any changes due to the construction of the Kelsey Generation Station have been apparent yet downstream?

MR. EHNES: No.

MS. KEARNS: So turning to slide 23, did the greenhouse gas lifecycle assessment include any emissions that would have been incurred in the planning stages of Keeyask?

MS. KOENIG: No, it did not.

MS. KEARNS: Thank you.

Slide 34, so did those historical air photos provide the Partnership with any information that could be used to describe the pre-development ice formations in Gull Lake and Gull Rapids?

MR. De WIT: No, the air photos were only from open water periods.

MS. KEARNS: Thank you.

Did you analyze what the ice conditions would have been in that area with no hydro development and what of the current ice conditions is caused by the existing Hydro projects?

MR. REMPEL: I would like to respond to that by saying that the Lake Winnipeg/Churchill Nelson River Study Board did comment on this particular reach, as I mentioned, from Split Lake to Kettle Rapids, and said that they did not think that the ice processes would change substantively with further development, that basically the ice formation, the ice jams that were occurring then would continue to occur with Lake Winnipeg Regulation and CRD.

MS. KEARNS: So can I follow up? So then in the study board report when they were referring to the current ice conditions, that was post Kelsey, so that would have been ice conditions that were caused by the development at the date of that report?

MR. MALENCHAK: Yes, at that time, given the date of the report, it would be post Kelsey. But it was -- it is not anticipated that Kelsey would have any effect on the ice processes occurring downstream of Split Lake. Another source of information that us in the river ice engineering field go to quite a bit is the 1968 report by Robert Newberry, which basically goes over all of the ice processes in this reach of the river, at that time and before, so...

MS. KEARNS: So I don't know that I have heard an answer yet to my question. So did you then look at what the -- what of the current ice conditions are caused by the existing development and what would have been natural?

MR. MALENCHAK: So I guess the short answer to your question would be no, we did not consider that comprehensively. But aside from the large hanging ice dam pointed to in the top right of the slide shown up there, which essentially is a product of Stephens Lake holding the reservoir there, the rest of the ice processes would be the same.

MS. KEARNS: Thank you.

Okay, so turning to slide 36. So, as discussed at the project description panel, the stumps and roots will remain after the areas are cleared of timber. Has the Partnership calculated how long it is expected to take for the stumps and roots that are left to be liberated from the flooded areas?

MR. ST. LAURENT: Before we answer that question, just to clarify, the plan is not to leave in all of the stumps throughout the reservoirs. We expect that the vast majority of the reservoir would be machine cleared. And I think there was a slide that shows the reservoir clearing plan in this presentation, but only a very small proportion of the reservoir would be cleared by hand. And it is the hand clearing areas only where stumps would remain in place.

MS. KEARNS: Then to clarify, but roots will remain everywhere?

MR. ST. LAURENT: That's right. So where the shearling occurs, once the stump is removed, there would be the roots that remain in place after the stump is removed, yes.

MS. KEARNS: So of the stumps and roots that are left, has the Partnership calculated how long it will take for those stumps and roots to be liberated once the land is flooded?

MR. ST. LAURENT: No, we have not tried to estimate how quickly or how long it would take for those roots to free themselves. But irrespective of that, there will be a waterways management program in place that should -- should that occur, and should that cause a hazard to navigation or restrict access to the waterway in certain areas, the program would be in place to remove those from the waterway.

MS. KEARNS: Do you have an estimate for how long it will take for the sunken wooden debris to biodegrade in the reservoir?

MR. ST. LAURENT: The plan is to remove woody debris or wood from the reservoir prior to reservoir impoundment. Is that what you are referring to?

MS. KEARNS: Once it is flooded, and there will be wooden debris left over from roots, and there is probably going to be other things, some stumps in some areas, so it is flooded and that wooden debris is there, it gets water logged and it sinks, has the Partnership calculated how long it expects it would take for that wooden debris to biodegrade in the reservoir?

MR. ST. LAURENT: We have not estimated that.

MS. KEARNS: Thank you.

Slide 42: The bottom of the slide it states, mineral shoreline recession rates decline to near existing rates. What are the existing rates of erosion in the local study area?

MR. EHNES: Less than half a metre per year. Some of the shorelines are stable. I believe that 60 per cent of the shoreline is currently stable.

MS. KEARNS: And what types of shoreline and areas would be more prone to continuous erosion after 30 years?

MR. EHNES: Mineral banks that are exposed to high wave energy, and in some of the back bay areas where peat land disintegration may still be ongoing.

MS. KEARNS: Thank you. Slide 45: In the top left hand corner, the third bullet there, says average of 13 to 19 milligrams per litre without project. And I believe that's referring to the mineral sediment concentrations. And my question is what would the average sediment concentrations be, if there were no hydro dams on the Nelson River?

MR. REMPEL: I referred earlier to the Lake Winnipeg/Churchill Nelson River Board, and they did describe the total suspended solids based on samples taken at Split Lake and Kettle. And they said it was very much in that range. They said they had an average I believe about 15, 16 milligrams per litre, and they expected that these concentrations would actually reduce with development.

MS. KEARNS: But again that report was done after hydro development had begun?

MR. REMPEL: Yes, after Kelsey, it was

actually 1972 to 1975.

MS. KEARNS: Thank you. And so is there any data on what the average would have been before development began?

MR. REMPEL: I don't think that we are aware of data of that type prior to Hydro development.

MS. KEARNS: Thank you. So still on slide 45 at the bottom right hand corner, this is the organic sediment concentration, the second bullet says, reduced to about 1 milligram per litre or less after year five due to reduced peat disintegration. My question is does this bullet refer to the main reservoir area?

MR. De WIT: So the milligram per litre after year five was referring to most of the reservoir.

MS. KEARNS: So what are the predictions for the back bays?

MR. De WIT: Related to this bullet?

MS. KEARNS: Yes.

MR. De WIT: Most of the back bay areas, it was about, I believe, 2 milligrams per litre or less.

MS. KEARNS: Thank you. Turning to

slide 50; you discussed debris management, including removing debris from navigation routes. What about the safe travel of animals?

MR. De WIT: Sorry, the safe travel of what?

MS. KEARNS: The safe travel of animals in the waterway.

MR. DE WIT: I believe the mammal specialist on the terrestrial environment panel, hopefully tomorrow, would be able to speak to that better.

MS. KEARNS: Thank you. In preparing your waterways management program, did you look at what has worked and what has not worked for debris management in other generations in the system?

MR. ST. LAURENT: The development of the waterways management program for Keeyask was a collaborative effort during the early negotiations of the Joint Keeyask Development Agreement. So there was a group of people from Manitoba Hydro, as well as the partner communities, that worked together to develop the program. And that was based largely on the program that's implemented within Hydro's system, but also the experiences that were -- the experiences of the partner communities, particularly on Split Lake or in the Gull Lake area, and bringing that knowledge and that experience of impacts of hydro on shoreline and debris generation, and that itself made its way into shaping that program.

MS. KEARNS: And did you talk to anybody other than the partner First Nations about their experience with the effectiveness of debris management programs?

MR. ST. LAURENT: That's something I'm not aware of. I would have to go back to find out if people beyond the partner communities were involved or not. It is a process that I wasn't personally involved with. But I would have to look up.

MS. KEARNS: Will it come up in another panel or is this the panel on it?

MR. ST. LAURENT: This would be the panel, yep.

MS. KEARNS: Would you able to undertake to go and look at anyone other than the partnership First Nations were -- whether or not you discussed with anyone other than the partnership First Nations about the effectiveness of debris management programs?

MR. De WIT: Do you mean people outside of Manitoba Hydro?

MS. KEARNS: Outside of Manitoba Hydro, so I'm thinking of people who live near generation stations, but are not members of the partner First Nations.

MR. ST. LAURENT: We could undertake that.

(UNDERTAKING # 9: Advise if Manitoba Hydro discussed with anyone other than the partnership First Nations about the effectiveness of debris management programs)

MS. KEARNS: Thank you. Slide 58: The diagram shows gray areas, and it is marked as being excluded from simulation. And my question is why were those areas excluded?

MR. De WIT: That's explained in the EIS. But those are areas that were relatively shallow, in the relatively shallow areas. I believe most of them, less than half a metre deep or so or less than 20 centimetres. But they cause some instability in the model that makes it difficult for the model to solve. But for those areas particularly, for example, in the bottom figure it is assumed that they are in the affected area that would have low dissolved oxygen. And in discussion with the aquatic folks as well, there is additional -- most of those areas are also within the area that may be wetted or dried as the reservoir goes up or down.

MS. KEARNS: Thank you. And did you do mapping for Stephens Lake reservoir for water temperature and dissolved oxygen during different seasons, or was it just summer?

MR. De WIT: There were -- monitoring was done in summer and winter. The aquatic studies certainly conducted studies in the winter in different areas of the Stephens Lake and the Gull Lake area, and that information was drawn upon.

MS. KEARNS: Thank you. So slide 67 -- sorry, slide 70. How will you monitor water levels on Clark Lake and Split Lake?

MR. ST. LAURENT: It would occur through the construction phase and through the operation phase. As part of the operation of the project we will need to have water level gauges on the reservoir. There will also actually be multiple gauges on the reservoir that would be used to establish that reservoir upper limit for operations. So in order for the project to operate it must have water levels all the way through operation.

MS. KEARNS: And what happens if water levels are found to be impacted more than what is expected on Clark Lake and Split Lake?

MR. De WIT: I think that the -- a fundamental operating feature of the Joint Keeyask Development Agreement is that water levels on Clark Lake and Split Lake would not -- open water levels on Clark Lake and Split Lake would not be affected. And I'm not completely familiar with it, but there is a process described in the Joint Keeyask Development Agreement on what processes would take place should a supplemental operating feature not be met.

MR. ST. LAURENT: Ms. Cole actually answered a very similar question on Friday where she talked about, you know, unanticipated effects or where, you know, the process for addressing. And I think the example used was a water level increase on Split Lake. So I believe the way the process was laid out is that, you know, we would certainly be monitoring the level on Split Lake, and we would need to compare those levels to our predicted levels, and determine if additional monitoring needed to be taken -- needs to occur, if there were problems with the monitoring equipment, which does happen from time to time, and determine if more monitoring would be required. Or also, you know, assess the effectiveness of any mitigation, and from there determine if more monitoring is required or depending on the nature of the effect of that deviation from the prediction, what that impact would be. And any -- which would then define if mitigation is required or the extent of that mitigation. And once that's implemented, if it is implemented, start by monitoring again.

MS. KEARNS: Thank you. Are you aware of any studies of the ways in which sediment passes through the Kelsey control structure?

MR. De WIT: So there is some data, historic data on Split Lake and upstream of Kelsey that was available.

MS. KEARNS: But no studies specifically on how sediment travels through the Kelsey control structure?

MR. ST. LAURENT: No, that's out of the scope of the study area that was defined for this particular project.

MS. KEARNS: And does Manitoba Hydro conduct the same level of sediment monitoring proposed for Keeyask in other reaches of the Nelson River?

MR. De WIT: I'm not sure that's necessarily relevant to the Keeyask project.

MS. KEARNS: It is relevant because we are looking at impacts of water quality for Keeyask. In order to understand those impacts, we need to look at how water travels down to Keeyask and the impacts of sediment upstream on the area where Keeyask is.

MR. ST. LAURENT: There will be monitoring stations, water quality stations on Split Lake, which is upstream of the hydraulic zone of influence, so those gauges or those locations wouldn't be expected to be impacted by the project itself. So comparing that data to gauges further downstream in water that's impacted by the project would enable -- would enable a difference or effect of the project on water quality to be determined. So no need to go upstream of Split Lake.

MS. KEARNS: Thank you. Those are my

questions.

THE CHAIRMAN: Thank you, Ms. Kearns. I have a couple of short snappers. One of the things should be pretty simple. You talked earlier today about life cycle assessment of greenhouse gases. Last week we saw the diagram with sort of three circles. A big one I believe was a coal generating station, and a medium sized one was gas, and a small dot was the Hydro project. And the question was asked last week, but we were told to ask it this week of this panel. Were those three dots all life cycle assessments?

MR. DE WIT: That chart would have been developed from the same information used to development the slide chart, same information and format.

THE CHAIRMAN: Okay. Thank you. Slide 34, I just have a question. I don't understand, at the bottom left side dialogue box, the potential Split Lake level increase up to 20 centimetres. You are saying that the ice might be 20 centimetres higher in these 1 in 20 year -- is that what that says? I just don't understand that box.

MR. MALENCHAK: Yeah, actually effectively that's what it is saying. Under low flow conditions, the ice cover is able to advance upstream earlier in the year and a lot quicker. And our modeling showed no effect actually on Split Lake, but it was contingent on two river ice processes occurring; one being anchor ice at the outlet of Clark Lake and another one being sufficient border ice growth. So what we did is we did a sensitivity, as if those two things did not occur, as a conservative estimate, and that's where we arrived at the 20 centimetre rise during low flow conditions. So that would be an increase under what would be considered a relatively already low water level.

THE CHAIRMAN: So this would be a 20 centimetre increase over normal?

MR. MALENCHAK: No. Actually it would be a 20 centimetre increase over infrequent low water levels. So it would be a low water level support.

THE CHAIRMAN: So it is going to be a low -- even with the 20 centimetre increase in ice, it is still going to be low?

MR. MALENCHAK: It is still already

going to be in the low range.

THE CHAIRMAN: That helps, thank you. I have another question, I have actually been waiting for nine and a half years for an answer to this question. It was asked during the Wuskwatim hearing and it wasn't answered at that time. It sort of came close to it today, and it is in relation to climate change, and you sort of gave models with increased precipitation, and I think all of us who follow climate change know that there will be increased precipitation. But there is also a chance for decrease in water flows, and Ms. Whelan-Enns this morning asked about drought. But the specific question that was asked during Wuskwatim was in relation to glacial melt in the Rockies. And there has been a lot of talk, or some talk in the media about climate change speeding up glacial melt, and what happens when the glaciers are gone. And has that been taken into consideration in these climate change models? Because most of the water that comes through the north and south Saskatchewan and probably, maybe the Churchill, I'm not sure, but certainly the north and south Saskatchewan, originates in glacial melt.

MR. De WIT: I will ask Ms. Koenig to address that.

MR. MALENCHAK: So I guess after conferring with my colleagues here, for the north and south Saskatchewan, the majority of the flow, it is our understanding, comes from rainfall and snow melt and not necessarily glacial melt per se. And on top of that, that particular input to our system is a relatively small contribution. It is a very vast watershed that has many inputs, and that's just one of them.

THE CHAIRMAN: But there has been some talk, certainly back at the time of Wuskwatim, there was talk about the possibility of the Saskatchewan River flow being much reduced. Does that show up in your current models?

MR. De WIT: Maybe clarify; do you have a sort of a geographic area in mind where it is discussed that that flow would be reduced?

THE CHAIRMAN: God no, this was somebody else's question during Wuskwatim that I thought was intriguing, but never got answered.

MR. De WIT: Just on a higher level, the effect of the glaciers on flow would be more pronounced, for example, if you are talking about a place like Calgary or Edmonton versus say the site of the Keeyask site, where you've got a vast watershed that's contributing water from a large area. So without a geographic context, it would be hard to say what -- to address that.

THE CHAIRMAN: Well, I think it is just the Saskatchewan River, which both north and south Saskatchewan River takes in half to two-thirds of Saskatchewan, Alberta and a reasonable chunk of Manitoba.

MR. MALENCHAK: So, I guess we are wondering if possibly we could get a chance to review what was mentioned in Wuskwatim, because we are not exactly sure, or unless you just want to talk in generalities?

THE CHAIRMAN: There wasn't much in the Wuskwatim, it was just a question that was posed, but it was actually dismissed by the Hydro panel at that time, I hate to say. But I always found it intriguing because I do recall reading at the time concern about the melt of rocky mountain glaciers, and what that might do to the prairies. And at that time, I don't think there was as much -- this is nine, ten years ago, the science on climate change hadn't evolved as much as it has now, and I don't think there was as much consideration then about increased precipitation, but there was certainly consideration about decreased water flows. So I thought I might get an answer out of you. But it doesn't seem that it is a major concern or at least one that has been considered very much. But at least you didn't dismiss me like somebody else got dismissed nine and a half years ago.

MR. De WIT: We would never do that.

THE CHAIRMAN: Let's leave that then. I had hoped for more irradiation, but we will move over to Mr. Nepinak who has a couple of questions.

MR. NEEPIN: This is for Mr. St. Laurent. Last week you mentioned excavated materials, and that they would be used to cover peat moss. Can you expand on what will be covered? How much of the peat moss is going to be covered and how will it be done? Do you remember that conversation?

MR. ST. LAURENT: Yes. We discussed the excavating material placement areas that will be established around the project in order to construct the principal structures, so the excess material from the excavations that can't be used for construction would be placed in these placement areas. Prior to establishing those areas, the plan would actually be -- are you referring to the peat in the reservoir? Okay.

MR. NEPINAK: Whichever you were talking about.

MR. ST. LAURENT: I'm starting to remember what we were talking about. There is a number of placement areas in the reservoir, and as Dr. Ehnes explained this morning, there is, you know, the peat will have -- the peat can resurface in the reservoir. Some of our areas have a high likelihood or moderate likelihood of detaching from the bottom -- from where it is, once submerged, and re-surfacing. So what I described was taking some of the material, excess material, and rather than putting it in to an EMP outside of the reservoir, actually spreading it out on top of the peat, and putting a layer, I believe it is about half a metre thick of material over top of this peat, and that would have the effect of actually weighing it down such that when the reservoir is impounded, and the water level goes up, that material -- that mineral soil is actually holding it down and preventing the buoyancy of that peat from detaching and floating upwards.

MR. EHNES: I would like to add to that. In our peat reserve scene predictions we didn't assume any of the peat would be weighted down by EMPAs because it is up to the contractor to decide where they will be and we don't know that beforehand.

MR. NEPINAK: I said a conversation, I should have said testimony, because we didn't have a conversation on it. And would this material be cleaned or washed prior to being set down or just --

MR. ST. LAURENT: It wouldn't be cleaned or washed, it would be placed as extracted.

MR. NEPINAK: Is there going to be any more in-depth on the blasting that's going to occur on another panel?

MR. ST. LAURENT: Certainly the next panel, aquatic and terrestrial and beyond would be prepared to talk about the effects of blasting. Certainly we talked about the fact that there will be blasting as part of this project, but the effects on mammals and aquatics and so forth will all be discussed in the next few days.

MR. NEPINAK: Okay, I will wait.

THE CHAIRMAN: Mr. Yee.

MR. YEE: Thank you, Mr. Chairman. I have sort of a residual question to ask that came across last Thursday, but it is relation to today's presentation. I draw your attention to slide 30, which talked about project impacts on river flows, water depths, water velocities, levels, fluctuations and ice formation. And my question is directed at Mr. Rempel. A similar question on Thursday was, what was Keeyask's impact on Hydro's overall system. And I think you responded by saying something to the effect it is not discernible. So I guess I would really like some clarification on what you mean by discernible, and how it applies to these specific areas?

MR. REMPEL: My comment did not relate to water velocities, et cetera. I was really commenting on the question which I thought was what would Keeyask, the addition of Keeyask do -- what would the addition of Keeyask do to system operations. And I think I responded that there are many factors at work in terms of influencing Hydro's operation, it is not a static operation.

It is dominated in terms of changes by virtue of the variability of the inflow. And I think I responded that, firstly, that licensed conditions for the upstream water bodies will not change, the patterns won't change. And any effects arising from the addition of Keeyask would not be discernible. And by discernible I meant would not be able to be detected by a monitoring program.

MR. YEE: Thank you.

THE CHAIRMAN: That seems to bring us to the end of our questioning and cross-examination for today. I would like to thank this panel, and their back team for their presentations and responses today. We will adjourn until 9:30 tomorrow morning, and we will be back with the aquatic effects presentation at that time. Thank you.

Did you have any documents to put in? Before you run away, I'm always forgetting the document registration. Madam secretary?

MS. JOHNSON: Yes, the presentation that was given today on the physical environment will be KHLP40.

(EXHIBIT KHLP40: Physical environment presentation)

THE CHAIRMAN: Okay. We are adjourned.

(Adjourned at 4:35 p.m.)

OFFICIAL EXAMINER'S CERTIFICATE

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

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