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SNAP LAKE DIAMOND PROJECT

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Snap Lake Diamond Project Geotechnical and North Pile

Terry Eldridge, P.Eng.
Golder Associates Ltd.

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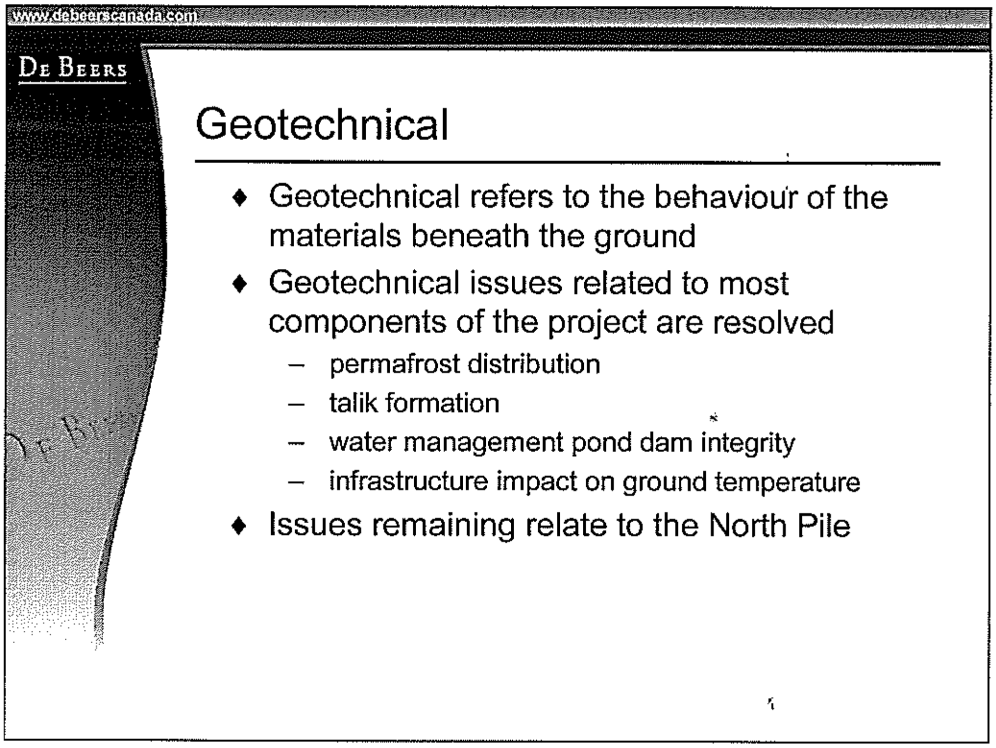
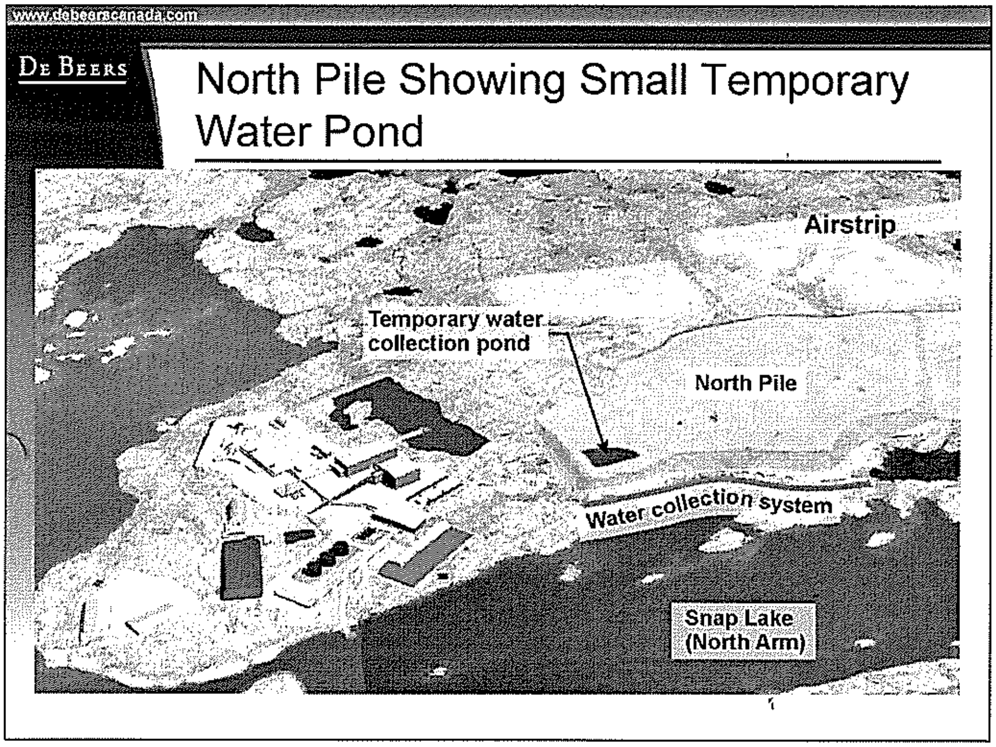


Mr. Chairman and members of the Board, I will be discussing geotechnical aspects of the Snap Lake Diamond Project. These are the aspects of the Project that relate to the soil and rock at the site.

Experts for De Beers and the interveners have reviewed the design of the facilities. The broad geotechnical issues have been resolved and only a few issues remain, all of which are related to the North Pile. Some of the issues that have been resolved are the distribution of permafrost at the site, the formation of taliks, the integrity of the water management pond dams and the impact of the infrastructure on ground temperature.

I will also briefly touch on geochemistry as it relates to the North Pile to help in the understanding of the performance of the North Pile.



This image shows the location of the North Pile relative to the north arm of Snap Lake and the airstrip. It also shows the small temporary water collection pond.

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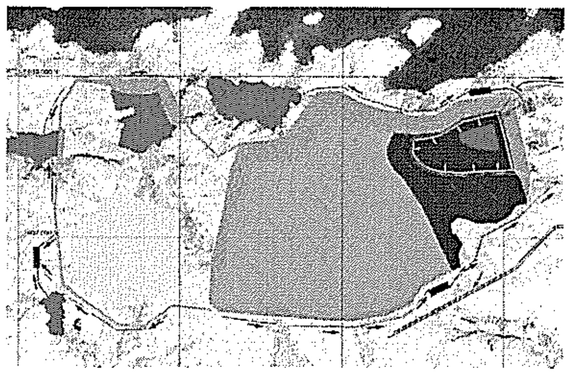
North Pile – What Is It?

- Permanent storage for processed kimberlite
- Wide embankments surrounding PK paste
- Small temporary water ponds
- Progressive reclamation while mine is operating

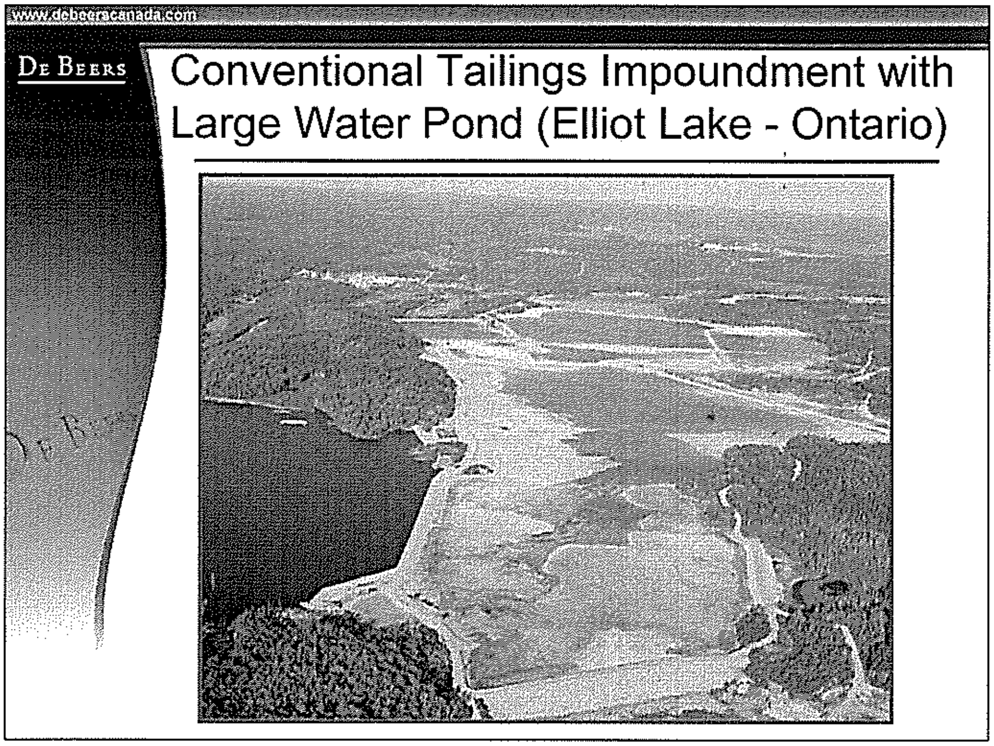


The North Pile will be the permanent storage for the processed kimberlite, which we call PK. De Beers will be developing an underground mine at Snap Lake, and about half of the PK will be placed underground as backfill. The material that will not fit underground will be placed in an area we have called the North Pile. The PK itself consists of three fractions: gravel or coarse fraction, sand or grits fraction and silt or fines fraction. Each of these is about one-third of the PK and they can be mixed together or handled separately.

When you look at the North Pile, you will see wide embankments constructed of rockfill and the gravel and sand PK. These embankments surround the paste made from mixing the three PK fractions: gravel, sand and silt. There may be a small, temporary water pond, but there will not be a large pond on the North Pile. The seepage and runoff collection system will have a series of ditches around the North Pile that join to sumps and small ponds outside the pile. Water will be pumped from these to the water treatment plant.

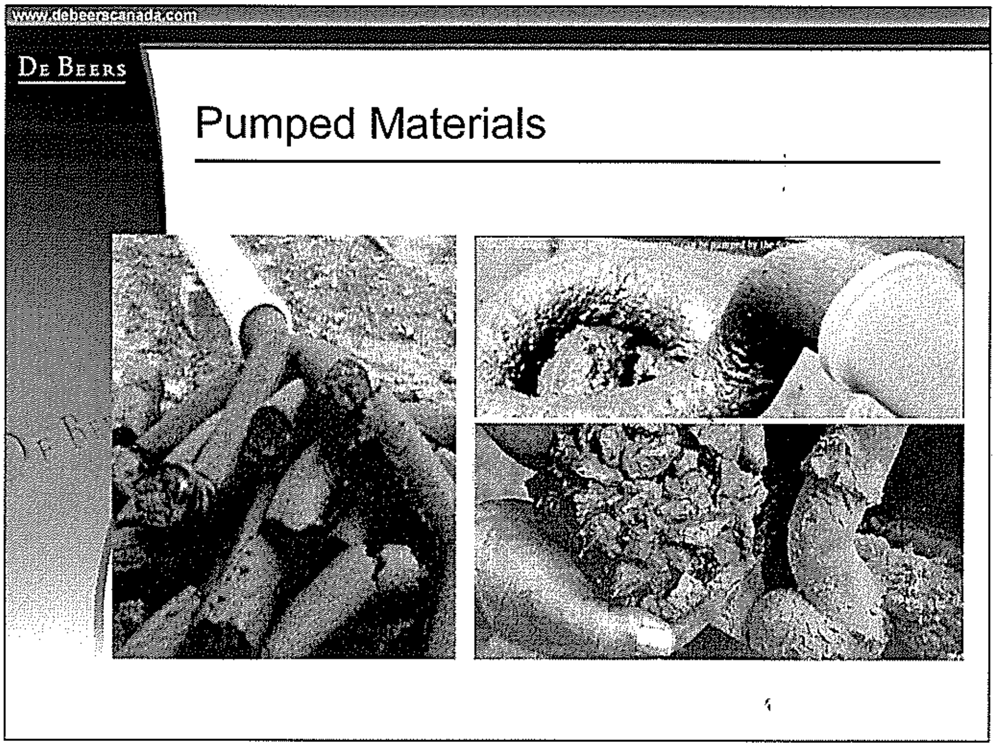
The North Pile will be constructed in three stages, or cells. The first cell will be located as far from Snap Lake as possible, near the airstrip. This starter cell will provide an opportunity for us to closely monitor the performance of the pile for two years before construction begins on the east cell. The information collected during these two years will be used to confirm our model predictions about the performance of the North Pile during this time and to allow us to increase the accuracy of our longer term predictions.

The surface of the pile will be progressively reclaimed by covering it with granite rockfill, which forms a cap over the surface. This starts in about the third year so we will be able to monitor the performance of the cap for nearly two decades while the mine is operating.



This is a photograph of a tailings facility that uses slurry deposition. This type of system has been used throughout the north, for example at Colomac, where you can see the large permanent ponds that are part of the operation.

When we started the design work for Snap Lake, we decided that we did not want a large pond and the associated problems, and the use of paste allowed us to eliminate the pond. So when you go to Snap Lake, you will not see a facility with a large pond like the one shown on this photograph.



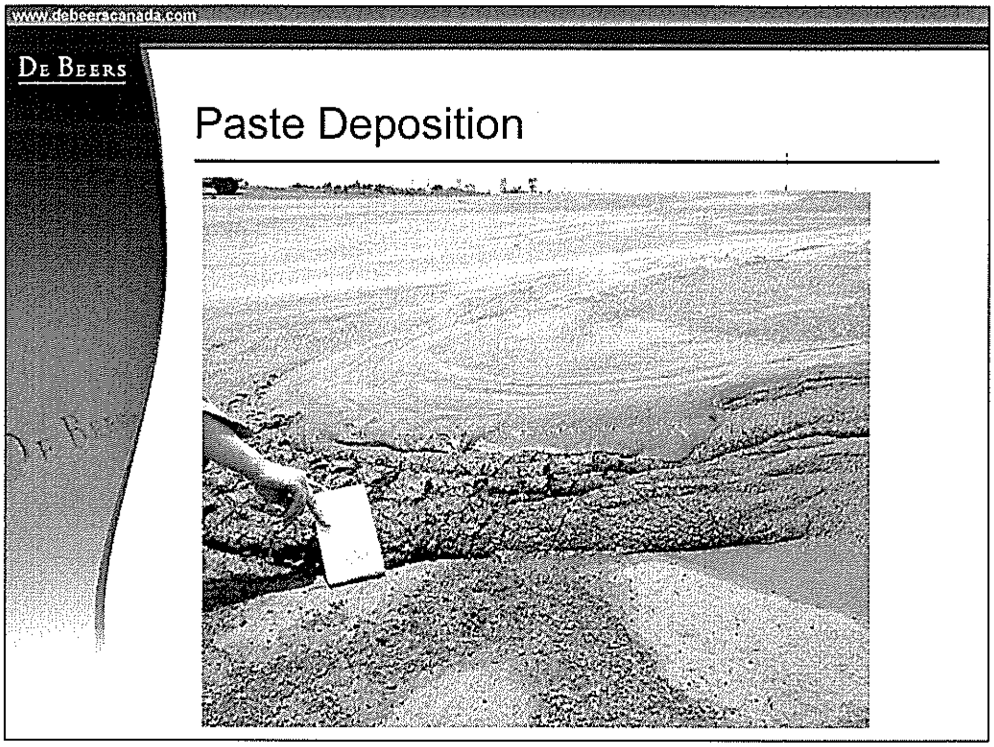
Paste is not a specific material. It is the consistency of a material with a low water content. Typical pastes are shown in the right photographs. The photograph on the left shows a drier material, what we would call a cake, that has been pumped. A slurry would be much wetter than the materials shown in these photos. In many applications, pastes will be moved by pumping through pipelines.

Material is moved by pipeline in many industries. Probably the best example of this comes from the construction industry where wet concrete, which is a paste, is moved by pump and pipeline. This technology is used worldwide and is well understood.

Paste is now used in many underground mine backfill systems. Paste has also been used on surface for tailings disposal at the Julietta mine in northern Russia, and a drier material is used at Greens Creek in Alaska. The Bulyanhulu mine in Africa is using a pumped paste system to move its tailings to a storage facility. Many other mines are at various stages of design of paste systems.

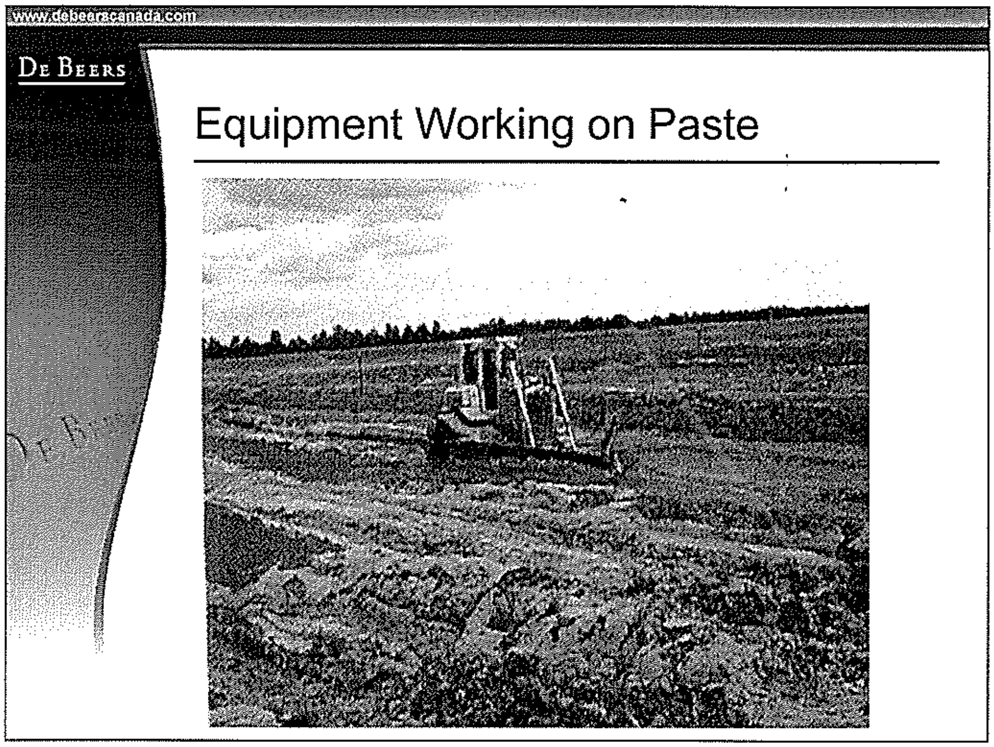
Thickened tailings are similar to paste, although a little wetter. Constructing a pile using thickened tailings has been done at the Kidd Creek Mine in Timmins, Ontario for over 20 years. Timmins has very cold winters, with temperatures of -40°C. The Cluff Lake mine in northern Saskatchewan recently started a thickened tailings pile, and have had no problems operating during the winter.

So we have seen how these types of systems work and what the problems are in cold conditions.

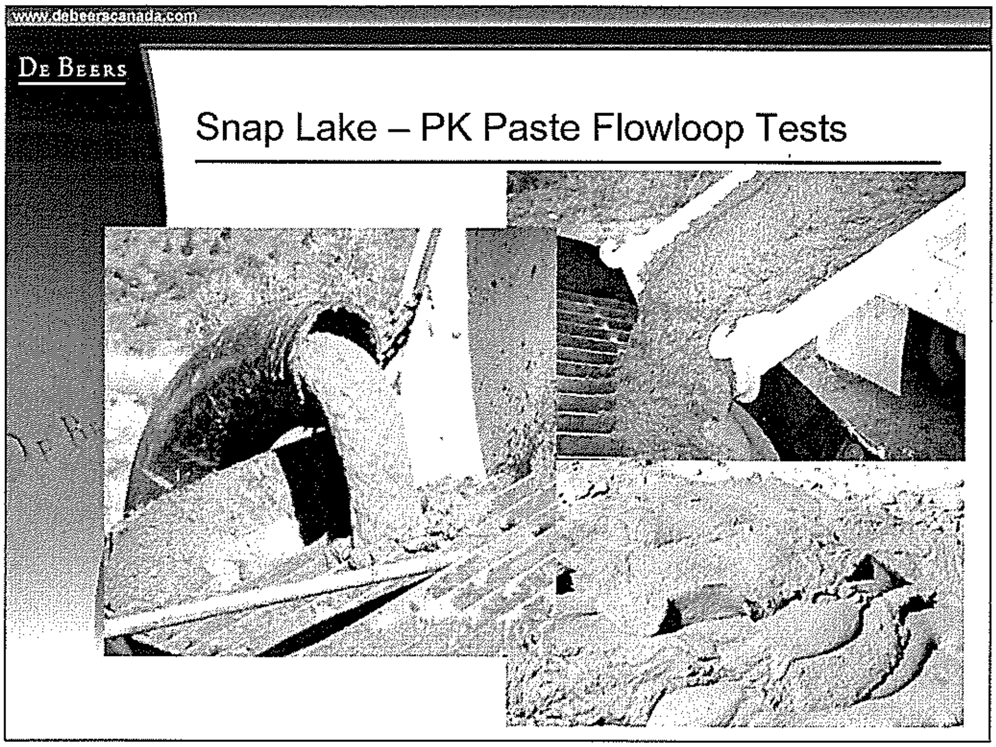


This photograph shows how paste tailings flow. You can see that at the leading edge there is no water being released. Compare this to what you have seen at mines using "conventional" slurry disposal methods and you see how this system reduces the amount of water that must be handled and contained.

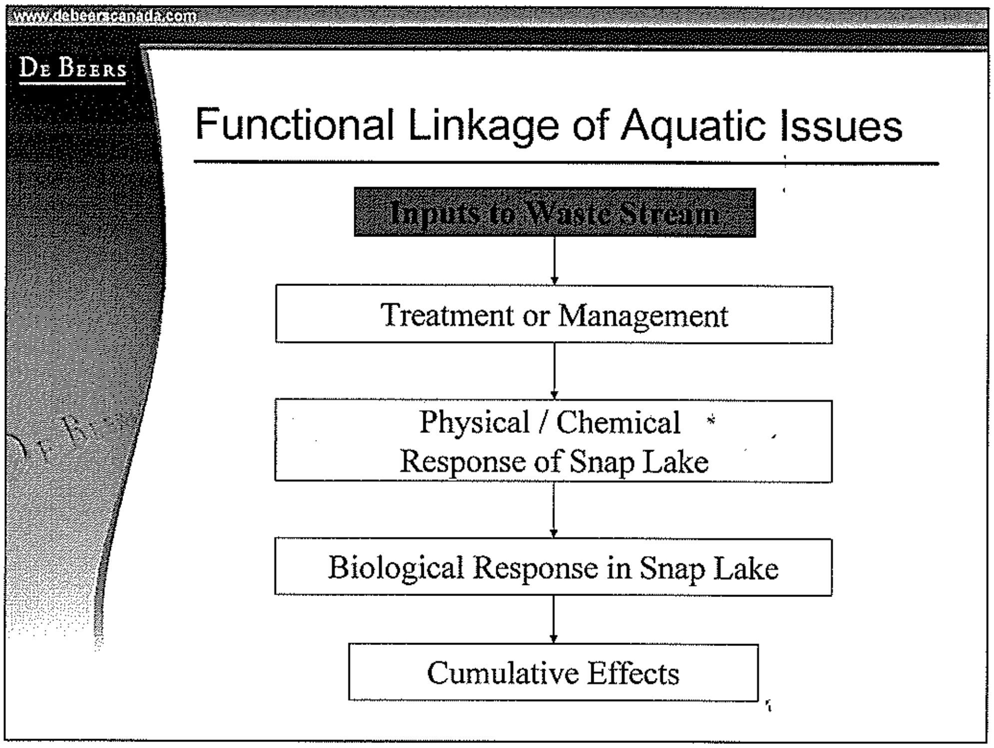
We understand that the material will not flow as far during the winter because it will freeze, and have made allowances in the design by having two pipelines and multiple points for discharge. The system may require more effort to operate, but this effort is worthwhile because it allows us to eliminate a large pond on the surface of the North Pile.



After paste has been on the surface for a short time, anywhere from a few days to a few weeks, if it does not freeze, it will consolidate. In either case, whether frozen or consolidated, equipment will be able to work on the surface. This will allow the cap to be placed a short time after an area is completed.

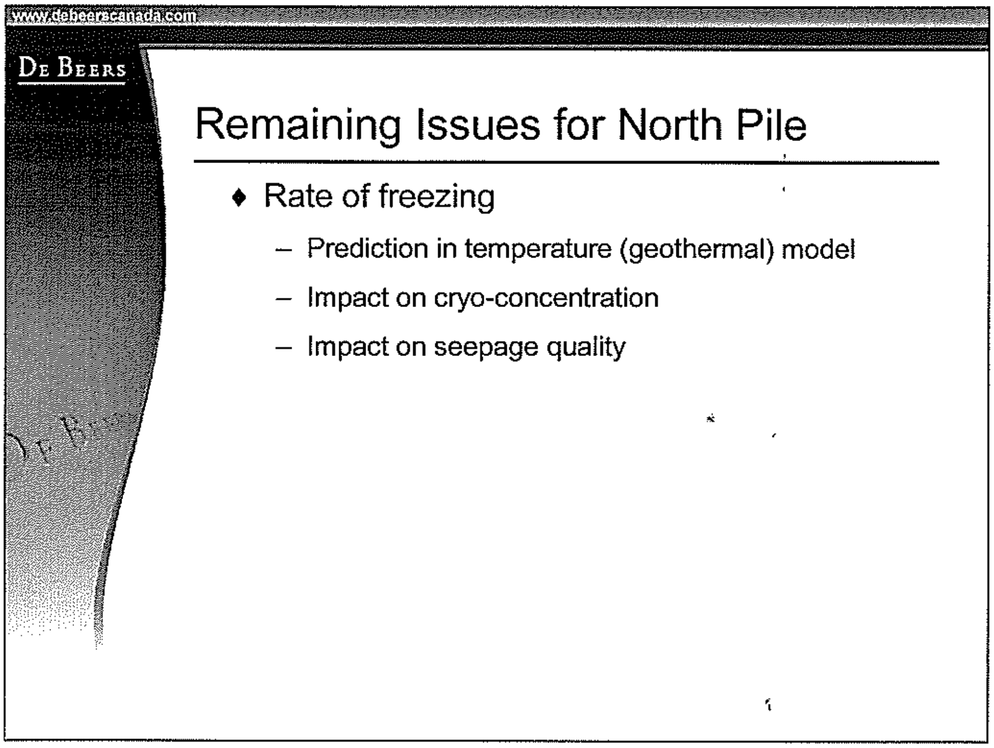


For Snap Lake, Mine Systems Design carried out extensive test work on making and pumping the PK as a paste. As you can see in these photographs, the PK from Snap Lake can be mixed to paste consistency and moved by pipeline.

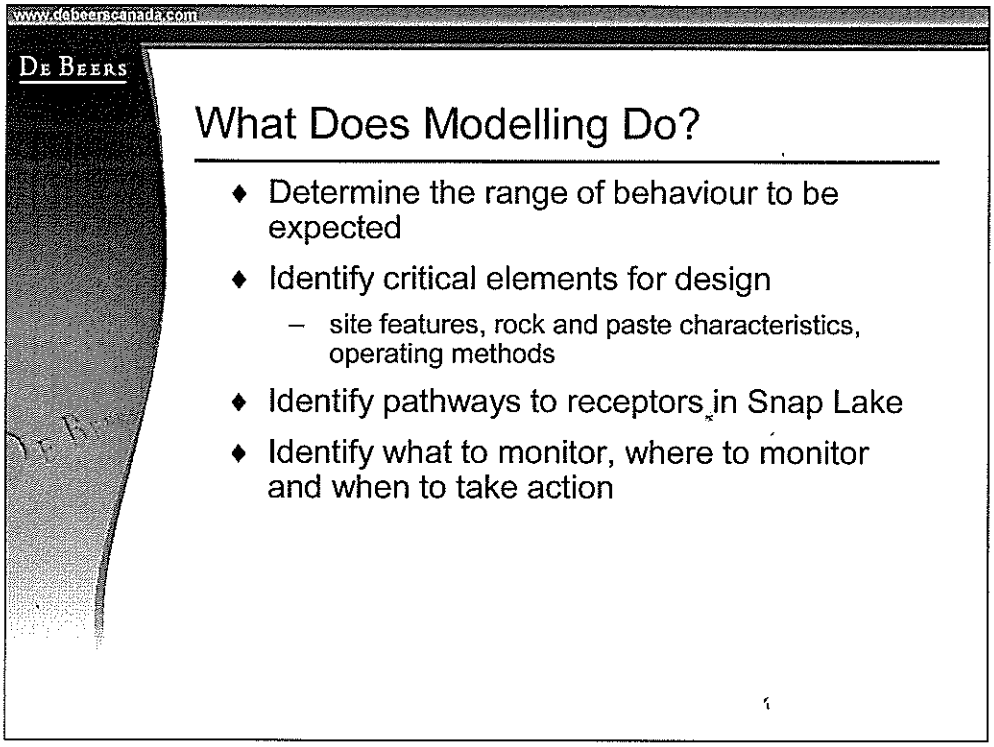


Now that we have seen what the North Pile looks like, we can take a step back to see where the design work fits in to the overall assessment process.

Most of the issues with the North Pile relate to water and the impact on the aquatic life in Snap Lake. The diagram follows the flow of water from sources on the site through the water treatment plant to Snap Lake. In this drawing, which you will see throughout the presentations, water from the North Pile is an input to the waste stream. This discussion falls at the start of the assessment process.

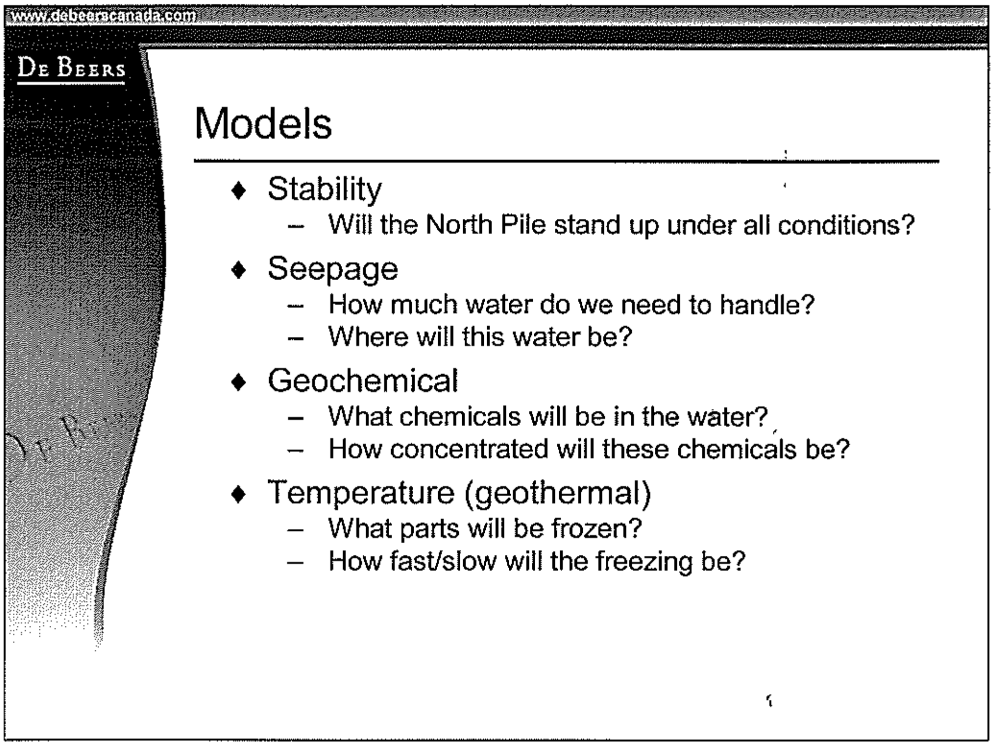


Experts for both De Beers and the interveners reviewed the design for the North Pile. Most of the issues related to this design were resolved, but a few remain for discussion. These all relate to the rate at which the PK will freeze in the North Pile. Specifically, the issues are the prediction of the rate of freezing in the temperature model that was used, how the rate of freezing could impact cryo-concentration and how this could affect the quantity of quality of the seepage released from the North Pile.



As part of the design process, we need to understand the range of behaviour that we can expect, and this is what we have done with our models. Modelling helps us to identify the critical considerations for design in the site features, such as the climate, topography and geology, the PK/paste and rock characteristics, and the operating and construction methods that will be used.

Models allow us to ask "what if" questions to test the behaviour of the system and help us to identify what we should monitor to determine performance in the field, where we can best monitor and when action should be taken.



For most projects, we model or analyze for stability, seepage and geochemical performance. At cold climate or Arctic projects, where freezing is important, we also do temperature modelling, called geothermal modelling, to determine what will freeze and how fast or slow this freezing will occur.

For Snap Lake, the assessment of stability shows the North Pile will be stable for all the expected conditions, including earthquakes.

Seepage modelling was carried out to determine how much water would be handled and where this water would flow. We used thawed conditions, which produce the largest estimate of seepage, when we were looking at how large to make the seepage collection ditches.

The geochemical model was run to understand what chemicals would be in the water and what the range of concentrations would be.

The temperature model was used to provide the temperature profile for the geochemical model so that the chemical reaction rates could be reduced as the temperature decreased and freezing occurred.

As mentioned earlier, the temperature model is an unresolved issue and will now be discussed.

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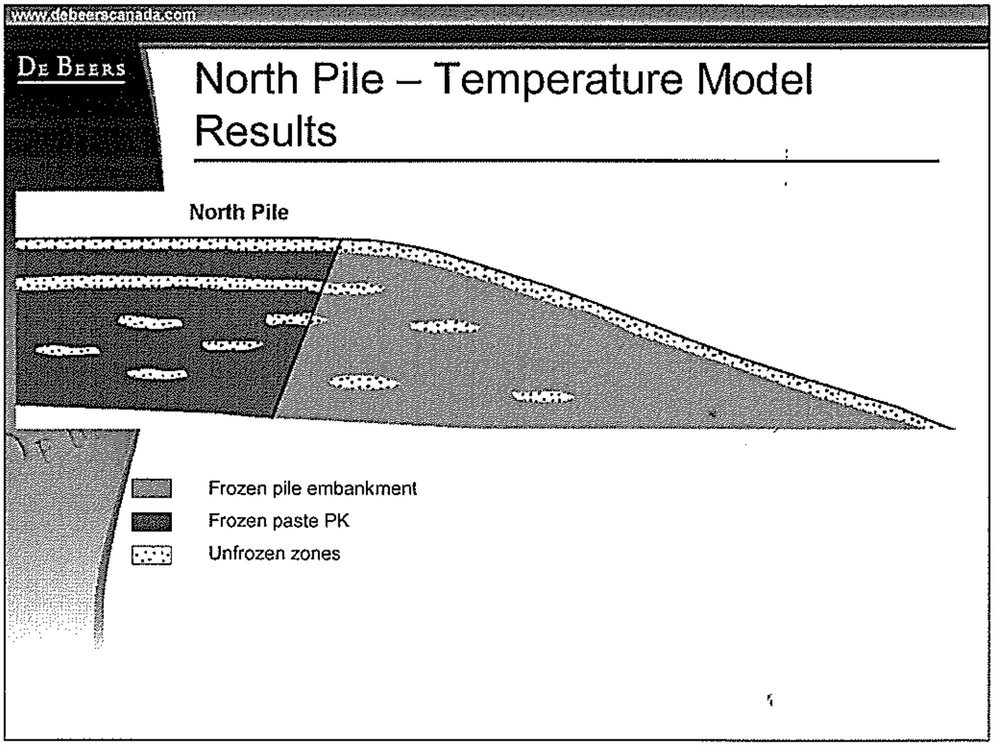
How Much Precision is Needed in the Temperature Model?

- Temperature model shows:
  - frozen and unfrozen zones in the pile
  - paste temperature below 0°C in about two years
  - paste continues to cool for decades
- Uncertainty remains with year-to-year weather prediction

The temperature model was set up using the laboratory measured characteristics of the paste PK and the actual site weather data. The model was calibrated to the actual temperatures measured in boreholes located at the North Pile and this calibration showed that the model gave reasonable results for the conditions we see at the site now. We then ran the model with what we thought would be the most likely conditions during operation and post-closure.

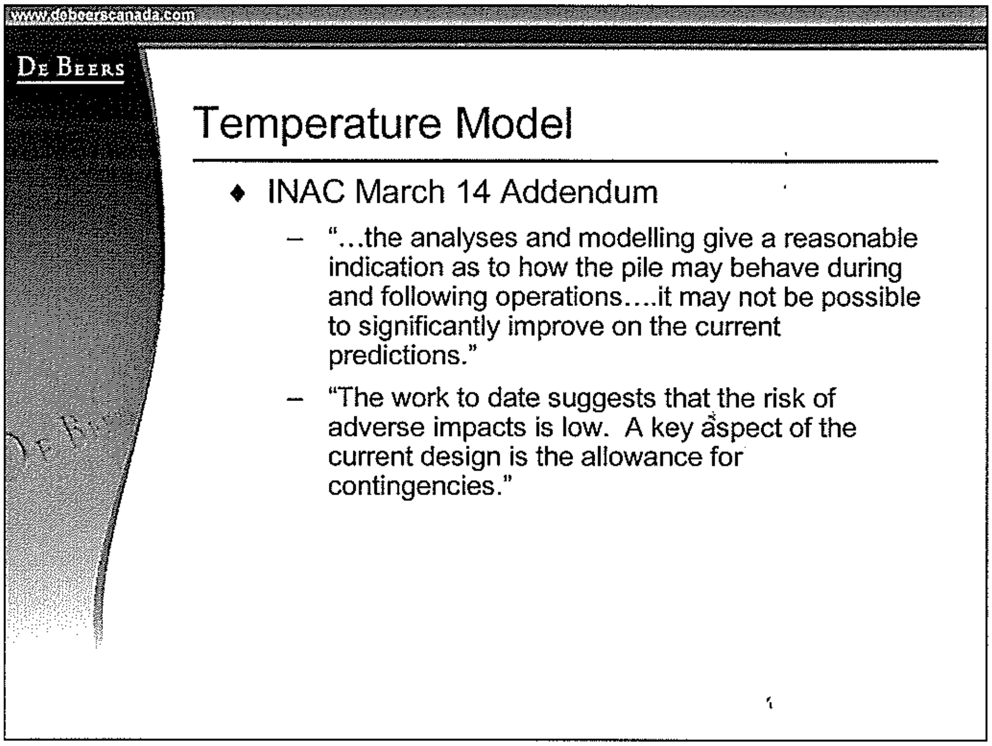
We did various runs changing the surface temperature, looking at the impact of a warmer winter and a colder winter, looking at deeper snow cover, and changing the water content of the paste to see what impact these changes would have on the temperature of the North Pile.

We think that the largest uncertainty left with the model is the prediction of the weather conditions year by year. There is general agreement on patterns and ranges of behaviour and contingency measures.



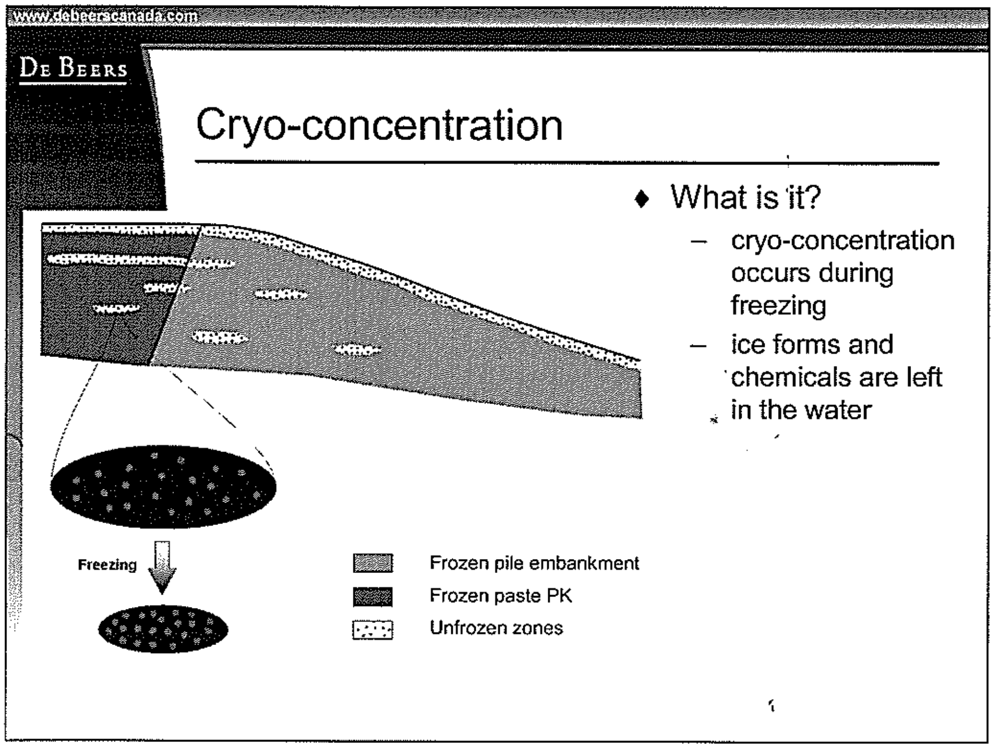
The temperature model shows that there will be frozen and unfrozen zones in the pile since the pile freezes very slowly. We are not certain about the exact distribution of the unfrozen areas in the pile, because this will depend on both the exact pattern of PK placement and the weather at the time of placement, but the operating methods are designed to accommodate this condition.

The temperature model also shows that the PK paste will be below 0 degrees within about two years of it being placed in the pile. The temperature will be near -0.2°C and then continue to cool with time.

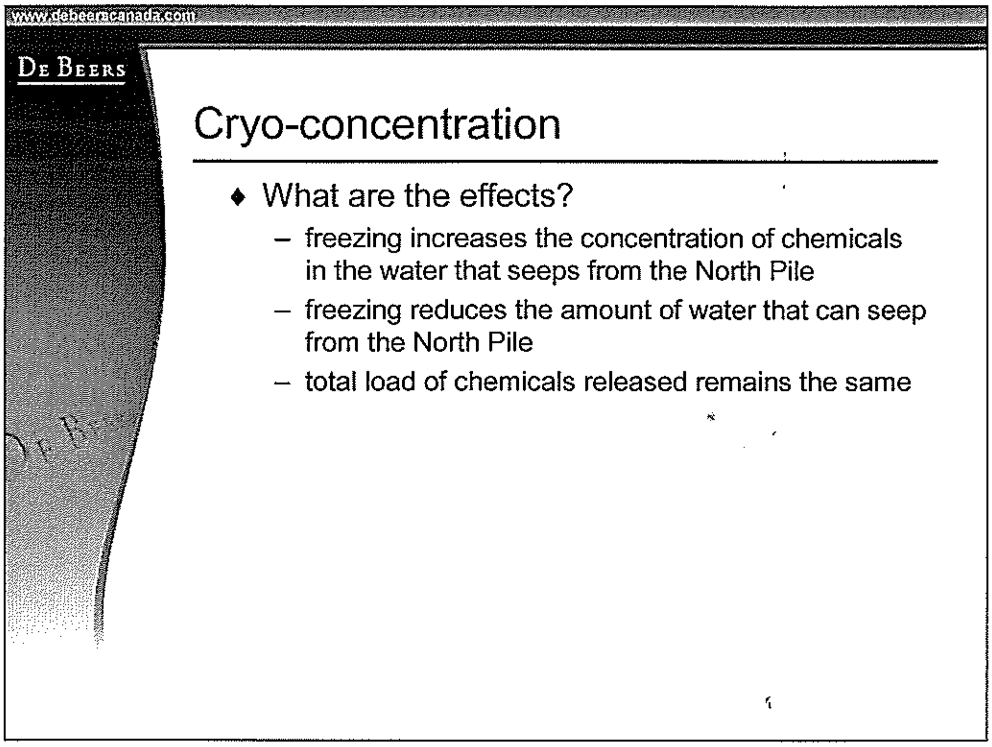


Although there are still some unresolved issues with the temperature model, experts for INAC agree that the model gives a reasonable indication of how the pile will perform and that there will be a low risk of adverse impact.

As previously mentioned, the North Pile will be developed in cells and we will be monitoring the temperature of the paste as it is placed in the starter cell so that we can refine our predictions during the mine life.

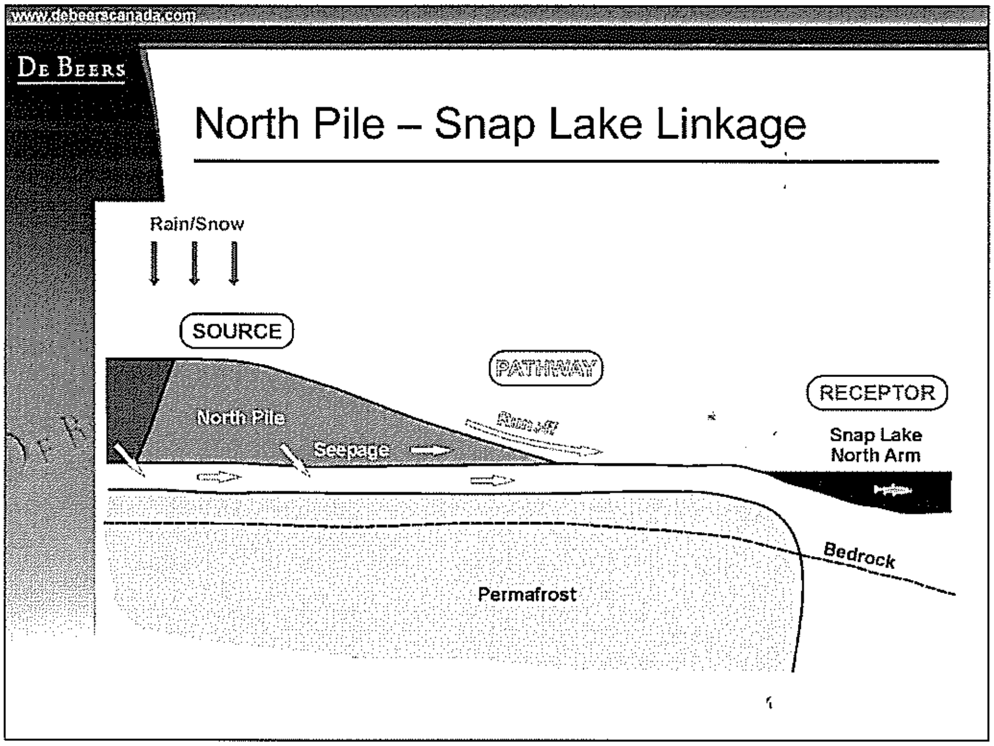


Now I'll move into the second of the three concerns relating to the North Pile, which is cryo-concentration. It can also be called freezing concentration, and occurs during freezing. As ice forms, materials in the water are expelled from the ice and remain in the water.



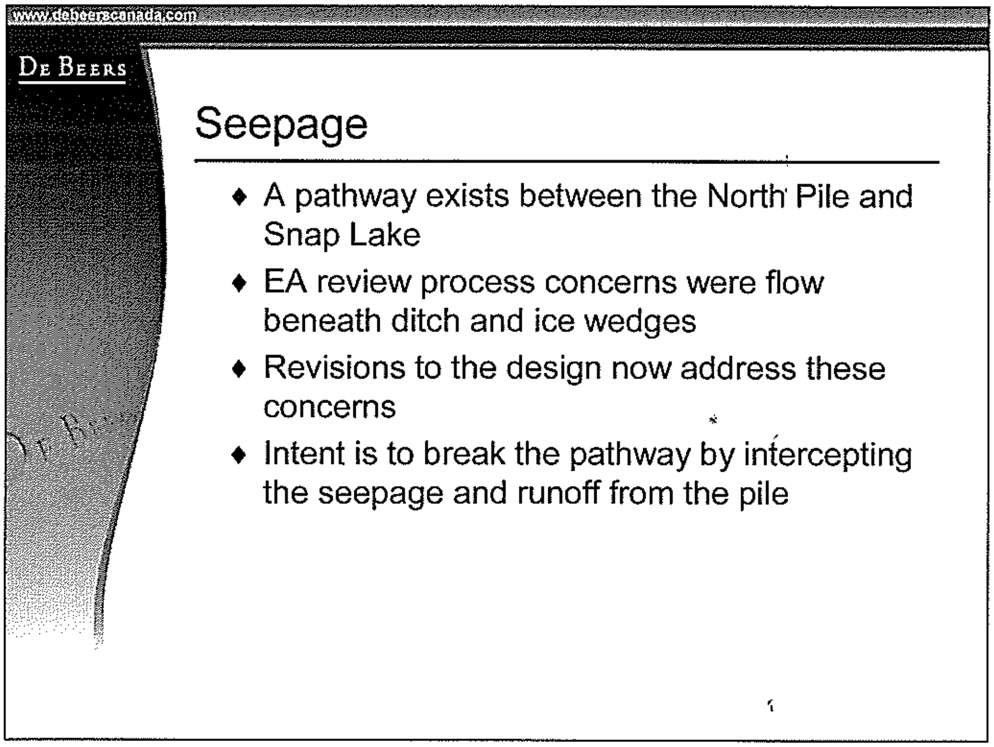
Cryo-concentration is important because it will lead to a higher dissolved solids concentration in the water that comes from the paste in the North Pile. We must also remember that the freezing process will reduce the amount of water that can come from the North Pile since more water will remain in the North Pile as ice. The result will be a smaller amount of water with a higher concentration of dissolved solids, but the total load of the dissolved solids will be about the same.

So, we can see that cryo-concentration relates to the quality of the water seeping from the paste and this leads us to our third issue, which is the seepage from the pile.



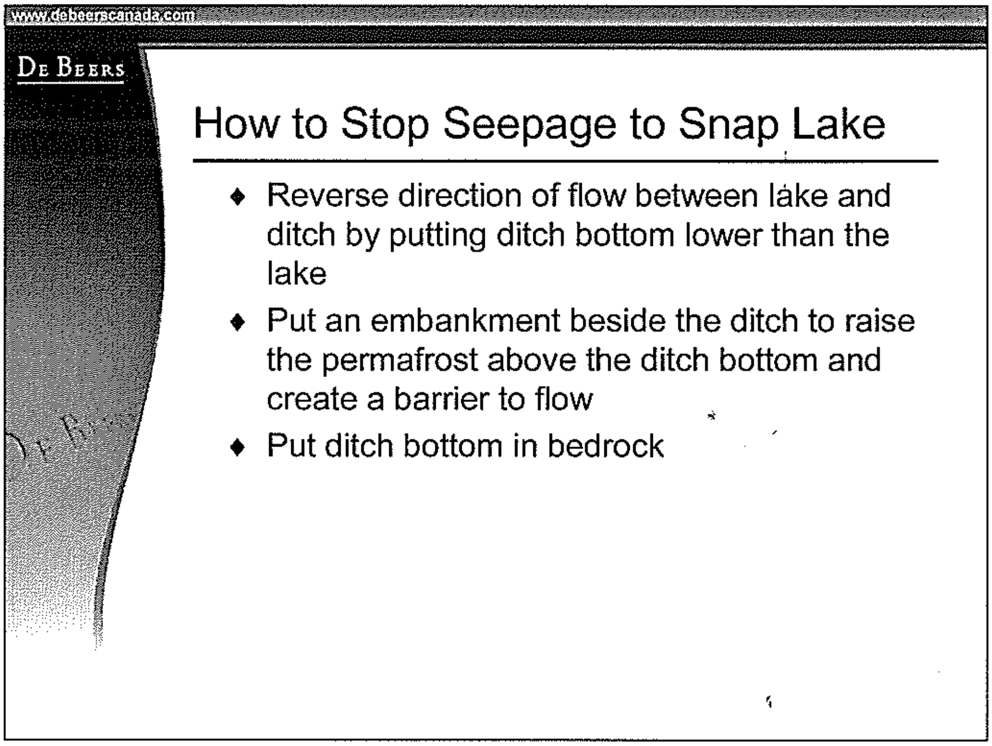
Since the North Pile is located close to the North Arm of Snap Lake, there are two potential pathways between the North Pile and Snap Lake. Water may run off the surface of the pile and this runoff may reach the lake.

Seepage is the movement of water in the ground and this is another pathway between the North Pile and the aquatic life in Snap Lake.



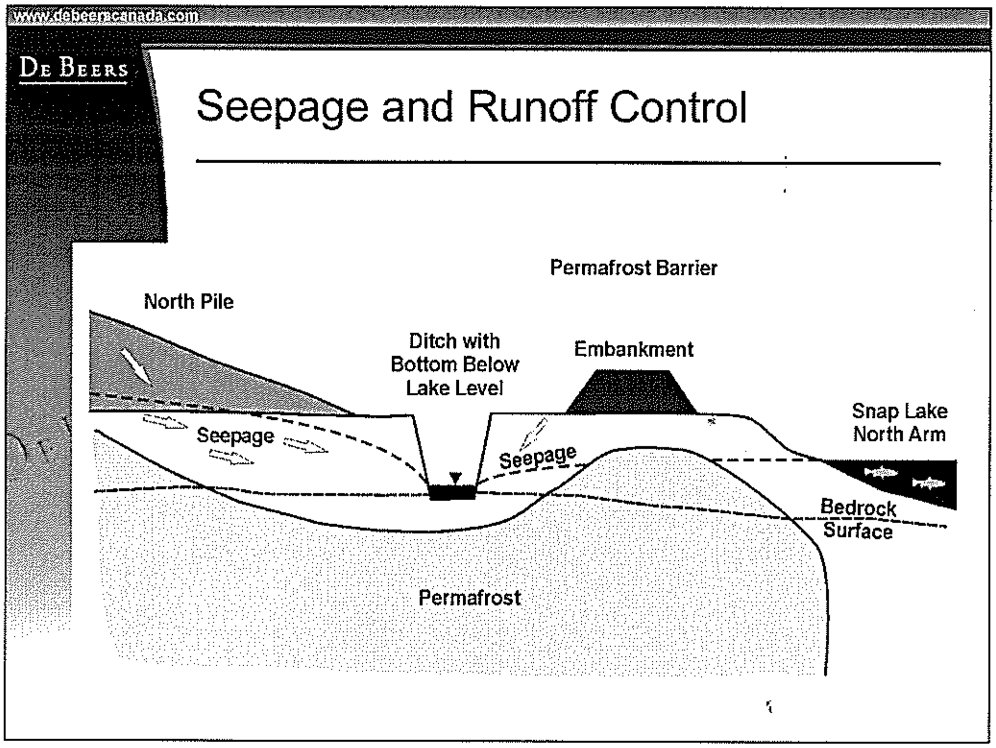
The experts that reviewed the design that was submitted with the EA identified a number of concerns with how we proposed to collect the seepage from the North Pile. The main concerns were related to flow and ice wedges beneath the ditch.

We took these concerns under consideration and adjusted the design to improve the ditch performance. We are confident that we have a good method for breaking the pathway between the North Pile and Snap Lake.

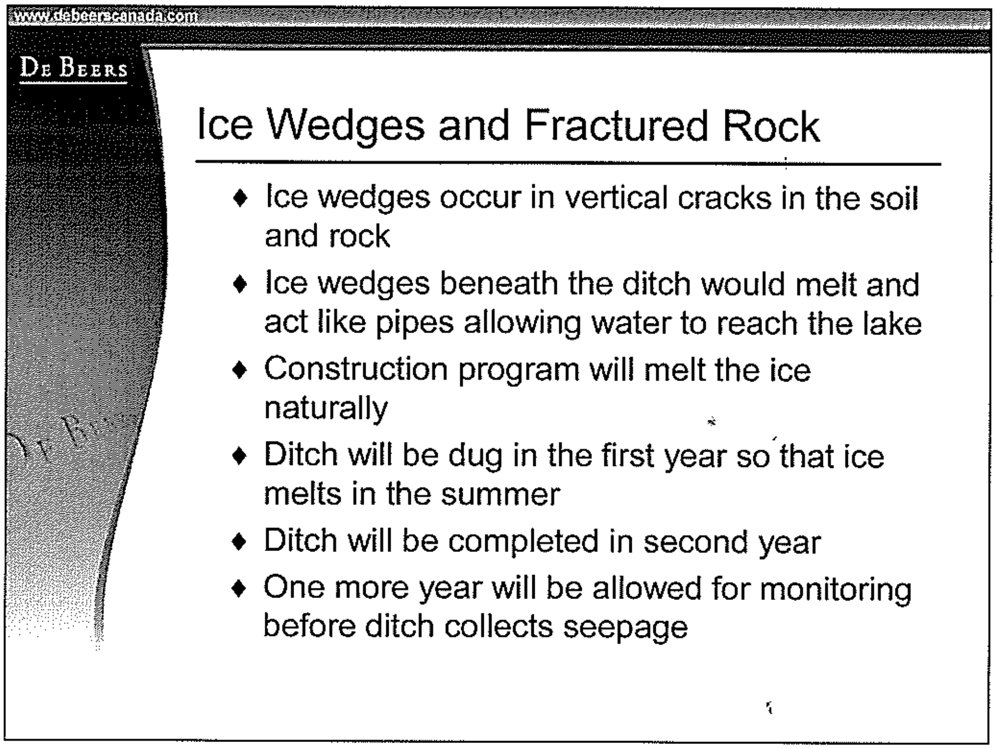


The issue was that water would seep from the ditch into the lake. To resolve the issue, we have reversed the direction of that flow so that it is now from the lake to the ditch. This was done by putting the bottom of the ditch slightly lower than the lake level along as much of the ditch as possible. This also means that the ditch bottom will be in granite bedrock.

As an additional control for seepage, we will build an embankment between the ditch and the lake to raise the permafrost level above the ditch bottom. This creates a barrier to flow, which is shown on the next slide.



Digging the ditch to a depth below the lake will increase the overall size of the ditch. We've estimated the seepage that will flow from the lake into the ditch to be 1 to 2 m^3/day. There will also be about 200 m^3/day of seepage from the North Pile flowing into the ditch. In addition, during the spring, there could be about 6,000 m^3/day of water from snow melt. The ditch itself will have a capacity much larger than this, so there is more than enough capacity to handle small ice accumulations or snow drifting into the ditch. T he embankment that will be placed along the ditch will also provide a year-round access road for ditch surveillance and maintenance. Any blockages will be removed as they occur.



The reviewers were also concerned about ice wedges in fractured rock beneath the ditch. Ice wedges occur in vertical cracks in the soil and rock. If they were to melt beneath the ditch, the resulting hole would act like a pipe allowing water to reach the lake. We designed the construction program so that any ice would be naturally melted during the summer. We will dig the ditch in the first year and then leave it for a year. By removing the soil cover, the ground will thaw much deeper than before and ice deeper in the ground will be melted.

We will finish the ditch in the second year, digging the bottom into the bedrock so we will be able to see and fix any fracture zones. We will then monitor the performance of the ditch for one more year before it will begin to collect seepage from the paste.

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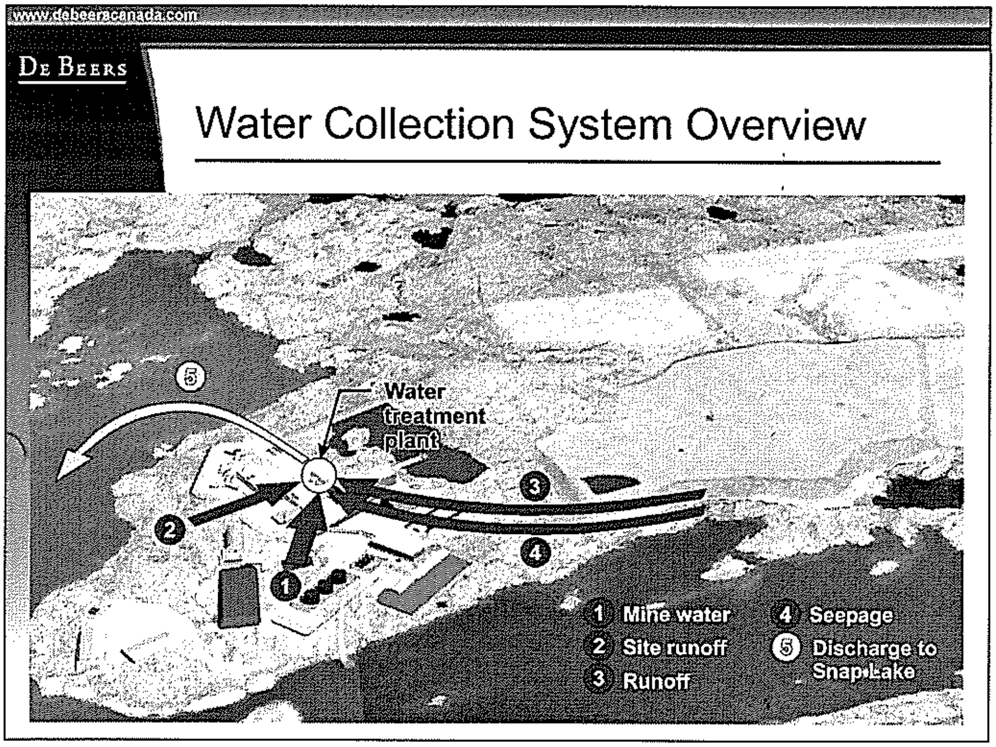
Intervener Comments

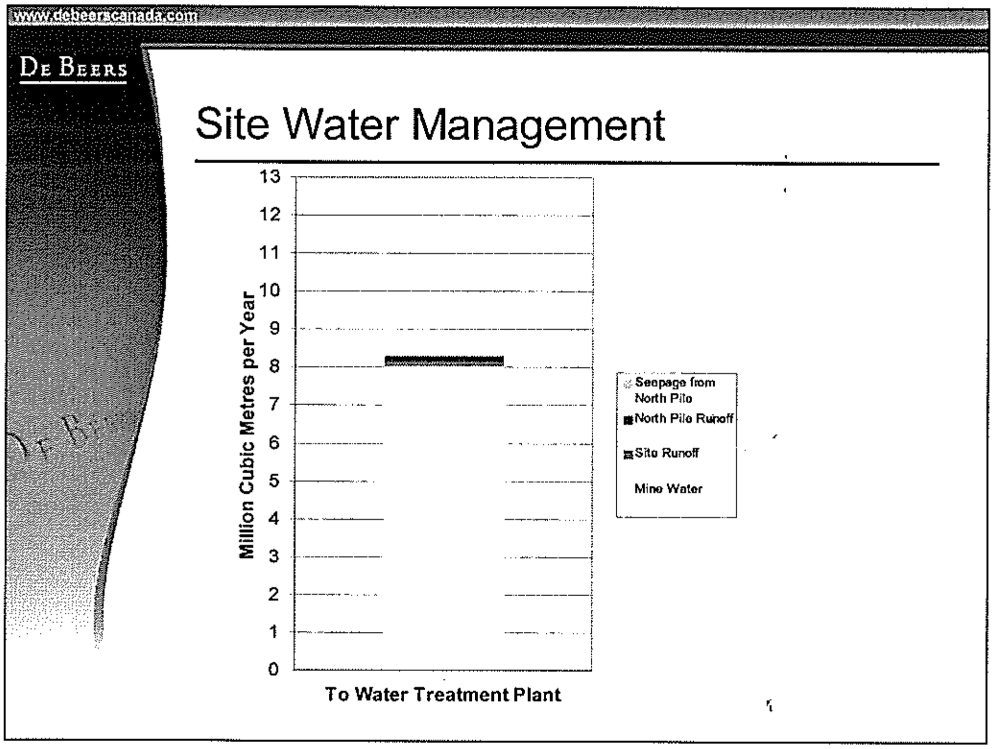
INAC March 14 Addendum:

- "The enhancements to ditch design and commitment to seepage treatment in the long run are critical aspects of DCMI's design proposal."
- "Borehole data have been presented in reasonable detail, and conceptual ditch designs have been provided, along with reasonable arguments as to why North Pile seepage into the North Arm of Snap Lake is unlikely to be significant."

So, with these modifications, we are confident that we have broken the pathway between the North Pile and Snap Lake. As the experts for INAC have concluded, these enhancements are critical to the design and it is reasonable to conclude that seepage is unlikely to be significant.

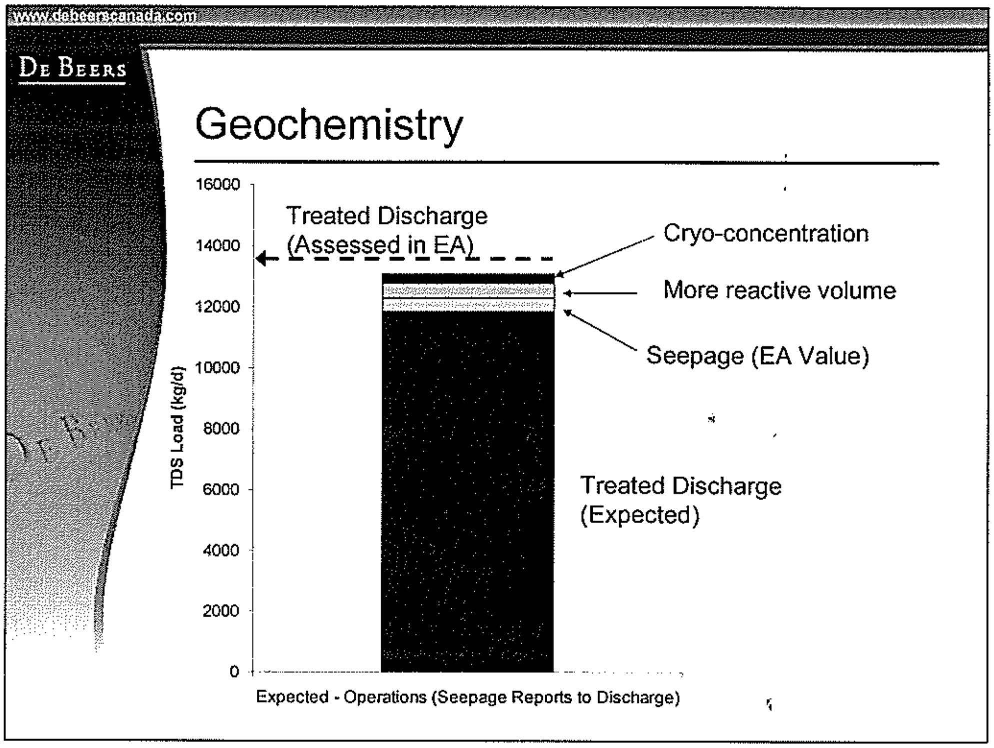


Surface water runoff and seepage from the North Pile are only two of the sources of water at Snap Lake. In terms of aquatic impacts, other inputs are surface runoff from the site and mine water. All of these inputs are sent to the water treatment plant.



In terms of the total quantity of water managed at the site in year 10 when all of the North Pile footprint has been developed, there will be about 8 million m^3 of water pumped from the mine to the treatment plant. This is the yellow bar shown on the graph. There will be about 110,000 cubic metres of runoff from the general site, this is the blue bar on the graph. From the North Pile, there will be about 160,000 m^3 of runoff that will be sent to the water treatment, this is shown by the red bar on the graph. We have also estimated that there will be about 70,000 m^3 of seepage from the paste that will be collected in the ditch and sent to the treatment plant. There is a green line at the top of the graph.

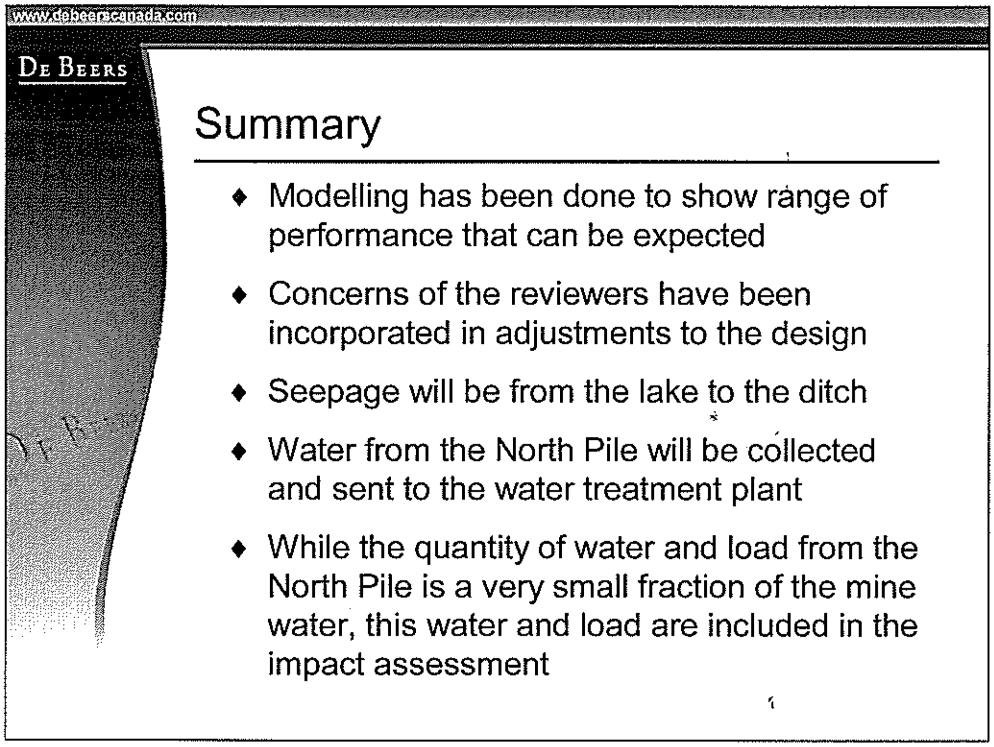
So, in the context of the overall project, the water that we are collecting from the North Pile is a very small component of the water being managed on the site.



This slide shows the distribution of total dissolved solids (TDS) that reports to the water treatment system and is later discharged to Snap Lake. The TDS load is just a measure of the mass of everything dissolved in the water.

The figure shows the potential additional seepage that will be collected, in the ditch, and additional chemical mass resulting from the using the interveners worst case scenarios in the geochemical model. Even when we add these together on the bar graph, we still have values for TDS load that are lower than those assessed in the EA. The TDS load used in the EA is shown by a dotted line.

At closure, only a small fraction of this TDS load (less than 10% of the total load during operations) will be discharged to the lake, and this load will decrease over time as the pile freezes.



In summary, we have listened to the concerns of the reviewers and adjusted the design of the water collection system around the North Pile. We will be constructing the ditch so that there will be a small flow from the lake into the ditch and we are confident that this breaks the pathway between the North Pile and Snap Lake. We will also be monitoring the performance of the North Pile – both the way the pile will be freezing and how the cap will be performing and we will be monitoring both the quantity and quality of the water collected from the North Pile. This information will allow us to refine the predictions of long term performance, and adjust the operation in accordance with DeBeer's Adaptive Management plan.