March 3, 2005

Mr. Joe Carrabba, President
Diavik Diamond Mines Inc.
Box 2498
YELLOWKNIFE, NT X1A 2P8

Dear Mr. Carrabba:

As-Built Report – Process Kimberlite Containment Facility (Phase III)
Diavik Diamond Mines Inc., Water License


Your report will be reviewed and you will be contacted should additional information or clarification be required. If you have any questions, contact me at (867) 669-0506 or email mvlwbpermit@mvlwb.com.

Sincerely,

[Signature]

Stephen Mathyk
Regulatory Officer

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Kathleen Racher, Water Resources Division, DIAND – copy of document
FILE NUMBER: N7L2-1645

Date: March 3, 2005

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Organization: Diavik Diamond Mine Inc.

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March 3, 2005

File: N7L2-1645

Distribution List: Diavik Technical Committee

Dear Sir/Madame:

**Water License Plan Submission and Review**
**Diavik Diamond Mines Inc., Lac de Gras Minesite**

Attached for your review and comments is the aforementioned As-Built Report – Process Kimberlite Containment Facility (Phase III) submitted to the Mackenzie Valley Land and Water Board by Diavik Diamond Mines Inc. under the terms and conditions of Type “A” Water License N7L2-1645, Part C, Item 16.

Please submit your comments in writing by **March 31, 2005** quoting Water License N7L2-1645. Should you find that additional time is required to review this document, please contact me prior to this date.

If you have any questions regarding the above stated report, please contact me at (867) 669-0506 or email mvlwbpermit@mvlwb.com.

Yours sincerely,

[Signature]

Stephen Mathyuk
Regulatory Officer

Attachment: As-Built Report – Process Kimberlite Containment Facility (Phase III)
March 3, 2005

Application N7L2-1645

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<td>Dogrib Treaty 11</td>
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<td>Jason McNeill</td>
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<td>Chris Hanks</td>
<td>NWT Chamber of Mines</td>
<td>669-9293</td>
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<tr>
<td>Dora Enzoe</td>
<td>Akaitcho IMA Implementation Office</td>
<td>867-370-3209</td>
</tr>
<tr>
<td>Sheryl Grieve</td>
<td>North Slave Metis Alliance</td>
<td>669-7442</td>
</tr>
</tbody>
</table>

If there is an error in our contact, please notify our office.
February 28, 2005

Stephen Nielsen, Interim Chair
Mackenzie Valley Land and Water Board
P.O. Box 2130
4910 –50th Ave, 7th Floor
Yellowknife, N.T. X1A 2P6

Dear Mr. Nielsen:

Re: As-Built Report- Processed Kimberlite Containment Facility (Phase III)

Please find attached as per Part C, Item 16 the as-built geotechnical engineering report for the Processed Containment (PKC) Facility. This report address the second 5 m raise for the east and west dams of the PKC. The report has been prepared by Dr Xiaogang Hu, and reviewed by Dr Bing Wang with Nishi-Knon/SNC-Lavalin (NKSL). One hard copy of the report and drawings are provided, as well as 20 CD’s containing the report and drawings in Acrobat pdf format.

Sincerely,

Duke Vetor
Vice President, Operations

Scott Wytrychowski
Manager, Environmental

Attachments:

(1) Hard Copy (CD included within document)
(2) 20 CD Copies in Acrobat pdf format
PROCESSED KIMBERLITE CONTAINMENT FACILITY

PHASE 3 CONSTRUCTION

AS-BUILT REPORT

February, 2005
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1.0 INTRODUCTION

Nishi-Khon/SNC-Lavalin (NKSL) was retained by Diavik Diamonds Mines Inc. (DDMI) to design and provide field inspections for the construction of the Phase 3 Dam raises of the Processed Kimberlite Containment (PKC) Facility.

This facility is designed to store the Processed Kimberlite (PK) materials, consisting of coarse PK and fine PK. The dams forming this facility are designed to be constructed in phases, initiated with two starter dams at the West and East ends of the PKC valley with a crest elevation of 430.0 m (Phase 1). These two starter dams were raised in 2003 to crest elevations of 435.0 m (Phase 2).

In 2004, these two dams were raised again to crest elevation of 440.0 m, constituting the Phase 3 PKC dam construction. The future raises will be in several increments to form a continuous, approximate 6 km long containment dam, to final estimated crest elevation of 460.0 m.

For the Phase 3 PKC dam construction, Lac De Gras Constructors 2003 (LDGC) constructed the upstream part of the dams. Aboriginal Engineering Ltd. performed the Quality Assurance (QA) and Quality Control (QC) survey and A & A Technical Services performed liner installation and associated QC testing.

NKSL provided design and field inspections for the construction of the Phase 3 Dams of the PKC Facility.

DDMI, represented by Messrs J. Reinson, J. Tymstra and T. Deans, was the Construction Manager in charge of the entire day to day construction activities, in terms of construction methods, material supply, directing the contractors and coordinating between different parties. Dr. X. Hu, a senior water resources and cold regions engineering specialist of NKSL visited the construction site several times during the construction. All field modifications and decisions were made jointly by DDMI and NKSL. This report was prepared by Dr. X. Hu and reviewed and approved by Dr. B. Wang, P.Eng. (NWT), a senior geotechnical specialist of NKSL.

1.1 General Information

The detailed design rationale of the dams is presented in the document titled “Processed Kimberlite Containment Facility, Updated Design Report”, dated April 2001, prepared by NKSL.

In general, the PKC Facility is formed within an east-west trending valley by damming up the east and west ends with two high density polyethylene (HDPE) lined impermeable dams constructed on frozen foundations. The dams are to be raised in stages and extended in both south and north directions to form a continuous containment structure.
The facility consists of two components, namely the coarse PK storage area and fine PK pond. The fine PK pond is located in the central valley. The coarse PK storage areas are located generally in the high ground areas, north and south of the fine PK pond. The coarse PK is trucked into the storage areas, initially starting from the north storage area. The fine PK is pumped in a slurry form from the process plant and discharged, through spigots located on top of the dams and on the north and south spigot benches, into the fine PK pond, starting from the West PKC dam. Water within the fine PK pond is recycled through a pump barge, located in the centre of the pond, back into the process plant.

The two starter dams were constructed under different foundation conditions. Details of these construction were described in the “Processed Kimberlite Containment Facility Phase 1 Construction As-Built Report”, dated October 2002, prepared by NKSL.

The Phase 2 construction of the dams consisted of raising of the crests of these two dams from elevation 430.0 m to el. 435.0 m. Details of the raises were documented in the “Processed Kimberlite Containment Facility Phase 2 Construction As-Built Report’, dated February 2004, prepared by NKSL.

The present Phase 3 construction of the dams consisted of raising of the crests of these two dams from elevation 435.0 m to elevation 440.0 m. As a part of the raise, the West Dam was extended by about 60 m in the south and 20 m in the north abutment areas, respectively. The East Dam was extended by about 120 m in the south abutment area and about 340 m in the north abutment area. The design of these raises are consistent with the previous design sections which consisted of a rockfill dam with an HDPE liner sandwiched in between two silty sand zones. The cut-off trenches in the abutment areas were connected with the Phase 2 cut-off trenches and the liner consisted of a base liner and a slope liner.

The planned major construction activities for the Phase 3 dam construction consisted of following components:

- Construct a 10 m wide rockfill zone to elevation 440.0 m for both dams, immediately downstream of the upstream silty sand zone;
- Construct the 17.0 m wide silty sand zone, including liner installation;
- Construct the 5.0 wide rockfill bench for the pipelines;
- Excavate the cut-off trenches in the abutment areas of the East and West PKC Dams, which includes ice-rich soil removal in two areas of the East Dam;
- Remove the temporary emergency spillway on the south abutment of the West Dam, constructed during the Phase 2 PKC dam raise. The new emergency
spillway for the Phase 3 will be located along the north side of the PKC around station 4+200, as discussed in Section 5; and

- Complete the downstream rockfill zones by DDMI.

This As-Built Report provides a description of the major construction activities, field modifications, photos showing different construction activities, material testing results and as-built drawings.

1.2 Construction Summary

Construction of the dam raising consisted of three components, the downstream rockfill raise, the foundation and cut-off trench work in the abutment areas and dam raises along the existing Phase 2 dam. The construction of the dams started on June 12, 2004 and completed on October 9, 2004. The main construction components for these two dams are described in following details:

West Dam:

- Foundation preparation in the abutment areas, including organic stripping;
- Cut-off trench excavation in the abutment areas, base liner installation and trench backfill;
- Downstream rockfill raising;
- Slope liner installation, included bedding material placement;
- Upstream dam zones construction, including upstream rock berm, silty sand zones and transition zone;
- Pipeline bench construction.

East Dam:

- Foundation preparation in the abutment areas, including ice-rich soil excavation and organic stripping;
- Cut-off trench excavation in the abutment areas, base liner installation and trench backfill. (Note that the slope liner at the north abutment area was not installed. This is in agreement with the original plan.);
- Downstream rockfill raising;
• Slope liner installation, included bedding material placement;
• Upstream dam zones construction, including upstream rock berm, silty sand zones and transition zone; and
• Pipeline bench construction.

1.3 As-Built Material Summary

Overall, the as-built quantities were generally more than the estimated quantities. The items that exceeded the estimates by more than 15% consisted of Zones 2, 3 and 4. This increase was caused by the field modifications, as discussed in detail in Section 6.0. However, the total placed material quantity was only 9.4% over the estimated figure, within the original target of ±15%. The details of the comparison is shown in Table 1-1.

Table 1-1: Comparison of Estimated and As-Built Material Quantities for PKC Dam Phase 3 Raise

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit</th>
<th>NKSL Estimated Quantity</th>
<th>LDG As-Built Quantity</th>
<th>Difference (%)</th>
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<tbody>
<tr>
<td>Till and Coarse PK Mixture (Zone 1)</td>
<td>m³</td>
<td>56,000</td>
<td>63,100</td>
<td>12.7%</td>
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<tr>
<td>Coarse PK (Bedding) (Zone 2)</td>
<td>m³</td>
<td>11,000</td>
<td>19,100</td>
<td>73.6%</td>
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<tr>
<td>Transition (Zone 3)</td>
<td>m³</td>
<td>13,000</td>
<td>15,800</td>
<td>21.5%</td>
</tr>
<tr>
<td>U/S Pipeline Bench (Zone 4B)</td>
<td>m³</td>
<td>32,000</td>
<td>40,200</td>
<td>25.6%</td>
</tr>
<tr>
<td>U/S 10 m Rock Supporting Berm (Zone 4A)</td>
<td>m³</td>
<td>118,000</td>
<td>133,700</td>
<td>13.3%</td>
</tr>
<tr>
<td>Till (Zone 5)</td>
<td>m³</td>
<td>45,000</td>
<td>43,200</td>
<td>-4.0%</td>
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<tr>
<td>Trench Excavation (By LDG)</td>
<td>m³</td>
<td>7,000</td>
<td>Included in above items</td>
<td></td>
</tr>
<tr>
<td>Stripping (By LDG)</td>
<td>m³</td>
<td>6,000</td>
<td>Included in above items</td>
<td></td>
</tr>
<tr>
<td>Total Volume</td>
<td></td>
<td>288,000</td>
<td>315,100</td>
<td>9.4%</td>
</tr>
</tbody>
</table>

1.4 Field Modifications

There were no major field modifications made in the field at the time of construction. Some minor modifications were made in the following areas in response to site conditions encountered during construction:
• Foundation and cut-off trench constructions; and
• Downstream rockfill berm construction;

Details of these modifications are discussed in Section 6.0 of this Report.
2.0 MAJOR CONSTRUCTION COMPONENTS

2.1 Foundation Preparation

The foundation preparation of Phase 3 PKC dams consisted of mainly stripping of the organics and removal of boulders in the dam abutment areas.

For the West Dam, the foundation work dealt with the south and north abutment areas only. It was found that the foundation soil condition was mainly upland tundra soil or bedrock with thin overburden cover. The organic cover and boulders were removed to reach competent soil or bedrock (Photo 1). All stripped surface boulders and organic materials were hauled to PKC area or to waste dumps.

Majority of the stripping was carried out by backhoe operations with a Komatsu PC 600 hoe and a Cat 345 hoe.

At the East Dam, the main dam location consisted of two valleys separated by a high bedrock ridge between stations 2+620 and 2+700. The foundation works for the north valley, between stations 2+690 and 2+960, and the area between 2+500 and 2+360 in the south valley, were completed in Phase 1 and 2 constructions. During the Phase 3 construction, the foundation works for the East Dam were mainly for the downstream part of the upper South valley area between stations 2+360 and 2+260 and the north abutment area between stations 2+960 and 3+280.

In the south abutment area, the working area reached the upper portion of the valley. Even though the surface organic cover was still relatively thick in the downstream area of the dam, the underlain soil has become ice-poor. In the area along the cut-off trench, bedrock was at or very near the surface. The foundation work in the south abutment area consisted of stripping of the organic material, generally less than 0.3 m thick and the excavated material was hauled to the waste dump area (Photo 2).

In the north abutment area, there was a localized bog soil deposit between stations 3+020 and 3+080. Frost mounds were present in this area. The area between stations 3+100 and 3+300 consisted of mainly bedrock outcrops with some localized depressions that contained thicker organic materials.

In the ice-rich area, a trench was first blasted and excavated to examine the extent of the ice-rich material (Photo 3). The observation revealed that massive ground ice existed in the form of frost mound ice core (Photos 4 and 5), ice wedge (Photo 6) and segregated ice lenses. The ice-rich soil in the upstream area was blasted and material excavated (Photos 7 and 8). After removal of the material, the foundation was founded on ice poor soil. The excavation was between 2.5 and 3 m in depth.
In the bedrock outcrop area between stations 3+100 and 3+300, localized organic materials deposited in the depressions were excavated and surficial loose rock and boulders were excavated (Photos 9 and 10).

2.2 Cut-off Trench Construction

All cut-off trenches were in the abutment areas. The design specified the cut-off trench to be excavated to a minimum depth of 1 m into the bedrock or ice-poor soil.

For the West Dam south abutment, the constructed cut-off trench was about 60 m in length. For the north abutment, the trench was about 20 m in length. For both abutments, the bedrock surfaces were either exposed or with a very thin cover. The soil cover was generally less than 0.5 m in thickness. The surface vegetation and loose soil were first removed with a backhoe and a cut-off trench was blasted and excavated to the required depth thereafter, about 2.0 m in depth (Photo 11). After removal of the blasted material, the entire trench was backfilled with compacted silty sand (till) in 0.5 m lift (Photos 12 and 13). The cut-off trenches were re-excavated to a depth of 2 m or to bedrock, re-shaped and bedded with coarse PK for liner installation (Photo 14). The trenches were connected with the existing trenches constructed in Phase 2 construction.

For the East Dam south abutment, the constructed cut-off trench was about 120 m in length. The cut-off trench in the north abutment area was much longer, about 320 m. The south abutment area consisted mainly of a bedrock outcrop with thin overburden, generally less than 0.3 m. In the north abutment area, the ground condition was more complicated, consisted a bog area between stations 3+020 and 3+080 and mainly a bedrock outcrop between 3+100 and 3+280. In the bog soil area, the ground was ice-rich and in the bedrock outcrop area, the surface consisted large amount of boulders and heavily fractured rocks.

In the north abutment area, the cut-off trench was excavated into the ice-poor soil, with a excavation depth between 2 and 2.5 m (Photos 15 and 16). After the removal of the upstream ice-rich soil, the area was backfilled with compacted Zone 5 (till) material (Photo 17). In the northern part of the north abutment area and in the south abutment area, the cut-off trench was drilled and blasted in the bedrock (Photos 18 and 19). The blasted depth was about 2 m. The trenches were machine cleaned of loose materials and reached competent bedrock (Photos 20 and 21). These trenches were also backfilled with compacted Zone 5 (till) material (Photo 22).

After completion of the backfill, the trenches were re-excavated within the backfilled material to a depth of about 2 m (Photo 23). These trenches were shaped (Photo 24 prior to installation of the bedding material for the liner installation.
All final cut-off trenches were machine cleaned for mass excavation and labour cleaned for any loose debris. Soils at the bottom of the trench were not sampled because, in all cases, the bottom material was the backfilled compacted Zone 5 material (till).

2.3 Backfill of Cut-off Trenches

The lower bedding material was placed on the slope with a backhoe to form a smooth upstream and bottom surface for the liner installation. After the bedding material was placed on the slopes (Photos 25 and 26), liner was installed in the trenches (Photo 27), and a 300 mm thick layer of bedding sand (Zone 2) was placed on the slope to protect the liner. Zone 5 material was placed in 0.5 m lifts and compacted with a 10 t vibratory compactor, with minimum 6 passes to reach the required density (Photos 28, 29, and 30).

2.4 Liner Installations

The liner installation for the Phase 3 PKC dam constructions consisted two types, the base liner in the cut-off trenches and slope liner on dam faces.

For the cut-off trenches, after shaping of the slopes with machine and labourers, (Zone 2) bedding material, 300 mm thick, was placed on the upstream slope of the trench (Photos 25 and 26). The liners were installed, starting from the cut-off trench connecting point, to the end of the trenches (Photo 27). Prior to the liner installation, liner edges at all connection points were exposed (Photo 31) and liner was installed from the bottom of the trench, following the upstream slope of the trench and extended 1.5 m beyond the edge of the trench, for joining with the slope liner (Photo 27). All liners joints were wedge (double seam) welded except at corners where liner joints were extrusion welded. Upon completion of liner installation, the entire liner was covered with 400 mm of Zone 2 bedding material.

After the Zone 5 silty sand below the liner was constructed, the slope was shaped to 2.5(H):1(V) (Photos 32 and 33). Due to the presence of cobbles in the silty sand (till) material, a layer of Zone 2 bedding material, 300 mm thick, was placed, as the lower liner bedding (Photo 34). Prior to installation of the slope liner, all liner edges installed during the Phase 2 construction were exposed (Photos 35 and 36). These edges were carefully inspected for any damages and manually cleaned for remaining bedding material and snow (Photo 37). The slope liner was then installed on the prepared bedding slope, if there was no snow (Photo 38). Otherwise, the snow was cleared off from the bedding material prior to installation of the liner (Photo 39). All slope liner panels were wedge welded (Photo 40) and the double seam pressure tested (Photo 41).

The liner edges between the base liner in the cut-off trench and the original starter dam liner installed during Phase 2 construction were extrusion welded (Photos 42 and 43). These welds were tested by vacuum method.
Following installation, the liner was covered with 400 mm of Zone 2 bedding material placed with a backhoe (Photo 44) and checked constantly to verify the thickness of the placed layer (Photo 45).

After installation of the slope liner and associated cover material, Zone 1 material was placed and compacted in the upstream zone (Photo 46) to form the platform for the construction of the upstream pipeline bench.

The final stage of liner installation consisted of protecting the liner on the crest of the dam by placing a layer of plywood, followed by a 0.5 m bedding material berm (Photo 47).

In general, all bedding materials were inspected carefully. All lower bedding surfaces were manually raked to form a smooth surface and to remove any large boulders and cobbles before liner installation. The upper bedding layer was placed with a backhoe in a single lift to avoid damage to the installed liner.

Because all the liner work was conducted during relatively warm weather, freezing of the bedding material was not encountered.

All liner wedge weld double seams were tested by the subcontractor, A & A Technical Services, and NKSL inspectors witnessed all tests. All extrusion welds were tested by vacuum method. The entire liner surface was checked thoroughly before cover material was placed to ensure that there were no defects. All damaged areas, including holes, blisters, cracks and machinery damage were patched with the same HDPE material and extrusion welded. All destructive tests were carried out and reported to DDMI in accordance with the requirements of the Engineering Specifications and QA/QC Plan for The Construction of Phase 3 Processed Kimberlite Containment Facility.

2.5 Zone 1 and 5 (Silty Sand Zones) Construction

The Phase 3 dam construction consisted of two silty sand zones, one below the liner (Zone 5) and one above the liner (Zone 1). The Zone 5 was a till material farmed from the till dumps and the Zone 1 was a mixture of till and coarse PK materials.

In general, these materials were hauled with 777 and D300 trucks (Photos 48 and 49), levelled by a D6 dozer and compacted with a 10 t compactor (Photo 50).

The Zone 5 till material was compacted in 0.5 m lifts directly against the transition zone (Zone 3) (Photos 51 and 52). All lifts were overbuilt by about 1.0 m to ensure that the entire zone was compacted in accordance with the specifications. The slopes were trimmed in two stages using a backhoe (Photos 53 and 54). After the completion of the slope trimming, the surface was carefully inspected and grade markers installed for the bedding material placement (Photo 55).
The Zone 1 was constructed after the liner and cover was installed. The grade line was marked on the slope and along the upstream edge (Photo 56). Material was placed using the same construction method as Zone 5 (Photos 57 and 58). Large amount of frozen chunks were found during the construction of 438.5 m lift of the West Dam, between stations 5+230 and 5+970 (Photo 59). These frozen chunks were removed to the satisfaction of the Construction Manager (Photo 60).

During the construction of these two silty sand zones, the lift thickness was controlled in 0.5 m and the compaction met or exceeded the required four passes with a 10 t compactor.

2.6 Zone 3 - Transition Zone Construction

The transition zones for both dams included only the slope transition zones against the rockfill buttress.

The transition materials for the rockfill slopes were constructed after raising the rockfill for 2 to 3 meters. The majority of the transition material was placed with a backhoe and raised and compacted along with the Zone 5 material (Photos 61, 62 and 63). Occasionally, the transition was placed by the D6 dozer and overbuilt to ensure the compaction (Photo 64). The overbuilt portion was later trimmed and placed in the subsequent lift. The transition material was hauled with D300 trucks and compaction was carried out by a 10 t compactor, with minimum four passes (Photos 61 and 64).

2.7 Zones 4A and 4B – 600 mm Minus Rockfill Construction

The planned rockfill for both dams in 2004 included two components: construction of upstream 10 m wide rockfill (Zone 4A) buttress berms to elevation 440.0 m and installation of 5 m wide pipeline benches (Zone 4B) upstream of the Zone 1 material.

The Zone 4A material was obtained either from the clean rock dump or from the A154 pit. The rockfill in the 10 m wide upstream rockfill buttress berm was constructed between June and July of 2004 for the West Dam and between July and August 2004 for the East dam. The rock was hauled by 777 trucks, and placed in 1.0 m lifts (Photos 65 and 66). The material was compacted by a 10 t compactor with six passes.

The upstream slopes of the rockfill were trimmed to a 1.5(H):1(V) slope for transition material placement (Photo 67). The trimmed material consisted of large amounts of oversized and segregated rock particles and were placed along the downstream edge of the constructed buttress berm (Photos 67 and 68). This material was directly pushed to the downstream slope of the constructed rock buttress berm (Photo 69), as directed by the Site Manager. This resulted in a segregated zone of rock along the downstream rockfill berm slope (Photos 70 and 71).
The Zone 4B rockfill pipeline benches were constructed at the end of the each dam construction. The material was placed in a single lift. The material was hauled with 100 t trucks and placed with a D10 dozer. There was no specific compaction requirement for this zone and the material was compacted by machine travel. Because these benches will be covered with fine PK in the near future, the slopes did not require trimming.
3.0 CONSTRUCTION MATERIALS AND PLACEMENT

The construction of the dams involved several materials, namely HDPE liner, Zone 1 - silty sand mixed with coarse PK, Zone 2 - bedding material, Zone 3 - transition material and Zones 4A and 4B – rockfill, and Zone 5 – Silty Sand (till).

3.1 Zone 1 – Silty Sand Mixed with Coarse PK

The Zone 1 material was a mixture of 50% silty sand and 50% coarse PK by volume. The silty sand was borrowed from till stockpiles created during stripping of the A154 open pit. The silty sand material was a well graded material with cobbles and boulders. Boulders larger than 0.3 m were removed during the process. The coarse PK was a 10 mm minus material from the processing plant.

Silty sand material was placed in 0.5 m lifts and compacted with 10 t vibratory compactors, with minimum of four passes.

3.2 Zone 2 - Bedding Material

Bedding material consisted of coarse PK. This material was a fairly uniform material with maximum size of about 10 mm and the minimum size of about 1 mm. The bedding material was placed in a single lift on either side of the liner. During placement, thickness was constantly monitored to avoid machinery damages to the liner.

3.3 Zone 3 - Transition Material

Transition material was a 300 mm minus crushed rock. The transition material was placed in 0.5 m lifts and compacted with a 10 t vibratory roller, minimum 4 passes.

3.4 Zones 4A and 4B - Rockfill

Rockfill was run-of-mine country rock. Two types of materials were used, 1000 mm minus material and 600 mm minus material. The 1000 mm minus material (Zone 4B) was used in the pipeline bench rockfill zone. This material was placed in a single lifts and compacted by machine travel.

The 600 mm minus material (Zone 4A) was used in the 10 m rock buttress berm. Material was trucked to the dam site using 100 t haul trucks, spread by dozers, placed in 1.0 m lift and compacted by 10 t vibratory rollers, minimum six passes. During the placement, oversized material and material contaminated by frozen soil, snow and ice were rejected.
3.5 Zone 5 - Silty Sand (Till)

Silty sand was borrowed from either till stockpiles created during stripping of the A154 open pit or from the open pit directly. The till material was a well graded silty sand with cobbles and boulders. Boulders larger than 0.3 m were removed during the placement process.

Silty sand material was placed in 0.5 m lifts and compacted with 10 t vibratory compactors, minimum four passes. To backfill the cut-off trench after the liner installation, material was placed in a width that would allow the roller to compact the material without damage the liner, and compacted with the 10 t vibratory roller.

3.6 HDPE Liners

The liners used for construction consisted of two types of material: high density polyethylene (HDPE), 60 mil (1.52 mm thick), black, double-sided textured and single side textured sheets. The single sided textured liner was restricted to be used in the cut-off trenches only and the double sided textured liner was used on the slopes for stability reasons. The liner sheets were either wedge welded or extrusion welded as described previously in section 2.4. All seams were tested either by pressure or vacuum method, depending on the type of the welds.
4.0 MATERIAL TESTING AND RESULTS

Materials subject to laboratory testing included the Zones 1, 2, 3, and 5. These materials were tested for gradations and moisture content at defined frequencies, as required by the QA/QC Plan. The tests were carried out by A & A Technical Services.

Since smaller volumes were involved in the dam constructions, 4 samples of Zone 1, 5 samples of Zone 2, 7 samples of Zone 3 and 26 samples of Zone 5 were collected in total. All samples tested for Zones 1, 2, and 3 were within the specified gradation ranges. Most of the Zone 5 material samples tested were also within the specified gradation range. Only four samples of Zone 5 showed a lower fines content, between 10.5% and 14.5%. The one with 10.5% of fines content was obtained from a stockpile area and in place samples were all higher than 13%. These were accepted because the samples were from single points.

Only visual examination of Zones 4A and 4B rockfill materials were carried out during placement. Based on field observation, they met the specified gradation limits.

Table 4-1 presents material test locations. The detailed test results are summarized in Appendix B. The Linter Test reports are presented in Appendix C.

<table>
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<tr>
<th>Material</th>
<th>West Dam</th>
<th>East Dam</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Zone 2</td>
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</tr>
<tr>
<td>Zone 5</td>
<td>14</td>
<td>12</td>
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</tbody>
</table>
5.0 TEMPORARY EMERGENCY SPILLWAY

The temporary emergency spillway constructed in Phase 2 PKC dam construction was removed prior to the construction of the Phase 3 dam raise. There was no need for new spillway construction in Phase 3. A depression, located along the North Haul Road was utilized to function as the temporary spillway. This depression was wide (about 160 m) with an invert elevation of 438.32 m and has sufficient capacity to convey the design flow should it be needed in case of emergency. The details of the emergency and overflow spillways are shown on the attached as-built drawings.
6.0 FIELD MODIFICATIONS

There was no major field modifications made in the field. Some minor modification were made in the following areas in response to site conditions encountered during construction:

- Foundation and cut-off trench constructions;
- Downstream Rockfill berm construction; and

6.1 Foundation and Cut-off Trench Constructions

The cut-off trenches for all abutments were first excavated to the required depth. The entire trench and foundation areas were then backfilled with the compacted thawed Zone 5 till material. The trench was re-excavated to a depth of 2 m. This modification of the construction method was mainly to simplify the construction and to ensure that the material around the trenches were properly compacted.

The ice-rich soil found in the north abutment of the East Dam, between stations 3+020 and 3+080 were removed from the upstream area.

6.2 Downstream Rockfill Buttress Berm Construction

The designed crest width of the downstream rockfill buttress was 10 m. To allow for the traveling of large 777 haul trucks, the rockfill berm for the East Dam was overbuilt between 12 to 15 m, to meet the safety requirement.
7.0 CONCLUSIONS AND RECOMMENDATIONS

The Phase 3 construction of the PKC Facility satisfied design requirements. The as-built dam crest and downstream conditions are showing on Photos 72, 73, 74, and 75.

The following is recommended for the PKC facility:

- The downstream rockfill at the West dam is currently at elevation 433.5 m and the East Dam is at about 434.2 m. It is recommended that these rockfill zones be constructed to el. 440 m as required to complete the Phase 3 raise prior to the next raise. Adequate QA/QC procedures should be followed to ensure quality construction. Should these zones be raised during the winter, snow should be removed prior to the placement of the rockfill as large amount of snow are expected to accumulate along the downstream slope of the buttress berm. As-built records should be kept and reviewed by qualified professionals.

- Performance of the PKC dams should be monitored following the Operations Plan.
8.0 CLOSURE

The PKC Phase 3 dam construction was carried out under the supervision of Messrs. J. Tymstra and T. Deans and management of Mr. J. Reinson of DDMI. Dr. X. Hu of NKSL provided periodic site visits and technical consultations and Messrs. C. Leycuras, O. Sanio, A. Stewart and Dr. T. Iryo of NKSL performed field inspections.

This report was prepared by Dr. X. Hu and reviewed and approved by Dr. B. Wang, P.Eng.

Respectfully submitted,

Xiaogang Hu, Ph.D. Bing Wang, Ph.D., P.Eng. (NWT)

Senior Water Resources and Cold Regions Engineering Specialist Senior Geotechnical Specialist
9.0 REFERENCES


NKSL, 2004, PKC Facility Phase 3 Construction Drawings (Rev 0):

<table>
<thead>
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<td>PKC Facility – Phase 3 Construction, PKC West Dam, Plan, Profile and Detail</td>
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