## Review Comment Table

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<th>Board:</th>
<th>WLWB</th>
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<tr>
<td>Review Item:</td>
<td>Diavik - Processed Kimberlite Containment Facility - North Dam - Modification Request (W2015L2-0001)</td>
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<tr>
<td>File(s):</td>
<td>W2015L2-0001</td>
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<td>Proponent:</td>
<td>Diavik Diamond Mines Inc.</td>
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<tr>
<td>Document(s):</td>
<td>PKC North Dam Modification Request (1 MB)</td>
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<td>Item For Review Distributed On:</td>
<td>Jan 4 at 17:11 Distribution List</td>
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<td>Reviewer Comments Due By:</td>
<td>Feb 19, 2016</td>
</tr>
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<td>Proponent Responses Due By:</td>
<td>Mar 2, 2016</td>
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### Item Description:

The Wek'eezhii Land and Water Board (WLWB) received a modification request from Diavik Diamond Minds Inc. (DDMI) on December 9, 2015, to place Type III waste rock along the North Dam.

**Update (February 19, 2016):** The WLWB hired SRK Consulting to review the technical aspects of the modification request for the WLWB; SRK and Board staff jointly prepared the WLWB staff comments and recommendations. SRK was provided the following background materials: PKC Design Report; PKC Operating Plan; relevant excerpts from the approved ICRP v3.2, Waste Rock Management Plan (Version 6); WRSA Design Report (previously referred to as North Country Rock and Till Storage Report, 2001); and the Water Licence (W2015L2-0001). Staff also updated SRK on the Inspector's recent findings that DDMI is not in compliance with the approved WRSA Design Report and Waste Rock Management Plan.

### General Reviewer Information:

The Board invites reviewers to submit comments and recommendations on the request via the WLWB Online Review System.

### Contact Information:

Jessica Pacunayen
Patty Ewaschuk 905-852-1516
Sarah Elsasser 867-765-4583

## Comment Summary

**Diavik Diamond Mines Inc. (Proponent)**
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<tr>
<th>ID</th>
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<tbody>
<tr>
<td>1</td>
<td>General File</td>
<td><strong>Comment (doc)</strong> DDMI Submission - Comment Responses - PKC Dam Modification Recommendation</td>
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<tr>
<td>7</td>
<td>General File</td>
<td><strong>Comment (doc)</strong> Attached is a technical memo from Arcadis Consulting commissioned by EMAB to accompany EMAB comments on the Diavik PKC North Dam Modification Request. Recommendation</td>
<td></td>
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<tr>
<td>1</td>
<td>General Comment</td>
<td><strong>Comment</strong> The modification request did not adequately address how the decision to propose using Type III rock as material to raise the dam was arrived at, and what the long term effects, or anticipated outcomes of this decision might be. Is this a result of having more Type III rock than expected? Were other options considered? <strong>Recommendation</strong> Please answer the questions: (1) What is the context for the proposal to use Type III rock in the North Dam section of the PKC raise? (2) How was the decision to use Type III rock?</td>
<td><strong>Feb 25:</strong> The north toe of North PKC Dam and the south toe of North Country Rock Pile (NCRP) are effectively one and the same. Along the North PKC Dam the NCRP is composed of Type III rock. As such there did not seem to be any benefit to constructing future raises of the North Dam from Type I rock. Currently the underground mining operations produce both Type I and Type III rock. Type I rock is fully used for construction and additional Type I rock is re-mined from the NCRP. Some Type III rock is used for underground backfill but more is produced than can be used. As such there is a surplus of Type III rock that needs to be disposed. As this material is surplus and already loaded, it is most efficient to place this material where it can be of greatest net benefit. The PKC North Dam is an ideal location. The area already contains Type III rock and placement can also support a construction need (PKC Dam Raise). The positive effects are reduced costs relative to using Type I rock (Type I rock would need to be re-mined from the NCRP) and a smaller Type III footprint (Type III rock not placed in PKC Dam would be placed as an expanded NCRP)</td>
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<tr>
<td>Section 3.0 Rockfill placement along the North Dam crest</td>
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<td>--------------------------------------------------------</td>
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| **Comment** The North Country Rock Pile (NCRP) was designed with drainage systems that allow leachate from Type III rock to be contained, collected and treated. The modification request did not address what the drainage collection system is for Type III rock if it is placed on top of the North Dam between 63+650 to 64+700.  
  **Recommendation** Please answer the questions: (1) Is there |
<p>| <strong>Feb 25:</strong> Type III rock in the North PKC Dam, past and proposed, will be within the SED and CLAR catchment areas. The drainage collection for the North PKC Dam would be the same as for other Type III rock in the SED and CLAR basins; that is Pond 3. There is potential for Type III rock in the PKC North Dam to leach as there is potential for any Type III rock in the SED and CLAR basin to leach. During operations any such seepage is collected in Pond 3. This leaching potential is to be mitigated with the placement of an engineered closure cover. |</p>
<table>
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<th>Section 3.0 Rockfill placement along the North Dam crest</th>
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| **Comment** The current closure method for Type III rock in the NCRP includes a 3 m Type I cover and 1.5 m till layer. The modification request did not address whether the reclamation of Type III rock on the North Dam would be to the same standard to prevent the Type III rock from leaching if it is used as material to raise the North Dam.  
**Recommendation** Please answer the question: Will reclamation of Type III rock on the North Dam be reclaimed to the same standard as Type III rock in the NCRP to prevent Type III rock from leaching if it is used as material to raise the North Dam? |
| **Feb 25:** Type III rock has previously been used in construction of the North PKC Dam. As such the planned NCRP Cover will extend over the dam. The North Country Rock Closure Design (Golder 2016) includes a typical cross-section through the PKC North Dam that confirms how the cover design is intended to be integrated with the PKC Dam. Please see Detail 3 Drawing 006. |

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| **Comment** The modification request did not include whether an engineered cover would be designed to prevent the Type III rock from leaching if it is used as material to raise the North Dam.  
**Recommendation** Please answer the question: Is a cover being proposed to prevent the Type III |
<p>| <strong>Feb 25:</strong> Type III rock has previously been used in construction of the North PKC Dam. As such the planned NCRP Cover will extend over the dam. The North Country Rock Closure Design (Golder 2016) includes a typical cross-section through the PKC North Dam that confirms how the cover design is intended to be integrated with the PKC Dam. Please see Detail 3 Drawing 006. |</p>
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<th>6</th>
<th>Section 3.0 Rockfill placement along the North Dam crest</th>
<th>Rock from leaching if it is used as material to raise the North Dam and what is the proposed engineered design for this cover?</th>
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<td><strong>Comment</strong></td>
<td>It would appear illogical to have additional risk from the placement of Type III potentially acidic waste rock in an area with no acidic material when there are extensive deposits of Type III waste in the existing Rock Pile. The Water Board should consider whether the additional risk associated with placement of Type III rock in the North Dam is preferred as compared with the potential need for a minor expansion of the North Country Rock Pile footprint. <strong>Recommendation</strong> Please answer the question: Why did DDMI not consider requesting a minor expansion of the North Country Rock Pile to avoid the additional risk associated with placement of Type III rock in the North Dam? Please provide a cost-benefit comparison (including the period to final closure) for placing the Type III rock in the North Country Rock Pile (including an expansion if necessary) vs. placing the Type III rock in the PKC North Dam raise as proposed. Unless Diavik can provide a stronger</td>
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<td><strong>Feb 25:</strong></td>
<td>This comment appears to predicated on the incorrect assumption that the North PKC Dam is in an area where there is no Type III rock. The North PKC Dam is in the SED and CLAR basins that are used for the disposal of Type III rock. Type III rock has been used previously in teh Phase 5 and 6 raises of the North PKC Dam. DDMI is not aware of &quot;any additional risks&quot; as stated by EMAB. DDMI also notes the conclusion of the GNWT Expert Advisor that the proposed placement of Type III rock does &quot;not pose any significant concerns&quot; (see GNWT-3). Please see DDMI Response to WLWB-2 and 4. Please also see DDMI Response to EMAB-1 for information on costs and benefits of this proposed modification.</td>
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</table>
justification for placing the Type III rock as part of the North Dam Raise it is recommended that the modification request not be approved and the Type III rock be placed in the North Country Rock Pile (NCRP).

### GNWT - Environment and Natural Resources: Central Email GNWT

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<tr>
<td>4</td>
<td>General File</td>
<td>Comment (doc) ENR Letter with Comments and Recommendations and Attached Technical Memo</td>
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<tr>
<td>5</td>
<td>General File</td>
<td>Comment (doc) Diavik Diamond Mine; Proposed Modifications to PKC North Dam - Brodie Consulting Technical Memo Attachment</td>
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</tr>
<tr>
<td>1</td>
<td>Topic 1: Closure Considerations â€” Cover</td>
<td>Comment DDMI is proposing to place Type III waste rock along the PKC Facility North Dam Crest. ENR’s review has not identified any geotechnical concerns. However, the placement of Type III seems to deviate from previous Waste Rock Management Plans which have been approved by the Board. Further, ENR notes that the approved ICRP version 3.2 requires that Type III waste rock</td>
<td>Feb 25: Type III rock has previously been used in construction of the North PKC Dam. As such the planned NCRP Cover will extend over the dam. The North Country Rock Closure Design (Golder 2016) includes a typical cross-section through the PKC North Dam that confirms how the cover design is intended to be integrated with the PKC Dam. Please see Detail 3 Drawing 006.</td>
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is covered with 1.5 m of till and 3 m of Type I rock. Thus, placing this material along the PKC north dam may have implications for closure. Note that recent active layer thickness research has suggested that it may vary from 4 m to 14 m in a waste rock pile (Tetra Tech -EBA 2015, Thermal Performance of Panda/Koala and Misery Waste Rock Storage Areas, Ekati Diamond Mine, NT).

The proposed cover over Type III rock is intended to maintain the zero degree isotherm in the till layer so it performs as an infiltration barrier. ENR also notes that recent information shows the footprint of the till stockpile as being much smaller than was initially anticipated.

**Recommendation**

1) ENR recommends that the geometry of the existing area to be filled with Type III rock and the final geometry of the placed rock allow for placement of the required cover to prevent long term seepage quality issues. This should include the side slopes of the Type III material which may require sloping/reworking.

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2 **Topic 2: Closure Considerations “Landfill**

**Comment** The proposed rock placement location is adjacent to the non-burnable waste dump. If the Type III material or the Till

**Feb 25:** The downstream slope of the rockfill placement from elevation 465 to 470 m is a continuation of the south slope of the non-burnable waste dump and no rockfill is planned to be placed over the existing side slopes of the non-burnable waste dump or over the
and Type I cover material encroaches on this area, potential exists for future settlement of the waste material to affect the integrity of the cover.

**Recommendation**

1) ENR recommends the placement of the Type III material should not encroach on the slopes and/or waste in the non-burnable waste dump. There should be sufficient space that neither the Type III rock nor Type I cover overlie the waste material to minimize issues with future settlement of the landfilled waste material and the associated covers over the landfill and Type III rock.

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3  Technical Memo

**Comment**

Att: Technical Memo - Diavik Diamond Mine - Proposed Modifications to PKC North Dam - February 18, 2016 - Brodie Consulting Ltd.

**Recommendation** None

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<tr>
<td>1</td>
<td>pg. 1, section 2.0, second paragraph. &quot;To avoid enlarging the footprint of the Type III</td>
<td><strong>Comment</strong> The Inspector acknowledges that the NCRP storage areas designated for Type III rock are nearing capacity, and the WLWB reviewers face the choice of either authorizing an enlargement of the footprint of waste inside the non-burnable waste dump (see Section B in Drawing 001).</td>
<td><strong>Feb 25:</strong> Drawing 4100-41D9-4019 from the Country Rock and Till Storage Update Design Report (NKSL, August 2001) shows two areas labelled CLAR and SED (copy attached). These are both part of the same drainage basin. Four structures were constructed within the CLAR and SED to form the On-Land Dredged Sediment Storage Facility. These are also shown on Drawing 4100-41D9-4019. The structure at the west end of the SED was a permeable dam designed</td>
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<td>rockfill storage areas within the NCRP</td>
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<td>Type III storage area or raising the maximum allowable height of the NCRP. However, for accuracy sake, the Inspector should point out that DDMI has already enlarged the footprint of Type III rock storage in the NCRP vs. the design report on record (the &quot;Country Rock and Till Storage Updated Design Report&quot; of August, 2001). <strong>Recommendation</strong> Update the &quot;Country Rock and Till Storage Updated Design Report&quot; of August, 2001) to reflect actual storage deposition and modern standards and industry best practices.</td>
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| to provide initial sedimentation of dredged solids with lower solids water flowing to CLAR for further clarification. As constructed SED and CLAR form a single drainage basin below this section of the NCRP. As described in NKS (August 2001) the original plan was to store Type II rock in SED and Type III rock in CLAR (Table 5-2, NKS (2001)). In March 2004 a decision was made to first re-use the CLAR basin to store construction water from A418 dredging and pool dewatering before storing Type III rock. This required a change to place Type III in SED. The Inspector was advised of the plan to place Type III in the SED (see for example Inspection Report May 31, 2005). Type III rock storage in SED began late in 2005. DDMI is not aware of any concerns raised at that time by the Inspector or the MVWLB and DDMI was not required to revise Country Rock and Till Storage Design Report. DDMI has submitted an updated engineering design for this area with the North Country Rock Closure Design (Golder 2016). Included in this report is Drawing 002 (copy attached) which delineates the extent of Type II/III rock within the NCRP and the extent of planned Type I re-mining. This information was also requested by the Inspector (Inspection Report November 27, 2015). By March 31, 2016 DDMI will submit an updated Rock Management Plan. DDMI will included in Version 7: 1) a current drawing showing locations where Type II/III rock (PAG) has been placed both within and outside the NCRP. This would include Type III rock used to date in PKC Dam construction (see also response to WLWB-3). 2) each area with Type II/III rock will also be identified as being permanent, active development, future planned development and/or temporary stockpile. For example the Type III rock shown separate from the main NCRP in Drawing 002 and noted by the Inspector as being in the CLR (an area designated for Type I) is a temporary stockpile to be re-mined for underground backfill. |

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<tr>
<th>Comment Is the reverse true? i.e., can we say with reasonable certainty that the PKC will not influence the freezing of the PAG rock which buttresses against the PKC? Much has been discussed in Section 3.0, third paragraph. &quot;The NCRP buttresses the downstream&quot;</th>
</tr>
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<tr>
<td>Feb 25: There is no &quot;PAG stored in the PKC&quot; as stated by the Inspector. Any negative influence of the PKC on the NCRP will be no different with or without this proposed modification.</td>
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</table>
The slope of the PKC North Dam and placement of rockfill is not considered to negatively impact the stability of the North Dam.

Learned about rock piles at Diavik, and consideration has been given to revising the design concept of the PKC from a full-cover, largely frozen facility to an somewhat warmer facility with a pond in the center. Will the PKC negatively influence the PAG stored in the PKC in any foreseeable way (by affecting the freezing or perhaps by some other mechanism)?

**Recommendation**

Answer the question: Will the PKC negatively influence the PAG stored in the PKC in any foreseeable way (by affecting the freezing or perhaps by some other mechanism)?

**Comment**

The drawing shows an area of the NCRP from approximately 63+660 to 64+700 (a total linear distance of about 1050 m). The actual Design Report on file with the WLWB (2001) shows PAG storage only occurring from about 64+700 to 64+450, or for about 250m out of the 1050 shown. In other words, the arrow delineating where placement of Type 3 rockfill is allowed is only correct for about 1/4 of the area shown, the other 3/4 of the area, representing about 800m, allows for SED storage (sediments dredged from dike footprint and

**Feb 25:**

Drawing 4100-41D9-4019 from the Country Rock and Till Storage Update Design Report (NKSL, August 2001) shows two areas labelled CLAR and SED (copy attached). These are both part of the same drainage basin. Four structures were constructed within the CLAR and SED to form the On-Land Dredged Sediment Storage Facility. These are also shown on Drawing 4100-41D9-4019. The structure at the west end of the SED was a permeable dam designed to provide initial sedimentation of dredged solids with lower solids water flowing to CLAR for further clarification. As constructed SED and CLAR form a single drainage basin below this section of the NCRP. As described in NKSL (August 2001) the original plan was to store Type II rock in SED and Type III rock in CLAR (Table 5-2, NKSL (2001)). In March 2004 a decision was made to first re-use the CLAR basin to store construction water from A418 dredging and pool dewatering before storing Type III rock. This required a change to place Type III in SED. The Inspector was advised of the plan to place Type III in the SED (see for example Inspection Report May 31, 2005). Type III rock storage in SED began late in 2005. DDMI is not aware of any concerns...
pit stripping, as well as a cover of type II rock), as per the Design on file with the WLWB (Table 5-2 of the Country Rock and Till Storage Updated Design Report, August, 2001).

**Recommendation** Update the Country Rock and Till Storage Report Design Report, include a discussion of environmental consequences of both proposed changes to the PAG storage & proposed changes of Rock Storage associated with the PKC N Dam Modification request.

Raised at that time by the Inspector or the MVWLB and DDMI was not required to revise Country Rock and Till Storage Design Report. DDMI has submitted an updated engineering design for this area with the North Country Rock Closure Design (Golder 2016). Included in this report is Drawing 002 (copy attached) which delineates the extent of Type II/III rock within the NCRP and the extent of planned Type I re-mining. This information was also requested by the Inspector (Inspection Report November 27, 2015). By March 31, 2016 DDMI will submit an updated Rock Management Plan. DDMI will include in Version 7: 1) a current drawing showing locations where Type II/III rock (PAG) has been placed both within and outside the NCRP. This would include Type III rock used to date in PKC Dam construction (see also response to WLWB-3). 2) each area with Type II/III rock will also be identified as being permanent, active development, future planned development and/or temporary stockpile. For example the Type III rock shown separate from the main NCRP in Drawing 002 and noted by the Inspector as being in the CLR (an area designated for Type I) is a temporary stockpile to be re-mined for underground backfill.

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### North Slave Metis Alliance: Shin Shiga

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<td><strong>Feb 25:</strong> Please see response to EMAB-1</td>
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</table>
| 2 | General Comment | **Comment** The modification request did not address the implications of using Type III rock on the North Dam for closure and reclamation.  
**Recommendation** Please answer the questions: (1) What effects will using Type III rock as material for the North Dam raise have on closure and reclamation? (2) How was placement of Type III rock considered in the current version of the ICRP? (3) How would this be dealt with in the upcoming ICRP revision? | Feb 25: Please see response to EMAB-2 |
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<td><strong>Comment</strong> The North Country Rock Pile (NCRP) was designed with drainage systems that allow leachate from Type III rock to be contained, collected and treated. The modification request did not address what the drainage collection system is for Type III rock if it is placed on top of the</td>
<td>Feb 25: Please see response to EMAB-3</td>
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<td><strong>Comment</strong> The current closure method for Type III rock in the NCRP includes a 3 m Type I cover and 1.5 m till layer. The modification request did not address whether the reclamation of Type III rock on the North Dam would be to the same standard to prevent the Type III rock from leaching if it is used as material to raise the North Dam. <strong>Recommendation</strong> Please answer the question: Will reclamation of Type III rock on the North Dam be reclaimed to the same standard as Type III rock in the NCRP to prevent Type III rock from leaching if it is used as material to raise the North Dam?</td>
<td><strong>Feb 25:</strong> Please see response to EMAB-4</td>
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<td>5</td>
<td><strong>Comment</strong> The modification request did not include whether an engineered cover would be designed to prevent the Type III rock from leaching if it is used as</td>
<td><strong>Feb 25:</strong> Please see response to EMAB-5</td>
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<td>Section 3.0 Rockfill placement along the North Dam crest</td>
<td>Comment</td>
<td>Feb 25: Please see response to EMAB-6</td>
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| | North Dam crest | material to raise the North Dam.  
**Recommendation** Please answer the question: Is a cover being proposed to prevent the Type III rock from leaching if it is used as material to raise the North Dam and what is the proposed engineered design for this cover? |
| | | It would appear illogical to have additional risk from the placement of Type III potentially acidic waste rock in an area with no acidic material when there are extensive deposits of Type III waste in the existing Rock Pile. The Water Board should consider whether the additional risk associated with placement of Type III rock in the North Dam is preferred as compared with the potential need for a minor expansion of the North Country Rock Pile footprint.  
**Recommendation** Please answer the question: Why did DDMI not consider requesting a minor expansion of the North Country Rock Pile to avoid the additional risk associated with placement of Type III rock in the North Dam? Please provide a cost-benefit comparison (including the period to final closure) for placing the Type III rock in the North Country Rock Pile (including an expansion |
if necessary) vs. placing the Type III rock in the PKC North Dam raise as proposed. Unless Diavik can provide a stronger justification for placing the Type III rock as part of the North Dam Raise it is recommended that the modification request not be approved and the Type III rock be placed in the North Country Rock Pile (NCRP).

**WLWB: Patty Ewaschuk**

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<td>1</td>
<td>Golder Memo dated December 7, 2015: North Country Rock Pile - Rockfill Placement Along the North Dam Crest - General</td>
<td><strong>Comment</strong> Part F, Item 5 of the Water Licence says: &quot;All rock used in Construction must meet the geochemical criteria specified in the approved Waste Rock Management Plan as per Part H, Item 7.&quot; The approved Waste Rock Management Plan establishes the geochemical criteria used to classify rock types (Table 2), and reiterates that only Type I rock will be used for Construction. Part A, Item 2 of the Licence states that Construction &quot;means any activities undertaken to construct or build any components of, or associated with, the development of the Diavik Diamond Mine.&quot; DDMI proposes to use Type III rock for</td>
<td><strong>Feb 25:</strong> The Type III rock in the North Country Rock Pile after re-sloping and the rock used to construct future raises of the PKC North Dam are essentially one and the same making this a unique situation with regard to construction material. DDMI is asking the WLWB to recognize this and provide DDMI with the approvals necessary to implement the proposed modification. The Waste Rock Management Plan will be updated by March 31, 2016 and will include this modification.</td>
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<td>2</td>
<td><strong>Golder Memo dated December 7, 2015 : North Country Rock Pile - Rockfill Placement Along the North Dam Crest - General</strong></td>
<td><strong>Comment</strong></td>
<td>DDMI proposes to place Type III rock along the north PKC Facility dam. The dam is adjacent to the WRSA &quot;CLAR&quot; and &quot;SED&quot; basins, which are identified in the approved Waste Rock Storage Area Design Report, 2001 (Section 5.2). According to the Design Report, the CLAR basin will receive Type III rock, and the SED basin will receive only Type II rock. Similarly, the approved Waste Rock Management Plan indicates that only Type II rock is to be placed in the SED basin. The Inspector recently determined that Type III rock is being placed in the SED basin, and noted that DDMI is therefore not adhering to the approved Design Report and is out of compliance. The Inspector has instructed DDMI to submit an updated WRSA Design Report and Waste Rock Management Plan immediately (Water Use Inspection Report, January 18, 2016). The submissions must be submitted by March 31, 2016. DDMI has submitted an updated engineering design for this area with the North Country Rock Closure Design (Golder 2016). Included in this report is Drawing 002 (copy attached) which delineates the extent of Type II/III rock within the NCRP and the extent of planned Type I re-mining. This information was also requested by the Inspector (Inspection Report November 27, 2015). By March 31, 2016 DDMI will submit an updated Rock Management Plan. DDMI will include in Version 7: 1) a current drawing showing locations where Type II/III rock is being placed.</td>
<td><strong>Feb 25:</strong> Drawing 4100-41D9-4019 from the Country Rock and Till Storage Update Design Report (NKSL, August 2001) shows two areas labelled CLAR and SED (copy attached). These are both part of the same drainage basin. Four structures were constructed within the CLAR and SED to form the On-Land Dredged Sediment Storage Facility. These are also shown on Drawing 4100-41D9-4019. The structure at the west end of the SED was a permeable dam designed to provide initial sedimentation of dredged solids with lower solids water flowing to CLAR for further clarification. As constructed SED and CLAR form a single drainage basin below this section of the NCRP. As described in NKSL (August 2001) the original plan was to store Type II rock in SED and Type III rock in CLAR (Table 5-2, NKSL (2001)). In March 2004 a decision was made to first re-use the CLAR basin to store construction water from A418 dredging and pool dewatering before storing Type III rock. This required a change to place Type III in SED. The Inspector was advised of the plan to place Type III in the SED (see for example Inspection Report May 31, 2005). Type III rock storage in SED began late in 2005. DDMI is not aware of any concerns raised at that time by the Inspector or the MVWLB and DDMI was not required to revise Country Rock and Till Storage Design Report. DDMI has submitted an updated engineering design for this area with the North Country Rock Closure Design (Golder 2016). Included in this report is Drawing 002 (copy attached) which delineates the extent of Type II/III rock within the NCRP and the extent of planned Type I re-mining. This information was also requested by the Inspector (Inspection Report November 27, 2015). By March 31, 2016 DDMI will submit an updated Rock Management Plan. DDMI will include in Version 7: 1) a current drawing showing locations where Type II/III rock is being placed.</td>
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include a "complete rationale for any changes, and a thorough explanation of the environmental considerations associated with the changes." The rationale and environmental considerations associated with proposed changes to the WRSA Design Report may also be relevant to this modification request.

**Recommendation** Discuss DDMI's proposed timing for Board approval of the modification for the PKC north dam. Does DDMI anticipate that the Board can approve the modification prior to considering approval of a revised WRSA Design Report and Waste Rock Management Plan? If so, please provide a rationale.

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**Comment** The modification request indicates “The rockfill placement layout has been restricted to the limits of the North Dam Type III rockfill area and does not enlarge the area of the NCRP Type III ROM”. No justification for the use of Type III waste rock is provided beyond a statement indicating that there is limited space remaining in the NCRP for Type III rock.

**Recommendation** Confirm that Type III rock placement in the PKC north dam will not affect rock (PAG) has been placed both within and outside the NCRP. This would include Type III rock used to date in PKC Dam construction (see also response to WLWB-3). 2) each area with Type II/III rock will also be identified as being permanent, active development, future planned development and/or temporary stockpile. For example the Type III rock shown separate from the main NCRP in Drawing 002 and noted by the Inspector as being in the CLR (an area designated for Type I) is a temporary stockpile to be re-mined for underground backfill. The section of the North PKC Dam where Type III rock is to be placed is within the SED and CLAR basins as was similarly done in the Phase 5 and 6 raises. The Inspector and Board have previously been informed of Type III rock placement in the SED basin (2005) and use of Type III rock in the North PKC Dam (2007 and 2013) without issues or concerns identified that DDMI could find. For the reasons included above, DDMI anticipates that the Board can approve this modification request and requests that this be done as soon as possible. Currently DDMI is missing a useful economic opportunity to direct haul surplus Type III waste rock from underground to construct the North PKC Dam.

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**Feb 25:** The SED and CLAR basins currently store predominantly Type III waste rock. Any operational seepage from these basins are collected in Pond 3. There will be no change to this as a result of the modification request. For closure the north side of the SED and CLAR will be re-sloped. The re-slope design assumes approval of the modification request. A till/Type I cover will be placed over all Type III rock in the SED and CLAR basins including Type III rock in the North PKC Dam. The cover is designed to keep the annual active thaw layer within the cover system to mitigate poor seepage water quality that could occur if Type III rock was within the active thaw zone.
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<td>4</td>
<td>None</td>
<td><strong>Comment</strong> It is unclear whether Type III waste rock has been incorporated in the dam in previous lifts. <strong>Recommendation</strong> DDMI should clarify whether Type III waste rock has been incorporated in the dam in previous lifts, and identify previous DDMI submissions or Board approvals regarding Type III in previous lifts.</td>
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<td>5</td>
<td>Golder Memo dated December 7, 2015: North Country Rock Pile - Rockfill Placement Along the</td>
<td><strong>Comment</strong> If Type III rock has been placed in previous lifts of the dam, this activity has already enlarged the area of Type III waste rock that will need to be covered at closure. It is not clear whether there will be sufficient till and Type I waste rock.</td>
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<td>North Dam Crest - General</td>
<td>available for cover material. <strong>Recommendation</strong> DDMI should provide the updated waste rock production schedule and estimated requirements for closure covers as per Tables 4-3A through D of the approved ICRP (v3.2) to demonstrate there will be sufficient till and Type I waste rock available to cover all of the Type III rock at the end of mine.</td>
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<td>6 Golder Memo dated December 7, 2015 : North Country Rock Pile - Rockfill Placement Along the North Dam Crest - Section 3, 4th pgr</td>
<td><strong>Comment</strong> The documentation indicates that &quot;The Type III ROM rockfill to be placed along the North Dam within the NCRP may be used for potential future raises of the PKC Facility dams&quot;, suggesting that another dam raise may or may not be required. DDMI did not address whether the final surface of the dam will be constructed from or covered with till and Type I waste rock. <strong>Recommendation</strong> DDMI should confirm that the final surface of the dam will be constructed from or covered with till and Type I waste rock. DDMI should also clarify whether additional dam raises will be required based on the current production schedule. <strong>Feb 25</strong>: The North Country Rock Closure Design (Golder 2016) includes a typical cross-section through the PKC North Dam that confirms how the cover design is intended to be integrated with the PKC Dam. Please see Detail 3 Drawing 006. Detail 3 shows the PKC to the 475 m elevation. Currently the PKC Dam is at 465 m elevation. The final PKC Dam elevation at the end of commercial operations is not known at this time.</td>
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<td>7 Golder Memo dated December 7,</td>
<td><strong>Comment</strong> The proposed location of Type III rock placement within the dam (Drawing 001 of the</td>
<td><strong>Feb 25</strong>: Most of the rainfall or snow melt that infiltrates the SED and could form a seepage would daylight in Pond 3. Rainfall or snow melt that enters the SED catchment area at the eastern extent could</td>
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<td>Date</td>
<td>Memo/Comment</td>
<td>References</td>
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<td>2015: North Country Rock Pile - Rockfill Placement Along the North Dam Crest - Drawing 001</td>
<td>modification request) is adjacent to the CLAR and SED catchments of the NCRP. It is understood that Type III waste rock has been placed in both of these areas. It is not clear whether seepage from the eastern extent of the Type III waste rock will be fully contained within the SED catchment area, and whether any seepages could report to Pond 1. It is also not clear whether there are any discharges from the CLAR and SED catchments, and if so where they daylight and how they are managed. <strong>Recommendation</strong> DDMI should also clarify whether there are any discharges from the CLAR and SED catchments, and if so, how those are managed.</td>
<td>feasibly deflect within the rock pile and follow a preferred flow path that could theoretically daylight as seepage in Pond 1 on the east side of the NCRP. Water from Pond 3 and Pond 1 are pumped to the North Inlet for treatment and discharge.</td>
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<td>8 Golder Memo dated December 7, 2015: North Country Rock Pile - Rockfill Placement Along the North Dam Crest - Section 3, 2nd paragraph and Drawing 001, cross-sections A and B.</td>
<td><strong>Comment</strong> In conjunction with the 5 m lift (from El 465 to 470 m), the upstream slope of the lift will be at angle of repose (1.33H:1V), and a minimum 2.65 m offset will be left from the surveyed crest of the existing Phase 6 liner (El 465) to allow for liner construction (potentially to El 470 m) in the event a future raise of the PKC Facility dam (above El 465 m) is required. At Sections A and B (Dwg 001), the offset is about 6 and 3 m, respectively.</td>
<td><strong>Feb 25:</strong> The rockfill placement design along the North PKC Dam from elevation 465 to 470 m has been prepared based on the specifications and design for the PKC Phase 6 Dam raise. As such, a minimum 2.65 m offset from the surveyed crest of the existing Phase 6 liner to the toe of the rockfill lift is required for placement of the liner and liner bedding system. Offsets larger than 2.65 m, as shown in Sections A and B, are in agreement with the requirement of a minimum 2.65 m offset. Recent completion of the PKC Facility Phase 6 Dam raise construction demonstrates the constructability of the liner and liner bedding system using these Phase 6 rockfill placement requirements. These requirements have been adopted for the North PKC Dam rockfill lift placement to elevation 470 m.</td>
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<td>Golder Report dated March 1, 2013: Processed Kimberlite Containment Facility Phase 6 Design Report - Tables 4-2, 4-3 and 4-4</td>
<td><strong>Recommendation</strong> DDMI should provide an explanation that demonstrates the constructability of the liner and its underlying transition layers in the event future raises of the PKC Facility dam (above El 465 m) are required.</td>
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<td>9</td>
<td><strong>Comment</strong> Table 4-2 indicates the upstream dam slopes will either be 3H:1V or, where required due to footprint constraints, 1.5H:1V. Drawing 001 from the comment block above indicates that the 1.5H:1V slope case would likely be required for dam raises above El 465, and Table 4-4 provides the thickness of materials that must be placed (0.6 m total, measured perpendicular to the face) prior to installing the liner. <strong>Recommendation</strong> DDMI should provide an explanation that demonstrates the constructability of the liner and its underlying transition layers in the event future raises of the PKC Facility dam (above El 465 m) are required.</td>
<td><strong>Feb 25:</strong> Please see response to WLWB - 8.</td>
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25 February 2016

Re: DDMI Response – PKC North Dam Modification

Please find attached the Diavik Diamond Mines (2012) Inc. (DDMI) response to reviewer comments on the PKC North Dam Modification. DDMI submitted this modification request on December 9, 2015. On January 4, 2016 you advised DDMI that the Board would require more review time than the 45 days specified in Part G Item 1. This resulted in DDMI placing its construction plans on hold.

Review comments were received by DDMI February 19, 2016. DDMI has expedited this submission of responses and requests that the Board advise us a soon as possible regarding your decision on this matter.

DDMI has provided complete responses to each reviewer comment. However, if the Board or Board Staff have any questions or require any further information regarding this submission, please contact me directly.

Responses have also been uploaded to the Online Review System.

Regards,

Gord Macdonald

cc: Sarah Elsasser (WLWB)
    Ryan Fequet (WLWB)
    Patty Ewaschuk (WLWB)

Attached: Comment Responses – PKC North Dam Modification
          Drawing Attachment
The downstream slope of the rockfill placement from elevation 465 to 470 m is a continuation of the south slope of the non-burnable waste dump or over the waste inside the non-burnable waste dump. The proposed rock placement location is adjacent to the non-burnable waste dump. If the Type III material or the Till and Clays is placed to or near this area, potential exists for future settlement of the waste material to affect the integrity of the cover.

The proposed rock placement location is adjacent to the non-burnable waste dump. If the Type III material is placed to or near this area, potential exists for future settlement of the waste material to affect the integrity of the cover.

This comment appears to be predicated on the incorrect assumption that the North PKC Dam is in an area where there is no Type III rock. Type III rock has previously been used in construction of the North PKC Dam. As such the planned NCRP Cover will extend the non-burnable waste dump. The North PKC Dam Closure Design (Golder 2014) includes a typical cross-section through the PKC North Dam that confirms how the cover design is intended to be integrated with the PKC北 Dam. Please see Exhibit 3 Drawing 006. This closure detail was not addressed in ICRP V3.2 and was provided in the 2015 ICRP Annual Report and will be included in ICRP V4.

The north toe of North PKC Dam and the south toe of North Country Rock Pile (NCRP) are effectively one and the same. The NCRP buttresses the downstream slope of the North PKC Dam and placement of rockfill is not considered to negatively impact the stability of the North PKC Dam.
The modification request did not adequately address how the decision to propose using Type III rock was made. The decision was to classify the North Dam rock as Type III to meet the geochemical criteria. Was this decision based on having more Type III rock than expected? Were other options considered?

Please answer the question: Why did DDMI not consider requesting a minor expansion of the North Country Rock Pile to accommodate the new Type III rock instead of using Type III rock on the North Dam?

Please answer the question: Will reclamation of Type III rock on the North Dam be reclaimed to the same standard as Type II rock in the NCRP? What may be the potential effects, or anticipated outcomes of using Type III rock as material to raise the North Dam?

Please answer the question: Is there potential for the Type III rock to leach from the proposed location? What treatment system for the Type III rock if it is used as material for the North Dam raise?

North Slave Metis Alliance: Shin Shiga

Please answer the questions: (1) What is the context for the proposal to use Type III rock in the North Dam section of the PKC north dam modification? (2) How was the decision to use Type III rock as material for the North Dam made, and what all options were considered? (3) What is the long-term plan for the North Dam and how will the Type III rock be used to raise the North Dam?

Please answer the question: What effects will using Type III rock as material for the North Dam raise have on closure and reclamation? (2) How was placement of Type III rock considered in the current version of the PKC? How would this be dealt with in the upcoming ICRP revision?

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The modification request indicates that the rockfill placement layout has been restricted to the limits of the North Dam within the NCRP. It is not clear whether there are sufficient till and Type I waste rock available for cover material. DDMI should provide the updated waste rock production schedule and estimated requirements for closure covers as per Table 4-4 through 12 of the approved ECP (v.2) to demonstrate there will be sufficient till and Type I waste rock available to cover all of the Type III rock at the end of mine.

DDMI should confirm that the final surface of the dam will be constructed from or covered with till and Type I waste rock. DDMI should also clarify whether additional dam raises will be required based on the current production schedule.

The North Country Rock Closure Design (Golder 2016) includes an updated estimate for the Type III cover of 2 Mm$^3$ of till and 4 Mm$^3$ of Type I rock. The source of the cover material is the A21 pit that is expected to produce 3 Mm$^3$ of till and 13 Mm$^3$ of Type I rock.

Most of the rainfall or snow melt that infiltrates the SED and could form a seepage would daylight in Pond 3. Rainfall into Pond 3 is pump to the North Inlet for treatment and discharge.
List of Drawings


2. NCRP Closure Drawing 002 from Golder (2016).


Diavik Diamond Mines (2012) Inc. (DDMI) has requested approval from the Wek’eezhii Land and Water Board for a modification to the North Dam of the Processed Kimberlite Containment Facility (PKC). This request is made under Water License W2015L2-0001, Part G Item 1.

DDMI has proposed to place a 5 meter lift of Type III potentially acid generating waste rock from the Underground Mine along the North Dam for the Phase VII Dam Raise.

Documentation in support of the application included a Technical Memorandum from Golder Associates dated December 17, 2015 titled “NORTH COUNTRY ROCK PILE - ROCKFILL PLACEMENT ALONG THE NORTH DAM CREST”.

Key information from the Golder memorandum includes:

- The raise will be 5 m using potentially acid generating Type III waste rock.
- The total length is just over 1000 m with an average width of about 50 m. Total quantity was not stated but would be more than 200,000 m³.
- The rationale for using the North Dam for Type III waste rock disposal is that the North Country Waste Pile is near capacity and would require expansion to accommodate the additional Type III rock.

Although we appreciate that additional capacity is required for Type III waste rock, we are not convinced that placement in the North Dam of the PKC containment is preferred. DDMI has undertaken extensive investigations to demonstrate that seepage from the PKC will not be a long-term concern. There may be cost advantages for using the underground rock, however there will also be much higher closure costs for
MEMO

the dam which will require till and Type I waste rock cover (per current closure strategy for closure of Type III waste rock in the existing waste dumps).

We see no material benefit in placing potentially acid generating rock in an area where no acid material is present. It may be much more prudent to utilize Type I waste rock for the dam raise. The total quantity of waste in the Rock Piles would likely be unchanged with the Type III rock replacing Type I rock in the pile.

Summary

1) The placement of Type III potentially acid waste rock as fill is technically feasible.

2) The only justification appears to be to use the North Dam for waste rock disposal as currently there is not enough space in the North Country Waste Pile without expanding the footprint.

3) Placement of Type III waste rock will require increased costs for closure of the PKC as this potentially acidic rock will need to be capped.

4) It would appear illogical to have additional risk from the placement of Type III potentially acidic waste rock in an area with no acidic material when there are extensive deposits of Type III waste in the existing Rock Pile.

5) The Water Board should consider whether the additional risk associated with placement of Type III waste rock in the North Dam is preferred as compared with the potential need for a minor expansion of the North Country Rock Pile footprint. Although, we are not convinced the footprint would be expanded if Type I waste could be reclaimed from the North Country Rock Pile and used in lieu of underground Type III rock.

Sincerely,

ARCADIS CANADA, INC.

Randy Knapp, P.Eng.
Senior Consultant to Arcadis

Shelagh Montgomery, Ph.D.
Senior Environmental Scientist, Arcadis
Dear Ms. Camsell-Blondin,

Re: Diavik Diamond Mine Inc. (DDMI)
Water Licence – W2015L2-0001
Processed Kimberlite Containment Facility - North Dam - Modification Request for Comment

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT), has reviewed the modification request at reference based on its mandated responsibilities under the Environmental Protection Act, the Forest Management Act, the Waters Act, the Forest Protection Act and the Wildlife Act and provides the following comments and recommendations for the consideration of the Board.

**Topic 1: Closure Considerations – Cover**

**Comment(s)**

DDMI is proposing to place Type III waste rock along the PKC Facility North Dam Crest. ENR’s review has not identified any geotechnical concerns.

However, the placement of Type III seems to deviate from previous Waste Rock Management Plans which have been approved by the Board. Further, ENR notes that the approved ICRP version 3.2 requires that Type III waste rock is covered with 1.5 m of till and 3 m of Type I rock. Thus, placing this material along the PKC north dam may have implications for closure.
Note that recent active layer thickness research has suggested that it may vary from 4 m to 14 m in a waste rock pile (Tetra Tech -EBA 2015, Thermal Performance of Panda/Koala and Misery Waste Rock Storage Areas, Ekati Diamond Mine, NT). The proposed cover over Type III rock is intended to maintain the zero degree isotherm in the till layer so it performs as an infiltration barrier.

ENR also notes that recent information shows the footprint of the till stockpile as being much smaller than was initially anticipated.

**Recommendation(s):**

1) ENR recommends that the geometry of the existing area to be filled with Type III rock and the final geometry of the placed rock allow for placement of the required cover to prevent long term seepage quality issues. This should include the side slopes of the Type III material which may require sloping/reworking.

**Topic 2: Closure Considerations – Landfill**

**Comment(s):**

The proposed rock placement location is adjacent to the non-burnable waste dump. If the Type III material or the Till and Type I cover material encroaches on this area, potential exists for future settlement of the waste material to affect the integrity of the cover.

**Recommendation(s):**

1) ENR recommends the placement of the Type III material should not encroach on the slopes and/or waste in the non-burnable waste dump. There should be sufficient space that neither the Type III rock nor Type I cover overlie the waste material to minimize issues with future settlement of the landfilled waste material and the associated covers over the landfill and Type III rock.

Comments and recommendations were provided by ENR technical experts in the Water Resources Division and the North Slave Region and were coordinated and collated by the Environmental Impact Assessment Section, Conservation, Assessment and Monitoring Division (CAM).
Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick_clancy@gov.nt.ca.

Sincerely,

Patrick Clancy  
Environmental Regulatory Analyst  
Environmental Assessment and Monitoring  
Land and Water Division  
Department of Environment and Natural Resources  
Government of the Northwest Territories

Att: Technical Memo – Diavik Diamond Mine - Proposed Modifications to PKC North Dam - February 18, 2016 - Brodie Consulting Ltd.
MEMORANDUM

DATE: February 18, 2016
TO: Paul Green, GNWT – ENR Water Resources Division
CC: 
FROM: John Brodie, P. Eng.
SUBJECT: Diavik Diamond Mine; Proposed Modifications to PKC North Dam

DDMI has submitted North Country Rock Pile – Rockfill Placement Along the North Dam Crest, GAL, December 2015. Comments are provided below.

The proposed placement of Type III ROM on the North Dam does not raise any significant concerns. Two minor points are:

1. The final geometry should allow covering with Type I ROM as per the closure plan for containment of Type III material. This should include side slopes of the Type III material.

2. The placement should not encroach on the slopes and/or waste in the non-burnable landfill. As per comment 1, the final geometry should allow for future covering with Type I material. Ideally, the Type III material, and the limits of the Type I material should not overlie the waste so that future settlement of the waste does not affect the cover.

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