DE BEERS
GROUP OF COMPANIES

29 June 2015 File:MV2005L2-0015

Mr. Tracy Covey
Box 1320
140 Bristol Avenue
Yellowknife, Northwest Territories
X1A 2L9

Angela Love
Regulatory Officer
Mackenzie Valley Land and Water Board
7th Floor, 4922 48 Street
P.O. Box 2130
Yellowknife, NT
X1A 2P6

Dear Mr. Covey

**Re: Response to Information Request Presented in Water License Inspection Report Dated 26 June 2015**

In response to your Inspection report dated 26 June 2015, De Beers is pleased to provide the following update on the current Landfarm activities as well as the future plans for a Landfarm facility that is anticipated to be constructed during the operational year of 2017.

*"The Inspector requires written notification detailing how De Beers proposes to deal with current and future Landfarm/soil reclamation requirements, notably:*

a. *When will the Landfarm detailed in drawing in the 2014 Landfarm Management Plan be completed & ready to receive contaminated soils for treatment?*
b. *How does De Beers propose to actively reclaim and "Landfarm" contaminated soils in the interim period? "How" reclamation is to proceed is actually detailed in the Landfarm Management Plan, but a facility to put into action those Landfarming practices, i.e., to actively Landfarm any current/future contaminated soil reclamation, is lacking."*

**In Response to Part A:** The current construction forecast for the Operations Phase Landfarm shows the completion and commissioning of the facility by spring of 2017. Once the facility is commissioned, any remaining material from within the current Landfarm that still requires additional treatment will be transferred to the Operations Phase Landfarm and the current Landfarm decommissioned.

DE BEERS

GROUP OF COMPANIES

**In Response to Part B:** The immediate plan for the materials remaining within the current landfarm facility is to excavate all materials where content is confirmed to be below Industrial Criteria but above Parkland ( Golder 2014, Landfarm assessment document, attached). The removed Industrial Criteria compliant materials will be integrated into site construction activities such as overliner material at the new 18M litre tank farm or other lined and bermed areas. Materials confirmed to be below Parkland Criteria were removed and stockpiled last year for future re-vegetation trials or other appropriate uses in accordance with the De Beers Waste Management Plan V4.

The removal of the Industrial Criteria compliant materials will be immediately followed up by a Golder Associates landfarm assessment which is currently scheduled to be performed on 6 July 2015. The purpose of the assessment will be to examine the remediation progress of the materials remaining after the Industrial criteria compliant material is removed. Additional assessments of remedial progress will occur in the months of August and September in accordance with the Landfarm Management Plan commitments.

Following each site assessment by Golder, the materials within the landfarm will be treated with fertilizer and cultivated until freezing conditions are experienced which annually occurs in late September. Winterization of the landfarm will be similar to previous years in that impermeable materials such as liner or tarps will be used to cover the materials and will be weighed down to avoid wind damage. During 2016, the current landfarm will continue to be operated in accordance with the De Beers Landfarm Management Plan leading up to the construction and commissioning of the Operational Phase landfarm in 2017.

I trust this information satisfies your request. Should you have any further questions, please do not hesitate to contact me at your convenience.

Sincerely

*Patrick Kramers*

Att: Golder 2014, Recommendations for Management of Soil Treatment Facility, Summer 2014 Treatment Season

July 25, 2014 Project No. 14-1324-0017

Sarah McLean
DeBeers Canada Inc.
Suite 300, 5201 - 50 Street
Yellowknife, NT X1A 3S8

**RE: RECOMMENDATIONS FOR MANAGEMENT OF SOIL TREATMENT FACILITY, SUMMER 2014 TREATMENT SEASON**

Dear Ms. McLean:

This letter provides our recommendations for Soil Treatment Facility management during the 2014 Summer Treatment Season (July-September). These recommendations are based on data and field observations collected through to June 2014. This letter will summarize the remedial objectives, present some of the soil quality data collected in June 2014, and provide recommendations for soil movement and reuse, and treatment cell nutrient and moisture requirements.

The Soil Treatment facility comprises seven current treatment cells and five former treatment cells. The layout of these cells is presented on Figures 1 and 2. The five former cells were removed in 2013 to make room for site operations. Soils from these treatment cells were relocated across the current cells. This has resulted in elevated concentrations of hydrocarbons in some of the cells that had previously shown lower concentrations.

## Remedial Objectives

Discussions with former Indian and Northern Affairs Canada, now Aboriginal Affairs and Northern Development Canada (AANDC), were held in 2007 to establish remediation objectives for this impacted material. At that time, AANDC directed DBCI to use the Government of Northwest Territories (GNWT) Environmental Guideline for Contaminated Site Remediation (GNWT 2003) parkland soil quality guidelines as the remedial objective until such time as the industrial guidelines could be applied. It is understood that, with recent site activities, permission has been provided to DBCI to use soil meeting the GNWT industrial soil quality guidelines in areas of the site where industrial land use is taking place (*e.g.*, as pad material in the tank farm).

Selection of the appropriate guideline is also dependent on soil texture and soil nature (organic vs. mineral soil). Based on the analysis carried out by Golder in 2007, the impacted soil is coarse-grained mineral soil (*i.e.*, sand and gravel).

Therefore, the remediation objectives for the site are the GNWT surface soil criteria for coarse-textured soils and parkland or industrial land use depending on the final use of the soil. These guidelines are summarized in Table 1 for benzene, toluene, ethylbenzene, xylenes (BTEX) and PHCs fractions 1 to 4 (F1 - F4).



**Golder Associates Ltd.**
102, 2535 - 3rd Avenue S.E., Calgary, Alberta, Canada T2A 7W5
Tel: +1 (403) 299 5600 Fax: +1 (403) 299 5606 www.golder.com
**Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America**

**Table 1: Remediation Objectives**

| Chemical of Concern | Benzene | Toluene | Ethyl-benzene | Xylenes | Petroleum Hydrocarbon Fraction F1 | Petroleum Hydrocarbon Fraction F2 | Petroleum Hydrocarbon Fraction F3 | Petroleum Hydrocarbon Fraction F4 |
|---|---|---|---|---|---|---|---|---|
| Parkland Objective[1] | 0.5 | 0.8 | 1.2 | 1.0 | 30 | 150 | 400 | 2,800 |
| Industrial Objective[2] | 5.0 | 0.8 | 20.0 | 20.0 | 310 | 760 | 1,700 | 3,300 |

**Notes:**
All units in mg/kg
[1] GNWT surface soil criteria for coarse-textured soils, parkland land use.
[2] GNWT surface soil criteria for coarse-textured soils, industrial land use.

## Results of the June 2014 Soil Sampling Program

Concentrations of F2 Fraction Petroleum Hydrocarbons in the sample areas within each Treatment cells are presented on the attached Figure 1 (representing 0-30cm depth) and Figure 2 (representing 30-60cm depth). Areas and cells shaded in green have F2 PHC concentrations below the GNWT Parkland remedial objective. This soil can be removed from the Treatment Cell, and can be used on the site wherever parkland land use is applicable. Areas and cells shaded in yellow have F2 PHC concentrations below the GNWT Industrial remedial objective, but above the Parkland objective. This soil can be removed from the Treatment Cell, and can be used on the site wherever industrial land use is applicable. Areas and cells shaded in red have F2 PHC concentrations above the GNWT Industrial remedial objective. This soil must remain in the Treatment Cell for additional treatment.

The target nitrate concentration in the Treatment Cells is 200 mg/kg. Concentrations of nitrate in samples collected in June 2104 range from 2.6 mg/kg to 49.4 mg/kg. Therefore, additional fertilizer must be added to the treatment cells. It is understood that there is surplus ammonium nitrate available at the site. This material is suitable for use as fertilizer in the Treatment Cells. Application rates are discussed further below.

Average moisture content in the cells ranged from 8% to 18%, which is dry of the optimum treatment moisture of 15-30%. However, free water was observed in the lower soil layer of the treatment cells. Therefore, the upper layers of soil are dry of optimum moisture, while the lower layers are too wet.

Field observations indicate that the upper layer of soil on many of the Treatment Cells has become compacted. A renewed focus on soil aeration is required for ongoing treatment.

Recommendations for soil movement, fertilizer addition and moisture control for each Treatment Cell are provided in Table 1, attached. Once the soil has been removed from the specified cells, the thickness of soil in all cells must be measured to allow for subsequent treatment planning and possible further movement of soils between cells to optimize treatment space. We also recommend continuing with the regular sampling and analysis program consistent with previous years.

We trust this letter provide you with the information you require. We suggest a follow-up conference call to discuss the recommended treatment prescription and to clarify any questions you may have.

**GOLDER ASSOCIATES LTD.**

Julie Burghardt

REGISTERED PROFESSIONAL GEOLOGIST
D.G. PRITCHARD
LICENSEE
N.W.T.
25 Jul 14

Julie Burghardt, M.Eng., P.Eng.
Project Manager, Environmental Engineer

David G. Pritchard, P.Geol.
Principal and Senior Geoscientist

**NAPEG PERMIT TO PRACTICE NO. P049**

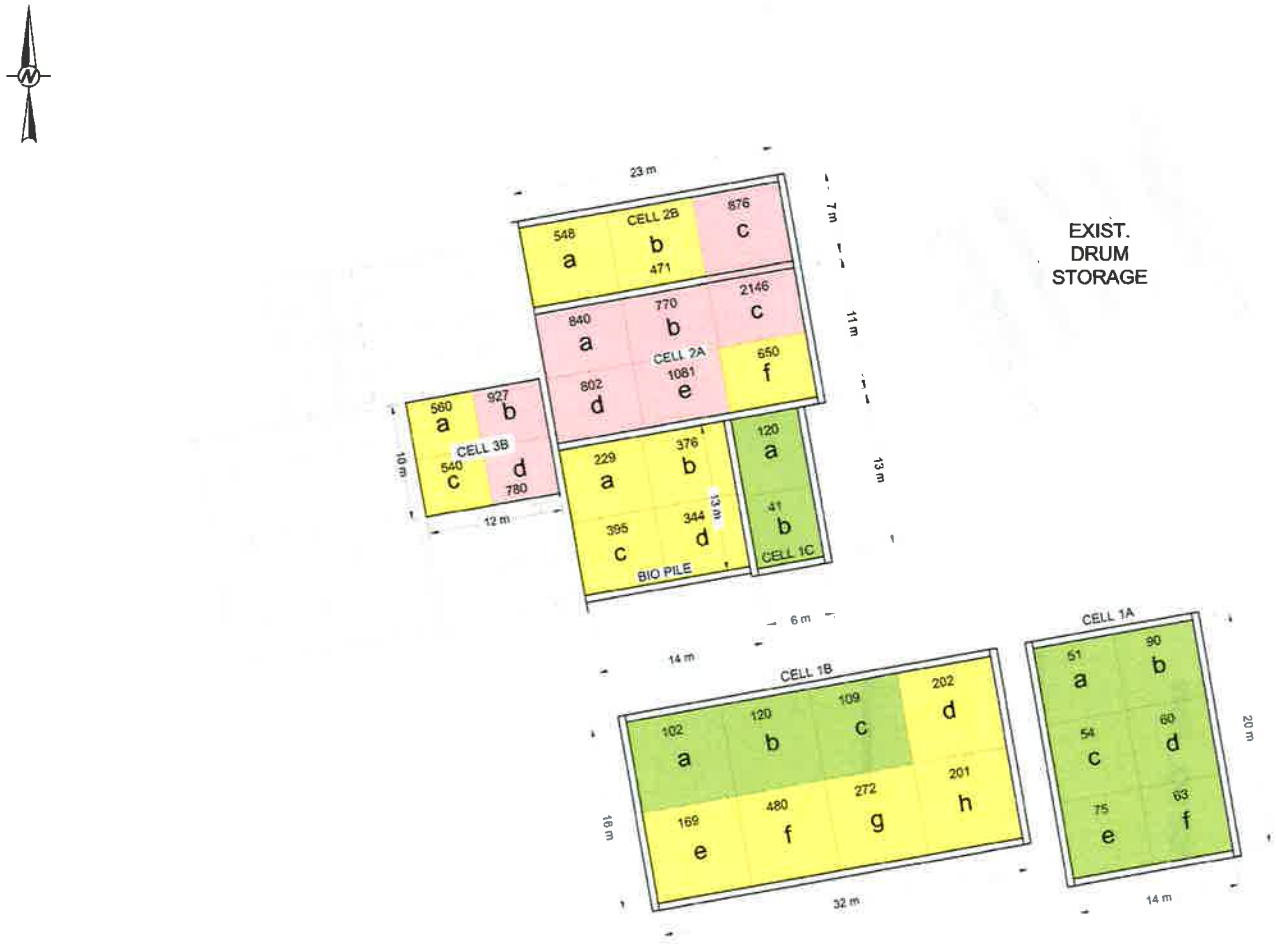
JMB/DGP/km

Attachments: Figure 1. Distribution of F2 Fraction Hydrocarbons in Upper 30cm Soil Layer – June 2014
Figure 2. Distribution of F2 Fraction Hydrocarbons in 30-60cm Soil Layer – June 2014
Table 1. Treatment Prescription, Summer 2014 Treatment Season

r:\active_2014\1324\14-1324-0017 de beers 2014 landfarm\deliverables\treatment recommendations\july 2014 treatment recommendations.docx



Golder Associates




## LEGEND

| | |
|---|---|
| a | SAMPLE AREA |
| 560 | CONCENTRATION OF F2 FRACTION HYDROCARBON MEASURED ON JUNE 2014 |

## F2 CONCENTRATIONS (BY CELL AREA)

- CELL REMOVED
- UPPER 30 cm BELOW INDUSTRIAL BUT ABOVE PARKLAND
- UPPER 30 cm ABOVE INDUSTRIAL
- UPPER 30 cm BELOW PARKLAND

## GNWT SOIL REMEDIATION OBJECTIVES

| | |
|---|---|
| PARKLAND | 150 mg/kg |
| INDUSTRIAL | 760 mg/kg |

## NOTES

CELL DIMENSIONS BASED ON OBSERVATIONS BY GOLDER FIELD STAFF JULY 2010.

## REFERENCES

ORIGINAL DRAWING OBTAINED FROM CLIENT NO. A1-1417S1-2100-121-0023 DATED 29/08/07, BASE DRAWING LANDFARM.
DATUM: NAD83 PROJECTION UTM ZONE 12

0 10 20
1:400 METRES

CLIENT
DE BEERS CANADA INC.

PROJECT
KENNADY LAKE SOIL TREATMENT FACILITY

CONSULTANT
Golder Associates

| | |
|---|---|
| YYYY-MM-DD | 2014-07-25 |
| PREPARED | A. MAGHERAN |
| DESIGN | D. PRITCHARD |
| REVIEW | D. PRITCHARD |
| APPROVED | D. PRITCHARD |

TITLE
**DISTRIBUTION OF F2 FRACTION HYDROCARBONS IN UPPER 30 cm SOIL LAYER - JUNE 2014**

| PROJECT No. | CONTROL | Rev | FIGURE |
|---|---|---|---|
| 1413240017 | REPA-HM0001 | A | 1 |


EXIST.
DRUM
STORAGE

## LEGEND

| | |
|---|---|
| a | SAMPLE AREA |
| ns | NOT SAMPLED IN JUNE 2014 |
| 358 | CONCENTRATION OF F2 FRACTION HYDROCARBON MEASURED ON JUNE 2014 |

F2 CONCENTRATIONS AT 60 cm DEPTH INTERVAL (2014)

- CELL REMOVED
- 30 - 60 cm LAYER BELOW INDUSTRIAL BUT ABOVE PARKLAND
- 30 - 60 cm LAYER ABOVE INDUSTRIAL
- 30 - 60 cm LAYER BELOW PARKLAND

## GNWT SOIL REMEDIATION OBJECTIVES

| | |
|---|---|
| PARKLAND | 150 mg/kg |
| INDUSTRIAL | 780 mg/kg |

## NOTES

CELL DIMENSIONS BASED ON OBSERVATIONS BY GOLDER FIELD STAFF JULY 2010

## REFERENCES

ORIGINAL DRAWING OBTAINED FROM CLIENT NO. A1-141731-2100-121-0023 DATED 29/08/07, BASE DRAWING LANDFARM.
DATUM: NAD83 PROJECTION UTM ZONE 12

0 10 20
1:400 METRES

CLIENT
DE BEERS CANADA INC.

PROJECT
KENNADY LAKE SOIL TREATMENT FACILITY

CONSULTANT
Golder Associates

| | |
|---|---|
| YYYY-MM-DD | 2014-07-25 |
| PREPARED | A. MAGHERAN |
| DESIGN | D. PRITCHARD |
| REVIEW | D. PRITCHARD |
| APPROVED | D. PRITCHARD |

TITLE
**DISTRIBUTION OF F2 FRACTION HYDROCARBONS IN 30 - 60 cm SOIL LAYER - JUNE 2014**

| PROJECT No. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 1413240017 | REPA-HM-0002 | A | 2 |

## Table 1. Treatment Prescription, Summer 2014 Treatment Season

| Treatment Cell | Soil Removal | Fertilizer Addition | Moisture Control |
|---|---|---|---|
| Cell 1A | Remove the entire upper 30cm from Cell 1 A and set aside for reuse where parkland-quality soil is required. Remove the entire 30-60cm layer and set aside for industrial use. | Add 23 kg of ammonium nitrate fertilizer across the exposed new soil layer requiring treatment using a broadcast spreader. Incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Check moisture content on new soil layer during next sampling event. |
| Cell 1B | Remove the entire upper 0-60cm from Cell 1B and set aside for industrial use. | Add 43 kg of ammonium nitrate fertilizer across the exposed new soil layer requiring treatment using a broadcast spreader. Incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Check moisture content on new soil layer during next sampling event. |
| Cell 1C | Remove the entire upper 30cm from Cell 1C and set aside for reuse where parkland-quality soil is required. Remove the entire 30-60cm layer and set aside for industrial use. | Add 7 kg of ammonium nitrate fertilizer across the exposed new soil layer requiring treatment using a broadcast spreader. Incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Check moisture content on new soil layer during next sampling event. |
| Cell 2A | Soil in Cell 2A does not meet industrial guidelines. Continue aggressive aeration of the upper 50cm of soil. | Add 23 kg of ammonium nitrate fertilizer across the upper soil layer using a broadcast spreader and incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Water the upper soil surface regularly to maintain moisture content. Check moisture content on upper soil layer during next sampling event. |
| Cell 2B | Soil in Cell 2B does not meet industrial guidelines. Continue aggressive aeration of the upper 50cm of soil. | Add 13 kg of ammonium nitrate fertilizer across the upper soil layer using a broadcast spreader and incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Water the upper soil surface regularly to maintain moisture content. Check moisture content on upper soil layer during next sampling event. |
| Cell 3B | Soil in Cell 2C does not meet industrial guidelines. Continue aggressive aeration of the upper 50cm of soil. | Add 10 kg of ammonium nitrate fertilizer across the upper soil layer using a broadcast spreader and incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Water the upper soil surface regularly to maintain moisture content. Check moisture content on upper soil layer during next sampling event. |
| Pilot Biopile | Remove the entire upper 30cm layer and set aside for industrial use. There is high variability in hydrocarbon concentrations in the 30-60cm layer, and this layer requires further treatment. Aggressively mix and aerate the exposed 30 60cm layer. | Add 15 kg of ammonium nitrate fertilizer across the exposed new soil layer requiring treatment using a broadcast spreader. Incorporate into the soil through aeration. | Excavate sump in corner of cell and pump free water from cell for treatment. Check moisture content on new soil layer during next sampling event. |

***Note*** - Once the soil has been removed and the exposed layers have been aerated and levelled for treatment, the regular sampling and analysis program can commence.