TECHNICAL MEMORANDUM

DATE March 1, 2018
PROJECT No. 1780495

TO Darren Stokes, R.T.Ag.
    Repsol Oil & Gas Canada Inc.

CC Aaron Jacobson, P.Geo.

FROM Paul Dewaele, P.Eng. (NT/NU)
EMAIL paul_dewaele@golder.com

DETAILED DESIGN CHANGE TO CONTAINMENT CELL DESIGN (2018) – SATELLITE BAY PANARCTIC F-68 REMEDIATION PROJECT

This technical memo is provided to describe the change to the design of the containment structure at the Satellite Bay Panarctic F-68 Remediation Project site (Site) per Part I, Item 1a of IWB licence N5L8-1837. This design change memo is provided to notify the Inuvialuit Water Board of the rationale for the design change and to describe the pertinent modifications in the containment structure features.

The original design for the containment structure included dimensions of the lined containment cell with dimensions of 34 metres (m) by 70 m, based on the containment of an estimated 850 m$^3$ of contaminated soil. This design included 2.4 m of sandy soil forming a thermal and protective barrier over the geomembrane liner. The thickness of the thermal barrier was based on modelling of the potential thickness of the transition zone under a conservative climate warming scenario.

In 2017, approximately 980 m$^3$ of contaminated soils were excavated and placed on the footprint of the planned lined cell and the western portion of the cell liner was placed and covered with sandy fill from the borrow area. An estimated 800 m$^3$ to 1,200 m$^3$ of additional potentially contaminated soil was identified in 2017; the volume range depends on the thickness of the transition (thaw) zone. The designed increase of the containment cell volume is required to accommodate this additional soil identified in 2017.

The design capacity of the lined cell has been expanded to a total of approximately 2,300 m$^3$ to accommodate the additional soil through the following:

- Extension of the length of the cell by approximately 7 metres to the east, as noted on Figures G-3 and C-7 (proposed extended cell);
- Excavation of clean soils in the area of the eastern extension to a depth of 0.5 metres;
- Decreasing the elevation of eastern edge of the top of the containment cell liner to maintain the required thickness of thermal cover in this area; and,
- Increasing in the height of the cell by approximately 0.75 metres.

The overall thickness of the protective and thermal cover soil remains a thickness of 2.4 m above the containment cell; the outer side-slopes of the cell remain at a slope of 6:1, including the transition between the existing capped
area and the higher cap to the east. The sideslopes to the east will be smoothed into the existing grades resulting in a 6:1 or shallower grade, as shown on Figure C-2.

The estimated additional soil fill from the borrow area required to complete the cell is approximately 15,000 m³ including ponded area fill. Filling of a portion of one ponded area (Area P) east of the cell will be required, in order to extend the 10 metre buffer area beyond the toe of the cell, similar to the existing design. The remainder of the containment structure design, including the locations of the thermistors for temperature monitoring relative to the lined cell and the anchor trench, are unchanged from the current approved design. The current stamped final design is appended.

We trust that the above is sufficient for your purposes at this time. Should you have any questions, please contact the undersigned.

Paul Dewaele, P.Eng. (NT/NU)
Principal, Geo-Environmental Engineer

PJD/MM/pjd

cc: Toivo Pallop, Golder Associates Ltd.

Attachments:

REFERENCE
1. BASemap NORTHWEST TERRITORIES CENTRE FOR GEOMATICS. WEBSITE: http://www.gnwtgeomatics.nt.ca

SITE LOCATION PLAN
SCALE 1:60,000

KEY PLAN
NOT TO SCALE

PROJECT LOCATION

SITE LOCATION PLAN
SCALE 1:60,000

FINAL

COVER SHEET AND DRAWING INDEX

DRAWING INDEX

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SATELLITE F-68 NWT, ARCTIC CONTAMINATED SOIL AND WASTE CONTAINMENT STRUCTURE

SATELLITE BAY, PRINCE PATRICK ISLAND, NWT

REPSOL OIL & GAS CANADA INC.
1. Dimensions, elevations and stations are in Metres unless noted otherwise.
2. Wellsite boreholes locations not shown for clarity. See drawings G-1.
3. Borrow area to be set back from borrow retaining embankments.
4. Depth of excavation within the borrow area shall be typically 0.5 to 1.0 meters below original grade. At the completion of the excavation, the borrow area will be left in place as a surface depression. For surface depressions, the Borrow area limits shall be staked in place and established boundaries to existing borrow to limit pond development.
5. Soil width surface water management control, measured from the depth of excavation, prior to and throughout construction activities. The locations of erosion control measures will be field verified, placed and maintained during construction. The erosion control measures will be inspect daily and after a precipitation event during construction.

References:
1. Existing Topographic Features Compiled Using UAV and Ground Survey including bathymetric performed by Golder Associates Ltd. 2015.
2. Coordinates Reference UTM Zone 11 WGS84.
1. Existing Topography compiled using LIDAR and ground survey including bathymetry performed by Golder Associates Ltd., 2015.

2. Drain all ponded areas within 10 m buffer zone prior to backfilling and compacting. All backfill within the 10 m buffer zone shall be compacted and graded to drain away from the contamination cell.

3. Estimated volume of contaminated soil, areas 1,380 m³ including buffer areas.


7. BATHYMETRY PERFORMED BY GOLDER ASSOCIATES LTD., 2015.

8. GOLDER ASSOCIATES, INC. JUNE 2016, TECHNICAL MEMORANDUM "GEOTECHNICAL FIELD INVESTIGATION TALISMAN ENERGY PANARCTIC SATELLITE F-68 WELLSITE", PROJECT NO. 1531921.

9. GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PATRICK ISLAND FOR ACCES SATELLITE F-68", PROJECT NO. 1531921.

10. GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PATRICK ISLAND FOR ACCES SATELLITE F-68", PROJECT NO. 1531921.

11. GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PATRICK ISLAND FOR ACCES SATELLITE F-68", PROJECT NO. 1531921.
1. DIMENSIONS, ELEVATIONS AND STATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. EXISTING FROZEN BURIED DEBRIS ARE NOT PLANNED GEOSYNTHETIC COVER ELEVATION TO BE GRADED TO CONTAINMENT CELL.
3. EXISTING CONTAMINATED SOIL AREAS TO EXCAVATED, RELOCATED TO CONTAINMENT CELL AND BURIED WITH CLEAN AGGREGATES AND SANDS. ALL MARL FILED WITH CLEAN AGGREGATES AND Sanded PRIOR TO BACKFILLING WITH AGGREGATE AND COMPACTING.
4. DRAIN PONDED AREAS PRIOR TO BACKFILLING WITH AGGREGATE AND COMPACTING.
5. EXISTING BURIED DEBRIS/CONTAMINATED SOIL (DO NOT EXCAVATE)
6. FROZEN BURIED DEBRIS/CONTAMINATED SOIL (DO NOT EXCAVATE)

REFERENCES
1. EXISTING TOPOGRAPHY COMPILED USING UAV AND GROUND SURVEY INCLUDING BATHYMETRY PERFORMED BY GOLDER ASSOCIATES LTD., 2015.
2. GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PRINCE PATRICK ISLAND FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.
4. GOLDER ASSOCIATES, INC. NOVEMBER 25, 2015, TECHNICAL MEMORANDUM "DESIGN OF WASTE CONTAINMENT STRUCTURE ON PRINCE PATRICK ISLAND, NWT", PROJECT NO. 1531921.
5. GOLDER ASSOCIATES, INC. OCTOBER 2015, TECHNICAL MEMORANDUM "2015 COORDINATES REFERENCE UTM ZONE 11 WGS84. ELEVATIONS ARE ORTHOMETRIC"
6. GOLDER ASSOCIATES, INC. OCTOBER 2015, TECHNICAL MEMORANDUM "2015 COORDINATES REFERENCE UTM ZONE 11 WGS84. ELEVATIONS ARE ORTHOMETRIC"
7. GOLDER ASSOCIATES, INC. NOVEMBER 25, 2015, TECHNICAL MEMORANDUM "DESIGN CRITERIA GUIDANCE FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.
8. GOLDER ASSOCIATES, INC. NOVEMBER 25, 2015, TECHNICAL MEMORANDUM "DESIGN CRITERIA GUIDANCE FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.

NOTES
FILL THICKNESS VARIES
RELOCATED CONTAMINATED SOIL (FULL THICKNESS VARIES)
EXISTING CONTAMINATED SOIL (FULL THICKNESS VARIES)
EXISTING GROUND
CONTAINMENT STRUCTURE, TYING TO EXISTING GRADE.
CELL AND BACKFILLED WITH CLEAN AGGREGATE AND MOUNDED. ALL BACKFILL WITHIN THE 10 m BUFFER AREA SHALL BE COMPACTED AND GRADED TO DRAIN AWAY FROM THE CONTAINMENT CELL.
GRADE TO DRAIN
ACTIVE PERMAFROST LOWER DEPTH AT TIME OF INVESTIGATION
PONDED AREA FILL
GRADE TO DRAIN
BUFFER ZONE
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BUFFER ZONE
GRADE TO DRAIN

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1. EXISTING TOPOGRAPHY COMPILED USING UAV AND GROUND SURVEY INCLUDING BATHYMETRY PERFORMED BY GOLDER ASSOCIATES LTD., 2015.
2. GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PRINCE PATRICK ISLAND FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.
DRAIN PONDED AREA PRIOR TO PLACING FILL (TYPICAL)

2% GRADE TO DRAIN (TYP.)

EDGE OF FROZEN BURIED CONTAMINATED SOIL

BURIED FROZEN DEBRIS / CONTAMINATED SOIL (DO NOT EXCAVATE)

RELOCATED CONTAMINATED SOIL (THICKNESS VARIES)

PONDED AREA FILL (SEE TABLE 1, DRAWING C2)

(SEE NOTE 1)

20 mm Ø FLEXIBLE ELECTRICAL CONDUIT WITH TAC THERMISTOR

20 mm Ø FLEXIBLE ELECTRICAL CONDUIT WITH TAC THERMISTOR

20 mm Ø FLEXIBLE ELECTRICAL CONDUIT WITH TAC THERMISTOR

2.4 m AGGREGATE COVER

RELOCATED CONTAMINATED SOIL (THICKNESS VARIES)

6H 1V 6H 1V 2H 1V 2H 1V

ACTIVE PERMAFROST LEVEL AT TIME OF INVESTIGATION

MINIMUM 0.15M SANDY SOIL OVER PRE-EXISTING WASTE

10 m BUFFER (GRADE TO DRAIN) (SEE NOTE 1)

20 mm Ø FLEXIBLE ELECTRICAL CONDUIT WITH TAC THERMISTOR

20 mm Ø FLEXIBLE ELECTRICAL CONDUIT WITH TAC THERMISTOR

GEOMEMBRANE LINER (40 MIL)

GEOSYNTHETIC LINER (0.75 m ADDITIONAL CONTAMINANT FILL & COVER (LONGITUDINAL AXIS TYP.)

THERMISTOR CABLE ENCASED IN 25 mm FLEXIBLE PEX TUBING COVER

PERMAFROST

GEOSYNTHETIC COVER GRADE 2%

TOP OF COVER ALIGNED AT 2:1 TOE OF CONTAMINANT FILL

1. ALL BACKFILL WITHIN THE 10 m BUFFER AREA SHALL BE COMPACTED AND GRADED TO DRAIN AWAY FROM THE CONTAINMENT STRUCTURE, TYING TO EXISTING GRADE.

2. TAC - THERMAL ELECTRICAL CABLE

NOTES

1. ALL BACKFILL WITHIN THE 10 m BUFFER AREA SHALL BE COMPACTED AND GRADED TO DRAIN AWAY FROM THE CONTAINMENT STRUCTURE, TYING TO EXISTING GRADE.

2. TAC - THERMAL ELECTRICAL CABLE