MONTHLY UPDATE REPORT - PRIMROSE SOUTH
09-21-067-04 W4M

APRIL 7, 2014

1 Introduction

The Canadian Natural Resources Limited Primrose South in situ oil sands project is located primarily in the Cold Lake Air Weapons Range approximately 65 km north-northeast of Bonnyville, Alberta. Canadian Natural operations staff discovered a flow to surface (FTS) bitumen emulsion at 09-21-067-04 W4M on June 24, 2013. The FTS area is beneath an unnamed water body within the Canadian Natural Primrose South production area.

On September 24, 2013, Alberta Environment and Sustainable Resource Development (ESRD) issued an Environmental Protection Order (EPO No. EPO-2013-33/NR), requesting the preparation of a Comprehensive Remedial Plan (CRP), as well as the preparation of a monthly progress report.
This report summarizes the progress towards the realization of this plan and includes data collected and reported up to March 24, 2014. The information in this report focuses on data collected since February 18, 2014.

2 Summary of Activities to Date

2.1 Individual Plan Submissions

As required by the EPO, the CRP includes the development, submission and implementation of several specific plans. The status of these plans is indicated in Table 1 below:

Table 1: Components of the Comprehensive Remedial Plan

Item	Plan Name	Due Date	Submission Date	Approval Date	Implementation Start Date	Completion Date	Section Discussed
1.	**Water Management Plan for Dewatering**	September 26, 2013	September 26, 2013	September 27, 2013	September 27, 2013	October 22, 2013	2.2
2.	**Water Body Monitoring Plan**	September 26, 2013	September 26, 2013	September 27, 2013	September 27, 2013	Ongoing	3.0
3.	**Erosion and Sedimentation Prevention Plan**	September 26, 2013	September 26, 2013	September 27, 2013	September 27, 2013	Ongoing	3.2
4.	**Phase II Environmental Assessment Plan**	October 15, 2013	October 3, 2013	October 17, 2013	January 6, 2014	Ongoing	3.3
5.	**Bitumen Emulsion Delineation and Containment Plan**	October 6, 2013	October 3, 2013	October 17, 2013	October 18, 2013	Ongoing	3.4

Item	Plan Name	Due Date	Submission Date	Approval Date	Implementation Start Date	Completion Date	Section Discussed
6.	**Amphibian Salvage Plan**	September 26, 2013	September 25, 2013	September 27, 2013	September 27, 2013	October 22, 2013	Complete
7.	**Fish and Fish Habitat Assessment Plan**	September 26, 2013	September 25, 2013	September 27, 2013	September 27, 2013	October 30, 2013	Complete
8.	**Wetlands Impact Assessment Plan**	September 30, 2013	September 25, 2013	September 27, 2013	September 27, 2013	October 30, 2013	Complete
9.	**Water Body Restoration Plan**	November 30, 2013	Revised Plan March14, 2014	March 14, 2014	No later than April 1, 2014	Pending	N/A
10.	**Wildlife Management Plan**	N/A	Revised Plan October 23, 2013	October 23, 2013	October 23, 2013	Pending	3.5
11.	**Waste Management Plan**	N/A	Revised Plan October 24, 2013	October 24, 2013	October 24, 2013	Pending	3.6
12.	**Bitumen Emulsion Delineation and Containment Plan**	October 6, 2013	Revised Plan December 22, 2013	February 7, 2014	November 27, 2013	Pending	3.3, 3.4

2.2 Water Management for Dewatering

The water body was divided in four basins as indicated on Figure 1. Basins 1, 2 and 3 were dewatered, while Basin 4 and a nearby borrow pit are being used to store the water from Basins 1, 2 and 3. Three independent pumping systems were used to pump water from Basins 1, 2 and 3. This configuration allowed Canadian Natural to adjust pumping rates in the various basins as specified in the approved Water Management Plan for Dewatering.

Pumping started on September 27, 2013. The volume of water pumped from each basin is presented in Appendix A. On October 22, 2013, pumping was stopped.

- Between February 18 and March 24, 2014, no water was pumped to surrounding areas as all water in Basins 1, 2 and 3 is frozen. Furthermore, due to freezing conditions, no fluid entered the excavations; therefore, no fluid (bitumen emulsion and surface water) was recovered from the 9-21 FTS site for disposal. Since excavation of impacted material from the 9-21 FTS began, a total of 355.8 m^3 of impacted water from the FTS excavation area was disposed at the Tervita Lindbergh, Alberta, cavern. Between February 18 and March 24, 2014, 491 m^3 of water was collected and hauled to a lined containment cell (Cell D) for storage. Details on containment cells are provided in Section 3.6.

The dewatering activities took place in accordance to the conditions specified in the Water Management Plan for Dewatering and in the Erosion and Sedimentation Prevention Plan (Table 1, Items 1 and 3).

3 Water Body Monitoring

In accordance with the Water Body Monitoring Plan (Table 1, Item 2), an extensive water quality and water quantity monitoring program was implemented on September 27, 2013. This ongoing program is tailored to the level of activity taking place at the 9-21 FTS site and complements the ongoing water quality and quantity monitoring implemented in June 2013.

3.1 Dewatering Water Quality

Weekly water sampling was discontinued after November 12, 2013 due to freeze-up and completion of dewatering, except weekly sampling, was continued through February 26, 2014 in one shallow groundwater monitoring well (13-DP-4, Section 3.1.3). During the dewatering program, water quality was within *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Tier 1) at all sampling locations. Sampling locations are shown on Figure 2.

3.1.1 Dewatering Water Quantity

The amount of water pumped from Basins 1, 2 and 3 as of December 7, 2013, was 404,378 m^3. Pumping to remove water seeping into Basin 1 was discontinued after November 24, 2013, due to freezing temperatures.

3.1.2 Surface Water Quality

Water quality samples were collected weekly from Basins 1, 2 and 3, during the dewatering period, and from Basin 4 and the downstream fen until freeze-up, which occurred between October 29 and November 12, 2013 (Figure 2). The samples were tested to ensure water quality in the receiving environment was not being affected by the dewatering operations. Water quality results are presented in Appendix B. No water quality samples were collected from the water body or downstream fen after November 12, 2013, due to frozen conditions.

In preparation for the rewatering activities, Basin 4 (13-SW12) was sampled on March 19, 2014. Water quality results were within freshwater aquatic life guidelines with the exception of one toluene measurement. Toluene is ubiquitous in the environment and has both anthropogenic and natural sources. The most common source of toluene is motor vehicle exhaust.

3.1.3 Shallow Groundwater

Shallow groundwater quality samples underlying the north end of Basin 3 of the water body were collected from one shallow drive-point piezometer well (13-DP4) on February 19 and February 26, 2014 (Figure 3). Water quality results are presented in Appendix B.

Water quality from the shallow groundwater locations was within freshwater aquatic life guidelines. Hydrocarbons were not detected in any shallow groundwater samples taken on February 19 and 26, 2014. Polycyclic aromatic hydrocarbons (PAHs) were not detected in any shallow groundwater samples taken on February 19 and 26, 2014. Chlorides were below detection limits in all samples.

3.2 Erosion and Sedimentation Prevention

The dewatering activities took place in accordance to the conditions specified in the Erosion and Sedimentation Prevention Plan (Table 1, Item 3). All erosion and sediment control structures, which

were set up during the dewatering program, were removed once pumping was suspended on October 22, 2013. However, containment structures, such as the aquadams located in Basin 4 and at the south end of Basin 1, will be removed in spring 2014. There were no signs of erosion or sedimentation associated with the dewatering program.

Erosion and sediment control structures are currently not required as all remedial works are being completed within the dewatered water body. Any water that was intermittently collected from the water body, after the dewatering phase was suspended on October 22, 2013, was stored in tanks and disposed offsite. Erosion and sediment control structures will be implemented during the water body refilling phase, as required.

3.3 Phase II Environmental Assessment

ESRD approved a plan for conducting an interim Phase II environmental site assessment (ESA) of shallow soils at the site on October 17, 2013. As part of the interim ESA in December 2013, boreholes were drilled in Basins 1 and 2 as well as the south portion of Basin 3, to assess soil types and the potential presence of bitumen emulsion in the soils underlying the water body. The drilling of shot holes, used for the placement of charges for a seismic survey in Basins 1, 2 and 3 (the seismic program was unrelated to the Phase II ESA or to the investigation of the bitumen emulsion release) was completed between February 8 and 10, 2014 in Basin 3 and on February 27, 2014 in Basins 1 and 2. A total of 214 shot holes were drilled to depths between 6 and 9 m in Basin 3 and 66 were drilled in Basins 1 and 2. The shot holes provide additional subsurface Information such as ice thickness, organic material thickness and presence/ absence of bitumen emulsion. This information will be included in the Interim Phase II ESA report. Based on observations, bitumen emulsion was encountered at the surface in two of the shot holes located in Basin 2. The two shot holes were drilled in areas scheduled for surface scraping to remove residual bitumen emulsion. Test pits were excavated in the area and confirmed that the bitumen emulsion was present at surface only. The area was subsequently scraped and sampled as part of the shoreline scraping activities. The Interim Phase II ESA report (soils only) is currently being compiled.

3.4 Bitumen Emulsion Remediation and Containment

3.4.1 Remedial Activities of the Release Point for Bitumen Flow to Surface

From February 18 to March 24, 2014, the following activities were carried out as part of the plan to characterize and contain the bitumen emulsion release point:

- Testing of ice thickness in Basins 1 and 3 was suspended in January 2014 due to temperatures measured below -15°C, and the last ice thickness measurement from January 2014 indicated that the ice was at least 30 cm thick. Ice thickness measurements were conducted in Basin 3 in February, before the second seismic survey activities started and the ice thicknesses measured were still at least 30 cm thick. Regular ice thickness measurements will not be conducted again as activities requiring access onto ice have ended.

- Excavation at the western shore of the water body, in the area of the fissures, was completed on February 15, 2014. This included the enlargement of the excavation to encompass the area required for the approved fissure containment structure and drilling pad. The fissure has been fully exposed and delineated.

- Bitumen-impacted excavated material was stockpiled in containment cells for temporary storage before trucking to landfill. Confirmatory soil samples collected in a grid pattern from the base of the area excavated to remove material containing bitumen emulsion and to expose the fissure, were submitted for analysis of hydrocarbons. Between November 27 and March 6, 2014, 182 samples were collected from the FTS excavation area. Samples were taken from the top 10 cm of clay exposed after excavation. On February 13 and 14, an additional 34 samples were collected from the final walls of the excavation near the centre of the water body. Based on sampling results, on March 21, 2014, seven remaining sample locations were rescraped and resampled. All confirmatory soil samples have been collected from within the fissure excavation. Analytical results have not been received from the last seven samples. All other confirmatory samples are within guidelines for petroleum hydrocarbons (PHCs) and PAHs. The extent of the scraped area is shown on Figure 4. Ice and high ice content frozen sediments with bitumen emulsion were temporarily placed in lined Cell C. The material will be allowed to melt so that the water and sediments can be disposed separately. Details on containment cells are provided in Section 3.6.

- Excavation of bitumen-impacted soil and ice, and removal of affected vegetation from shoreline areas continued intermittently between December 1, 2013 and March 24, 2014. Approximately 500 soil samples were collected from the scraped areas of Basin 1 as well as from the east and west sides of Basin 3, immediately north of the former east-west right-of-way. Samples were taken from the upper 10 cm of sediment remaining after excavation. The sediments were scraped to a depth of approximately 30 cm based on the visual observation of bitumen emulsion, and confirmatory samples were collected based on a 10 m linear grid pattern and tested for hydrocarbons. Over the course of the shoreline excavation, the bitumen-impacted soil and ice was transported either to containment Cells A and B for offsite disposal or containment Cell C or D for storage. Details on containment cells are provided in Section 3.6. All shoreline scrape activities are now complete, with the exception of minor areas that may need to be rescraped and resampled pending receipt of analytical data. Results from approximately 100 confirmatory samples are pending. Figure 4 shows the extent of the shoreline scrape area.

- Between March 19 and 23, 2014, 17 test pits were advanced in Basins 1 and 3 (Figure 4). The test pits were placed in areas not scheduled for shoreline scraping to confirm the absence of bitumen emulsion. In all but one of the test pits, bitumen emulsion was not observed. In the test pit where the bitumen emulsion was observed at the ice-sediment interface (TP6), the area was subsequently excavated following surface scraping protocols and confirmatory samples were collected. The area was in Basin 3 north of the former east-west access road.

- Clean organic sediment from the enlargement of the fissure excavation that was stockpiled in Basin 3 have been spread over the shoreline scrape areas of Basins 1 and 3 (approximately 7,576 m^3). The 1,224 m^3 of stockpiled clean clay from the removal of the ice road has been used to create soil "benches" for equipment to sit on inside of the containment wall during wall construction.

3.4.2 Containment of Bitumen Emulsion

Due to frozen conditions and the slow seepage of bitumen emulsion from the fissure, the temporary containment of bitumen emulsion during fissure exposure and material excavation was not required. However, due to construction activities within the excavation, a temporary low (0.5 to 1.0 m high) clay berm was constructed surrounding the fissure to ensure equipment would not come in contact with the bitumen emulsion. During the week of March 17, 2014, a polyethylene liner was placed over the fissures and additional flagging and wildlife deterrents were installed to prevent potential wildlife contact with bitumen. Water recovered from the excavation is currently collected in depressions within the excavation, removed by vacuum truck and hauled to Cell D for storage and future disposal. Details on containment cells are provided in Section 3.6.

3.4.3 Final Design for Permanent Containment of Bitumen Emulsion Seepage from Fissure

ESRD granted approval of the Temporary Workspace Containment Structure Plan (containment wall) on January 24, 2014. The containment wall is to be located in Basin 1 (Figure 4) to provide a temporary work space for completing bitumen emulsion containment berms around the fissure, as well as construction of a drilling pad. Construction of the containment wall started February 18, 2014. As of March 24, 538.5 m of the sheet pile wall has been erected, representing 100% completion of the pile driving phase. Approximately 62% of the 1 m^3 sand bags have been placed on the interior, upstream side of the wall. The remaining bags are scheduled to be in place in the next 10 days. The top elevation of the wall was surveyed on March 17, 2014, and cutting the excess steel to the final wall height started on March 11, 2014 and was completed on March 21, 2014. Capping of the wall was completed March 22 and the joint seam taping was completed March 20. It is planned to start refilling the water body on March 27, 2014, weather dependent.

The fissure containment structure will be similar to the structures completed at the 10-1, 10-2 and 2-22 FTS sites. The fissure will be surrounded by a low earthen berm, a heating pipe will be installed to facilitate bitumen emulsion removal in cold weather and the space within the bermed area containing the fissure will be filled with logs to create a void to allow the bitumen emulsion to collect. An impermeable liner will be placed over the logs and the structure covered with clay fill. When complete, the structure will be buried beneath the drilling pad and recovery culverts and monitoring wells installed to recover the bitumen emulsion and to track possible seepage outside of the structure.

Monitoring wells and recovery culverts will be installed through the drill pad, around the fissure containment structure, to allow monitoring and recovery of the bitumen emulsion seepage.

3.4.4 Schedule of Implementation

The schedule of implementation was provided in the approved Bitumen Emulsion and Delineation Plan; there have been no deviations to date.

3.5 Wildlife Management

Wildlife management activities between February 18 and 24, 2014 included maintaining perimeter fencing; installing, maintaining and frequently relocating up to four wildlife scare cannons (Zon Guns); conducting daily inspections; and installing new wildlife deterrents in preparation for refilling activities.

Ground disturbance activities were conducted on March 6, 2014 to prepare for additional wildlife deterrent installations and wildlife fencing to be constructed at the water body and at containment Cells C and D. Construction started March 7, 2014 and to date, 96% of the deterrents have been installed in the water body (Figure 5). Approximately 60% of the deterrents have been constructed on the top of the containment wall and two additional Zon Guns have been placed at the east gate entrance to the site. The wildlife and silt fences have been constructed surrounding Cell C and are 25% complete at Cell D. Details on containment cells are provided in Section 3.6.

3.6 Waste Management

Waste generated as part of the remediation program includes liquid bitumen emulsion, vegetation containing bitumen emulsion, oily absorbents, fluids and soil and sediment containing bitumen emulsion. All waste was collected in bags, bins or barrels or was trucked to lined containment cells for temporary storage. Waste is tested to ensure that it meets landfill requirements and is suitable to transport by truck. All waste is manifested for transportation and is disposed at certified waste management facilities. Soils near waste storage areas onsite are tested before collection and will be assessed following completion of the remediation program.

The waste management program is summarized as follows:

- Impacted soil temporarily stockpiled in Cells A and B have been transported to the landfill for disposal and both cells have been decommissioned. Materials in Cells C and D will be transported to the landfill for disposal in spring 2014, after the material has been dewatered to meet landfill criteria.

- Construction of the fourth lined containment cell (Cell D) was completed on March 2, 2014 at former lease 14-1, located at 15-26-067-04 W4M northeast of the water body. Cell D was constructed to hold organic and mineral soils that cannot be transported to the landfill due to high water content. The construction of Cell D was limited to within the boundaries of the temporary field authorization (TFA141897) issued under MSL 030705 in 15-26-067-04 W4M.

- Decommissioning of Cells A and B began on February 26, 2014 and was completed March 11, 2014. Impacted soil recovered during the cell decommissioning was transferred to the Tervita Corporation landfill in Bonnyville, Alberta, for disposal. Confirmatory soil samples were collected from beneath the decommissioned cells and submitted for laboratory analysis of salinity, metals, PHCs and PAHs in

accordance with the Waste Management Plan. Between February 18 and March 24, 2014, 1,543 tonnes of soil was transported to the landfill. To date, a cumulative total of 32,714 tonnes of soil containing bitumen emulsion has been taken to the Tervita Bonnyville landfill. Based on the bitumen content of the soil, a cumulative total of 108 tonnes of bitumen emulsion have been removed from the site as part of the impacted materials.

- Since excavation of impacted material from the 9-21 FTS began, a total of 355.8 m^3 of impacted water from the FTS excavation area was disposed at the Tervita Lindbergh, Alberta, cavern. The reported fluid volume in this report has been updated to reflect to-date summaries received from Tervita. A total fluid volume from the beginning of the FTS excavation is currently being processed by Tervita and Canadian Natural. Water captured in the excavation from the containment wall trench and in depressions within the FTS excavation was hauled to Cell D for storage and future disposal. Between February 18 and March 24, 2014, 491 m^3 of water was collected and hauled to Cell D for storage.

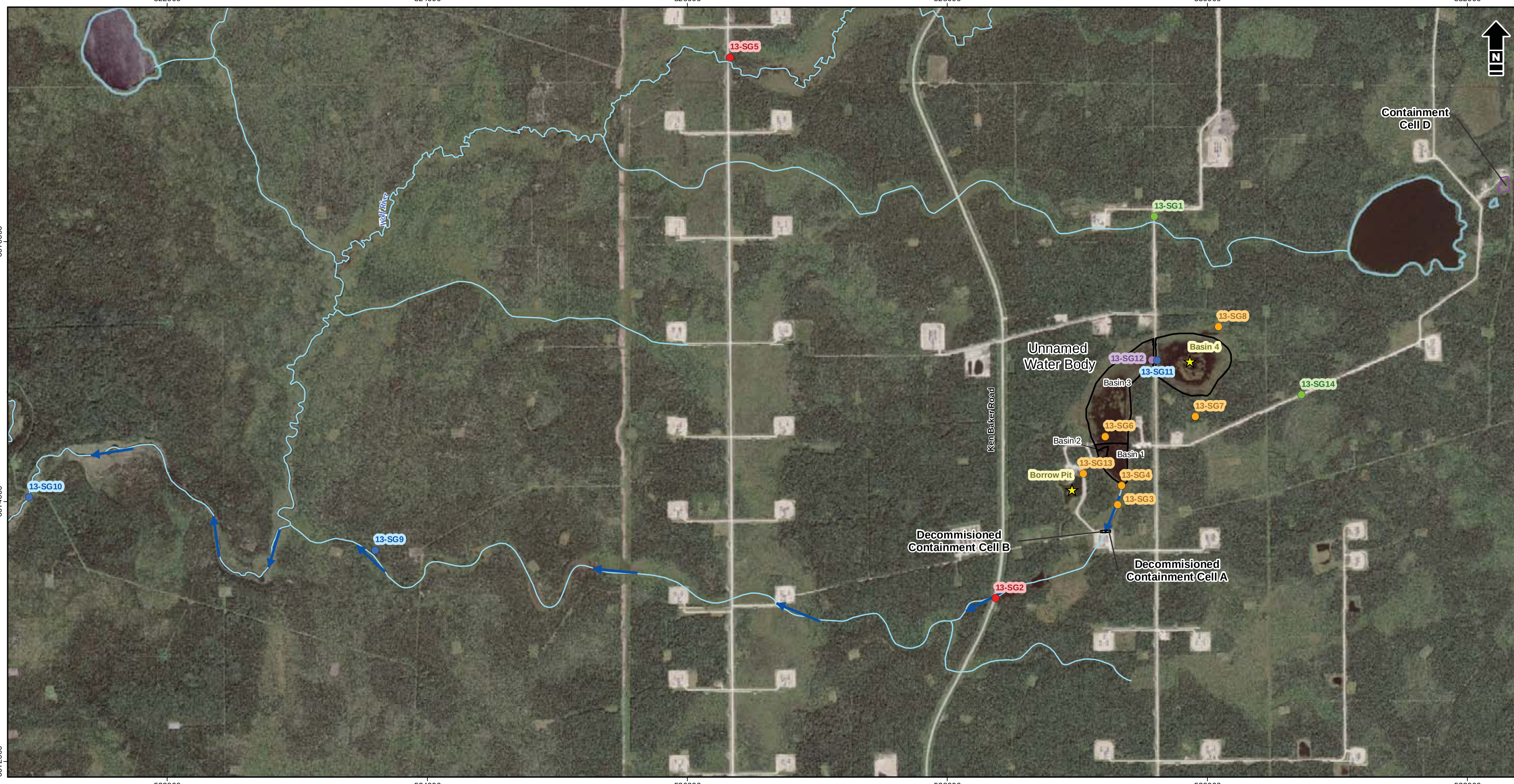
4 Conclusions

The data collected between February 18 and March 24, 2014, indicate that dewatering and subsequent remediation activities have not had any detectable adverse effect on the hydrology and water quality in the surrounding environment. Furthermore, continued compliance with requirements of the EPO has been demonstrated throughout the monitoring period.

Excavation of impacted soil within the fissure area is complete. Enlargement of the excavation to encompass the area needed for the fissure containment structures, including the containment wall and future drilling pad footprint, is also complete. Scraping of the impacted sediments along the shoreline in Basins 1 and 3 are complete pending receipt of all confirmatory soil sample analytical results. Installation of 1 m^3 sand bags placed on the inside the completed containment structure wall is ongoing and scheduled to be completed the first week of April.

Refilling of the water body outside of the containment wall is scheduled to start March 27, 2014 and will be consistent with conditions specified in the Water Body Restoration Plan (Table 1, Item 9).

The work is progressing as planned and the objectives, as required by the EPO, are being achieved within the required time frame.



- Basin Boundary
- Containment Cell D
- Decommisioned Containment Cell
- Water Body
- Watercourse
- Direction of Flow
- Staff Gauge Location (Discontinued on October 6, 2013)
- Staff Gauge Location (Discontinued on October 23, 2013)
- Staff Gauge Location (Discontinued on October 29, 2013)
- Staff Gauge Location (Discontinued on November 5, 2013)
- Staff Gauge Location (Discontinued on November 12, 2013)
- Water Level Monitoring Location

1:30,000

310 0 310 620 m

NAD 1983 UTM Zone 12N

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. Imagery obtained from client (September 2013) used under license.

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Primrose 09-21-067-04 W4M

Staff Gauge, Discharge, and Water Level Monitoring Locations

Date:	Project:	Technical:	Reviewer:	Drawn:
24 Mar 2014	8881-523	A. Ward	P. Hum	R. Keller

Figure
1

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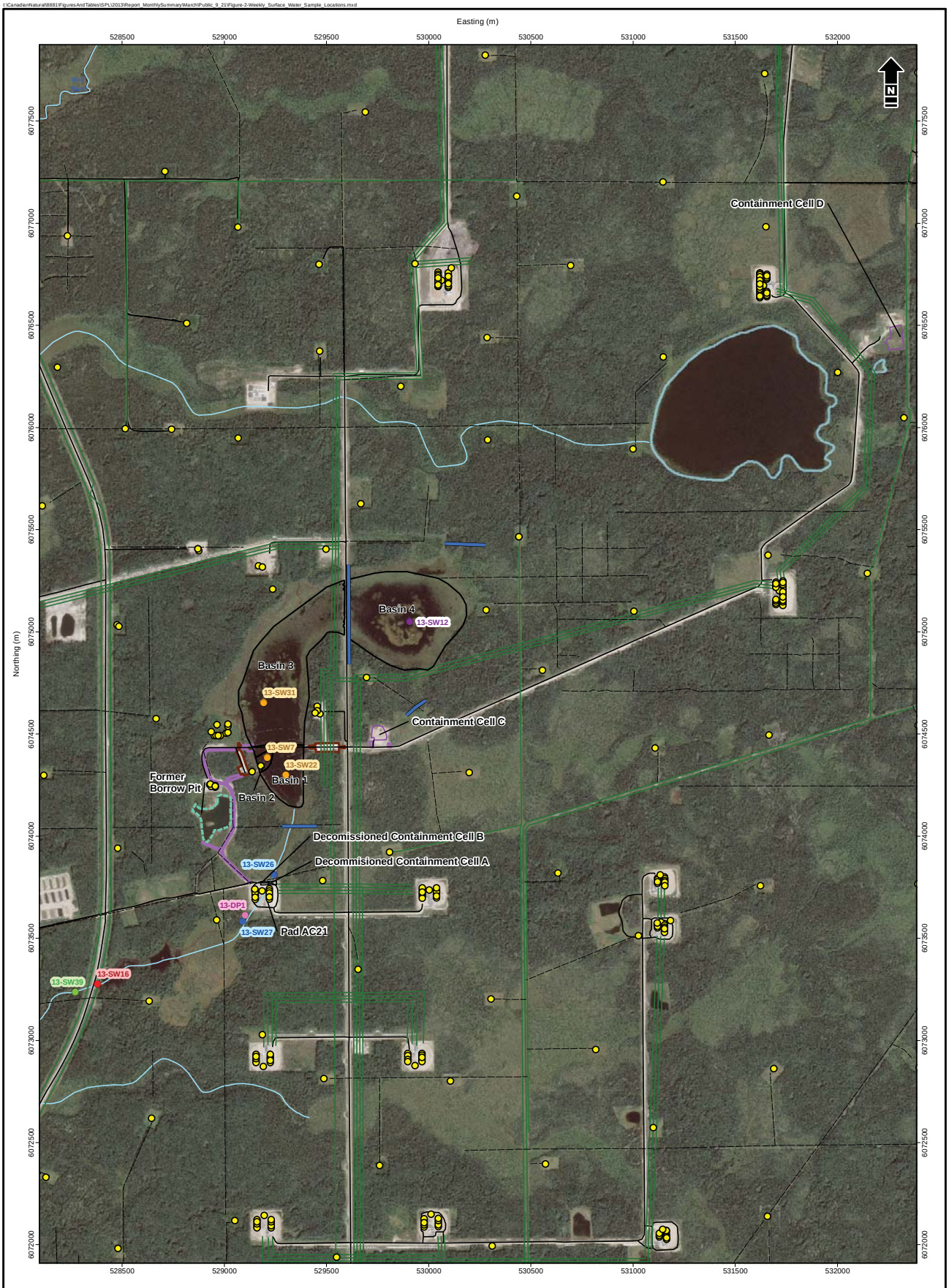

- Basin Boundary
- Old Borrow Area
- Access
- Containment Cell
- Decommisioned Containment Cell
- Matted Area
- Watercourse
- Aqua Dam
- Road
- Cut Line
- Pipeline
- Weekly Surface Water Monitoring Location (Discontinued on October 9, 2013)
- Weekly Surface Water Monitoring Location (Discontinued on October 29, 2013)
- Weekly Surface Water Monitoring Location (Discontinued on November 5, 2013)
- Weekly Surface Water Monitoring Location (Discontinued on November 12, 2013)
- Weekly Surface Water Monitoring Location (Continued on March 19, 2014)
- Drivepoint Piezometer Sample Location (Discontinued on October 29, 2013)
- Production Well

1:17,500
m
175 0 175 350
NAD 1983 UTM Zone 12N

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Weekly Surface Water Monitoring Locations as of March 24, 2014

Date:	Project:	Technical:	Reviewer:	Drawn:
25 Mar 2014	8881-523	A. Ward	P. Hum	R. Keller

Figure 2

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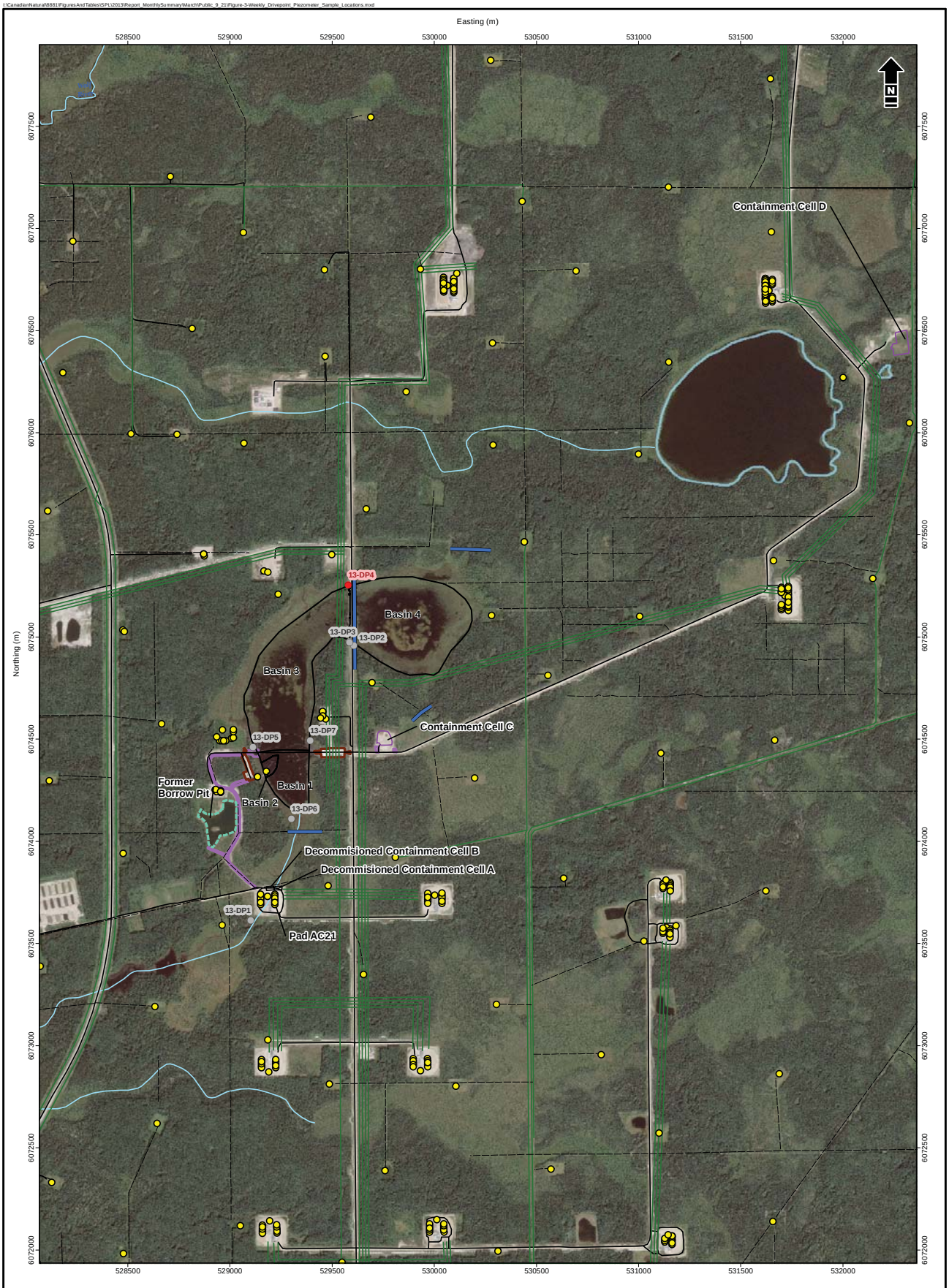

- Basin Boundary
- Old Borrow Area
- Access
- Containment Cell
- Decommisioned Containment Cell
- Matted Area
- Watercourse
- Aqua Dam
- Road
- Cut Line
- Pipeline
- Drivepoint Piezometer Sample Location (Discontinued on February 26, 2014)
- Discontinued Drivepoint Piezometer Sample Location (Discontinued on November 12, 2013)
- Production Well

1:17,500
175 0 175 350 m
NAD 1983 UTM Zone 12N

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Weekly Drivepoint Piezometer Sample Locations

Date:	Project:	Technical:	Reviewer:	Drawn:
25 Mar 2014	8881-523	A. Ward	P. Hum	R. Witty

Figure 3

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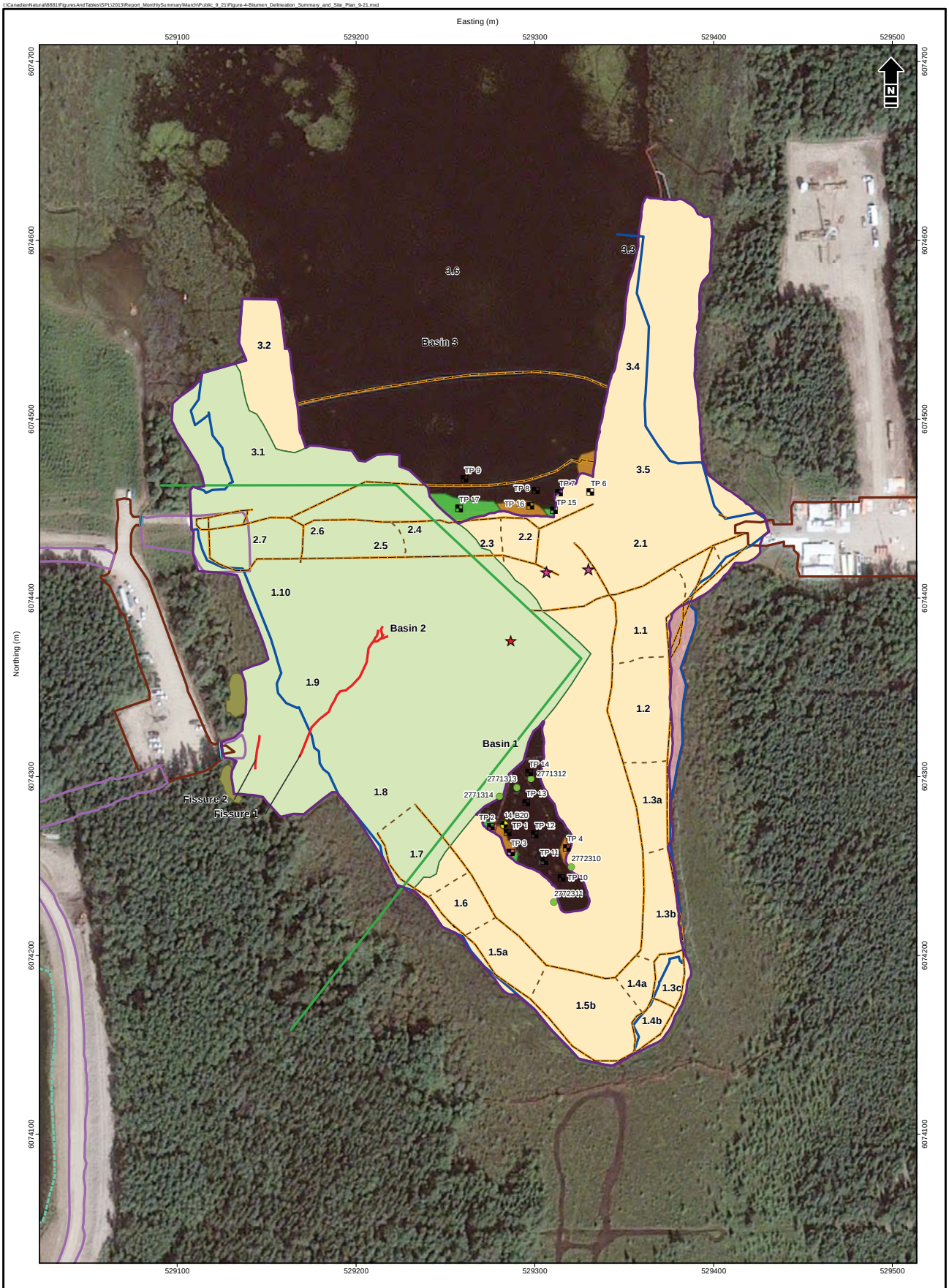

Scraped to 30cm
Excavation to Clay
Potentially clean peat
Old Borrow Area

Recommended Removal Option
1 - Manual Soil Removal and Full Vegetation Removal
2 - Manual Soil Removal and Partial Vegetation Removal
3 - Mechanical Soil Removal and Full Vegetation Removal
4 - Mechanical Soil Removal and Partial Vegetation Removal

Access
Rig Matting
Boom
Containment Structure
Gate
Exposed fissure
Silt Fence
Edge of Bitumen Emulsion Survey Assessment
Final Extent of Excavation or Shoreline Scrape and Observed Bitumen Emulsion at Shoreline

Piling
Spill Incident
GeoTech Borehole
Seismic Shothole
Test Pit

Scraped to 30cm - 39,053 m^2
Excavation to Clay - 35,207 m^2

Note: Removal Option Numbers (1 through 5) are described in Table 1 and presented in Appendix A.

1:2,000
m
20 0 20 40
NAD 1983 UTM Zone 12N

Reference: Imagery obtained from client (September 2013).

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Primrose 09-21-067-04 W4M

Bitumen Delineation Summary and Site Plan

Date:	Project:	Technical:	Reviewer:	Drawn:
25 Mar 2014	8881-523	A. Ward	P. Hum	R. Keller

Figure 4

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Preliminary Drilling Pad
Wetland Boundary
Pennant Flag
Bird Guard
Kite
Wavy Man
Windsock
Zon Cannon

1:5,000
m
50 0 50 100
NAD 1983 UTM Zone 12N

Reference: Imagery obtained from client (September 2013).

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Spring 2014 Proposed Deterrent Plan

Date:	Project:	Technical:	Reviewer:	Drawn:
24 Mar 2014	8881-523	S. Toner	S. Toner	R. Keller

Figure
5

APPENDIX A

DAILY FLOW VOLUMES

Appendix A: Daily Flow Volumes

CNRL Primrose 09-21 Water Body: Dewatering Phase

Date	Daily Total Discharge (m^3/day)	Cumulative Pumped (m^3)	Daily Total Discharge m^3/day	Cumulative Pumped (m^3)	Daily Total Discharge m^3/day	Cumulative Pumped (m^3)	Daily Volume from Water Body (m^3/day)	Cumulative Total from Water Body (m^3)
	Basin 1		Basin 2		Basin 3			
Design Rate:	**5,800**	-	**430**	-	**15,000**	-	**21,230**	
27-Sep-13	838	838	180	180	375	375	1,393	1,393
28-Sep-13	5,277	6,115	1,184	1,364	5,431	5,806	11,892	13,285
29-Sep-13	2,830	8,945	450	1,814	7,072	12,878	10,352	23,637
30-Sep-13	3,696	12,641	124	1,938	8,767	21,645	12,587	36,224
01-Oct-13	4,242	16,883	399	2,337	12,618	34,263	17,259	53,483
02-Oct-13	5,388	22,271	524	2,861	12,120	46,383	18,032	71,515
03-Oct-13	6,336	28,607	414	3,275	11,180	57,563	17,930	89,445
04-Oct-13	4,832	33,439	213	3,488	10,858	68,421	15,903	105,348
05-Oct-13	3,954	37,393	455	3,943	9,713	78,134	14,122	119,470
06-Oct-13	5,190	42,583	462	4,405	18,515	96,649	24,167	143,637
07-Oct-13	3,856	46,439	475	4,880	20,754	117,403	25,085	168,722
08-Oct-13	3,516	49,955	538	5,418	24,084	141,487	28,138	196,860
09-Oct-13	4,970	54,925	468	5,886	23,992	165,479	29,430	226,290
10-Oct-13	5,940	60,865	160	6,046	22,813	188,292	28,913	255,203
11-Oct-13	5,588	66,453	1,194	7,240	22,026	210,318	28,808	284,011
12-Oct-13	5,122	71,575	2,041	9,281	22,665	232,983	29,828	313,839
13-Oct-13	6,117	77,692	1,142	10,423	22,400	255,383	29,659	343,498
14-Oct-13	2,110	79,802	0	10,423	15,453	270,836	17,563	361,061
15-Oct-13	0	79,802	0	10,423	11,198	282,034	11,198	372,259
16-Oct-13	1,201	81,003	0	10,423	7,010	289,044	8,211	380,470
17-Oct-13	676	81,679	0	10,423	1,900	290,944	2,576	383,046
18-Oct-13	615	82,294	0	10,423	3,660	294,604	4,275	387,321
19-Oct-13	873	83,167	0	10,423	4,261	298,865	5,134	392,455
20-Oct-13	704	83,871	0	10,423	4,729	303,594	5,433	397,888
21-Oct-13	577	84,448	0	10,423	3,716	307,310	4,293	402,181
22-Oct-13	233	**84,681**	0	**10,423**	1,964	**309,274**	2,197	**404,378**

APPENDIX B

WATER QUALITY RESULTS

APPENDIX B1.

WATER QUALITY RESULTS - DISSOLVED HYDROCARBONS

Canadian Natural Resources Limited

09-21-064-04 W4M

Sample Point	Sample Date	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1[TT] C_6-C_{10} mg/L	F2 $C_{>10}$-C_{16} mg/L	F3 $C_{>16}$-C_{34} mg/L	F4 $C_{>34}$-C_{50} mg/L
13-DP4	03-Dec-13	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	---	---	---
13-DP4	04-Dec-13	---	---	---	---	---	<0.10	<0.20	<0.20
13-DP4	10-Dec-13	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	17-Dec-13	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	06-Jan-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	14-Jan-14	<0.00040	0.00056	<0.00040	<0.00080	<0.1	<0.15	<0.30	<0.30
13-DP4	22-Jan-14	<0.00040	0.00056	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	28-Jan-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	05-Feb-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	12-Feb-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	19-Feb-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-DP4	26-Feb-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
13-SW12	19-Mar-14	<0.00040	***0.0044***	<0.00040	<0.00080	<0.1	<0.10	<0.20	<0.20
Minimal Detection Limit		**0.0004**	**0.0004**	**0.0004**	**0.0008**	**0.1**	**0.1**	**0.2**	**0.2**
AENV Freshwater Aquatic Life*		**0.37^**	**0.002^**	**0.09^**	**NS**	**NS**	**NS**	**NS**	**NS**
AENV Agriculture - Irrigation*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
AENV Agriculture - Livestock*		**NS**	**0.024^**	**0.0024^**	**NS**	**NS**	**NS**	**NS**	**NS**

Notes:

--- - not analyzed

NS - guideline not specified

^ - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, acessed on line January 2014)

* - Alberta Environment Surface Water Quality Guidelines for use in Alberta (AENV, 1999)

Italics - indicates values do not meet applicable guidelines

APPENDIX B2.

WATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Canadian Natural Resources Limited

09-21-064-04 W4M

Sample Point	Date	Acenaphthene µg/L	Acenaphthylene µg/L	Acridine µg/L	Anthracene µg/L	Benz[a]anthracene µg/L	Benzo[b+j]fluoranthene µg/L	Benzo[k]fluoranthene µg/L	Benzo[g,h,i]perylene µg/L	Benzo[c]phenanthrene µg/L	Benzo[a]pyrene µg/L	Benzo[e]pyrene µg/L	Chrysene µg/L	Dibenz[a,h]anthracene µg/L	Fluoranthene µg/L	Fluorene µg/L	Indeno[1,2,3-cd]pyrene µg/L	Naphthalene µg/L	2-Methylnaphthalene µg/L	Perylene µg/L	Phenanthrene µg/L	Pyrene µg/L	Quinoline µg/L	TOTAL PAH µg/L
13-DP4	10-Dec-13	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	17-Dec-13	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	06-Jan-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	14-Jan-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	22-Jan-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	28-Jan-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	05-Feb-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	0.11	<0.10	<0.050	<0.050	<0.020	<0.20	0.11
13-DP4	12-Feb-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-DP4	19-Feb-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
13-SW12	19-Mar-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
Minimal Detection Limit		**0.1**	**0.1**	**0.2**	**0.01**	**0.0085**	**0.0085**	**0.0085**	**0.0085**	**0.05**	**0.0075**	**0.05**	**0.0085**	**0.0075**	**0.01**	**0.05**	**0.0085**	**0.1**	**0.1**	**0.05**	**0.05**	**0.02**	**0.2**	**-**
AENV Freshwater Aquatic Life*		**5.8^**	**NS**	**4.4^**	**0.012^**	**0.018^**	**NS**	**NS**	**NS**	**NS**	**0.015^**	**NS**	**NS**	**NS**	**0.015^**	**3^**	**NS**	**1.1^**	**NS**	**NS**	**0.4^**	**0.025^**	**3.4^**	**NS**
AENV Agriculture - Irrigation*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
AENV Agriculture - Livestock*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Notes:

--- - not analyzed

NS - not specified

^ - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, acessed on line January 2014)

* - Alberta Environment Surface Water Quality Guidelines for use in Alberta (AENV, 1999)

Italics - indicates values do not meet applicable guidelines

APPENDIX B3.

WATER QUALITY RESULTS - ROUTINE WATER CHEMISTRY

Canadian Natural Resources Limited

09-21-064-04 W4M

Sample Point	Sample Date	Lab pH	Lab EC	Ca	Mg	Na	K	Cl	SO_4	NO_2-N	NO_3-N	NO_3+NO_2-N	Total Alkalinity^	HCO_3	Hardness^	TDS	TSS	Turbidity
			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU
13-DP4	04-Dec-13	7.06	410	55	19	2.6	2.7	<1.0	<1.0	<0.003	0.030	0.030	220	270	220	210	---	---
13-DP4	11-Dec-13	6.95	400	50	18	2.5	3.0	<1.0	<0.5	<0.003	<0.003	<0.003	230	280	200	210	---	---
13-DP4	19-Dec-13	6.68	400	50	19	2.5	3.3	<1.0	<0.5	<0.003	<0.003	<0.003	210	260	200	210	44	11
13-DP4	06-Jan-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	18	14
13-DP4	14-Jan-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	86	30
13-DP4	22-Jan-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	12	5.9
13-DP4	28-Jan-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	430	220
13-DP4	05-Feb-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	610	370
13-DP4	12-Feb-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	290	140
13-DP4	19-Feb-14	---	---	---	---	---	---	<1.0	---	---	---	---	---	---	---	---	710	380
13-SW12	19-Mar-14	7.56	90	12	3	0.98	2.6	1.2	<1	<0.01	<0.01	<0.001	43	52	42	46	24	10
Minimal Detection Limit		**0.1**	**1**	**0.3**	**0.2**	**0.5**	**0.3**	**1**	**0.5**	**0.003**	**0.003**	**0.003**	**0.5**	**0.5**	**0.5**	**10**	**3**	**0.1**
AENV Freshwater Aquatic Life*		**6.5-8.5**	**NS**	**NS**	**NS**	**NS**	**NS**	**230^{cc}**	**NS**	**0.06*** **	**3***^{b}**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
AENV Agriculture - Irrigation*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**100^^**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**500^^**	**NS**	**NS**
AENV Agriculture - Livestock*		**NS**	**NS**	**1000**	**NS**	**NS**	**NS**	**NS**	**1000**	**10**	**NS**	**100**	**NS**	**NS**	**NS**	**3000**	**NS**	**NS**

Notes:

--- - not analyzed

NS - not specified

^ - expressed as $CaCO_3$

^^ - guideline level is crop dependent; criterion shown is most stringent value

^{cc} - continuous concentration guideline, National Recommended Water Quality Criteria (USEPA, 2009)

^{A} - 1 day minimum, acute guideline

^{b} - indicates long-term exposure guideline; short-term exposure guideline = 124 mg/L

* - Alberta Environment Surface Water Quality Guidelines for use in Alberta (AENV, 1999)

*** - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, acessed on line January 2014)

Italics - indicates values do not meet applicable guidelines

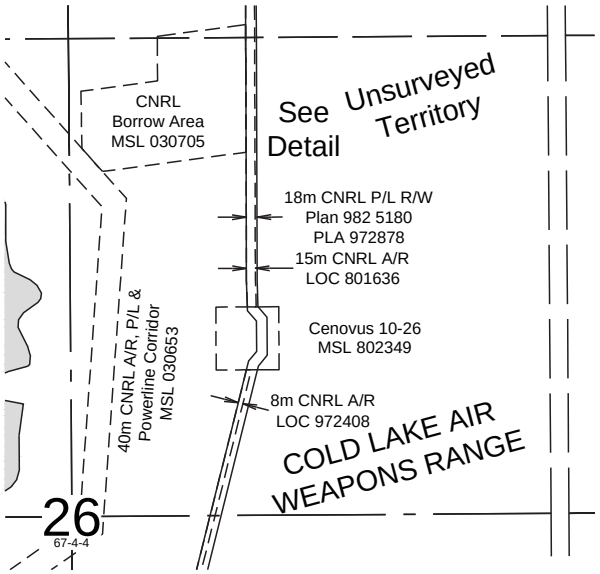
APPENDIX C

CELL D LEGAL SURVEY

Rev.0

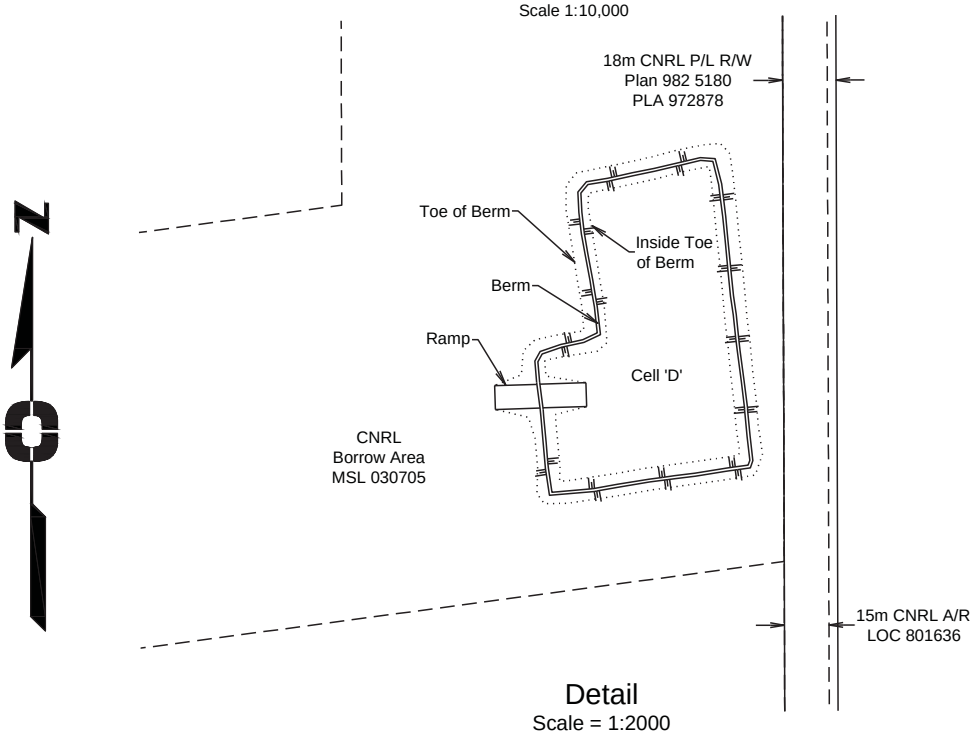
Plan Showing Containment Cell 'D' on Borrow Area (MSL 030705) within N.E.1/4 Sec.26 Twp.67 Rge.4 W.4 M. Improvement District No. 349, Alberta

Canadian Natural
Canadian Natural Resources Limited



0 100 200 400 600 metres

Scale 1:10,000



Detail

Scale = 1:2000

Note:
Volumes are Approximate due to Construction at time of Survey (Inside Toe of Berm Not Surveyed)

Volume

Containment Cell Volume 6390 m³

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P046
Focus Surveys Limited Partnership

Date	Description	Rev.
Mar.26/14 CAM/DL	Original Issue	0

Page 1 of 1	Focus File: 010044935-ABMC03-R00	EDM	

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