

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

OCTOBER 21 TO NOVEMBER 17, 2014

1 Introduction

The Canadian Natural Resources Limited Primrose South in situ oil sands project is located in the Cold Lake Air Weapons Range approximately 65 km north-northeast of Bonnyville, Alberta. Canadian Natural operations staff discovered a bitumen emulsion flow to surface (FTS) area at 09-21-067-04 W4M on June 24, 2013. The bitumen emulsion 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 addresses that requirement and summarizes the progress towards the realization of the CRP and includes data collected and reported between October 21 and November 17, 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. As of October 20, 2014, the status of these plans has not changed.

2.2 Water Management for Dewatering and Refilling

Activities related to dewatering and refilling were completed on June 22, 2014. No new information to report.

3 Water Body Monitoring

In accordance with the Water Body Restoration Plan (Table 1, Item 9), an extensive water quality and water quantity monitoring program was implemented on March 19, 2014. This program complements the ongoing water quality and quantity monitoring implemented in June 2013.

Details of the monitoring program are provided in the following subsections.

3.1 Water Quantity Monitoring

3.1.1 Basins 1, 3, and 4, Borrow Pit, and Downstream Fen

No new staff gauge readings were taken during this reporting period due to winter conditions..

3.1.2 Within Containment Structure

Water that seeped across the containment wall was collected and pumped from inside the containment wall back into Basin 1 from two sumps located on the north and south sides of the wall (Figure 1). Water

was pumped from the two sumps using automated sump pumps that were operational throughout the reporting period. A sheen was observed in the south sump on November 10, 2014 and pumping was suspended temporarily and the sheen was removed using absorbent pads. Sheen was not observed in the north sump or swale. Samples of water from inside the south and north sumps as well as from the south swale upstream of the south sump, were obtained and tested in the laboratory for concentrations of petroleum hydrocarbons (PHC). Results from the south sump, north sump and south swale upstream of the south sump (Upstream South) indicated that PHCs were not present. Results are presented in Appendix A1 and A2. Pumping into the water body resumed on November 12, 2014 when the analytical results were received. Daily monitoring of both the north and south sumps is being conducted and sheen has not been observed since November 10, 2014.

3.2 Water Quality Monitoring

Water quality was compared to the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (ESRD 2014a) and/or *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014b).

3.2.1 Basins 1, 3, and 4 and Downstream Fen

The next scheduled sampling event is May 2015.

3.2.2 Containment Area, Containment Cells, and Potentially Impacted Water System

No water was treated and released through the Potentially Impacted Water (PIW) system during the reporting period as it was decommissioned on October 19, 2014.

3.3 Aquatic Surveillance

Daily monitoring for signs of bitumen emulsion (pellets or sheen) within Basins 1 and 3 of the water body was conducted and documented by third-party contractors engaged by Canadian Natural. The monitoring was completed by walking the shoreline and by boat on the water body. Monitoring for bitumen emulsion was discontinued on November 8, 2014 due to freezing conditions (Figure 3). Monitoring for bitumen emulsion in the containment area dewatering sumps will continue as long as pumping continues.

Sheen and bitumen emulsion pellets were observed in Basin 1 in the water body intermittently during the reporting period. The source of the sheen and pellets was attributed to small amounts of bitumen emulsion that were not cleaned from the water column and sediment after the original cleanup of bitumen emulsion release. All observed bitumen emulsion pellets and sheen were collected, using absorbent material, and disposed in the onsite hazardous waste bin. Over the reporting period, less than 0.5 L of bitumen emulsion has been collected from Basin 1.

3.4 Erosion and Sedimentation Prevention

The refilling activities were completed in accordance with the conditions specified in Extension 4 of the Water Body Restoration Plan (Table 1, Item 9).

- In order to winterize the site, all silt booms, baffles and Clearflow sediment control systems were removed from the water body and from the swales inside the containment area. The dewatering hoses were heat traced and a heater placed inside each sump to extend the pumping period into the winter months.
- The erosion and sediment control monitoring was stopped due to winter conditions with the exception of turbidity monitoring related to dewatering of the containment area, which will continue as needed.

3.5 Bitumen Emulsion Containment

3.5.1 Containment of Bitumen Emulsion Seepage from Fissure

In early May 2014, the fissure containment structure (FCS) was approved. A Canadian Natural construction crew built the FCS between May 4 and June 30, 2014. Following discussion with Alberta Energy Regulator (AER) and ESRD, a revised design of the access pad was prepared and submitted to AER and ESRD for review and approval. Verbal approval to start construction was received and construction of the access pad over the FCS started on September 10, 2014. Construction of the pad was completed on October 26, 2014. Bitumen recovery pipes were installed into the FCS. .

3.6 Wildlife Management

No injured or distressed wildlife was observed during this reporting period. From October 23 to October 24, 2014, wildlife deterrents and noise deterrents were removed from within the water body. Additional wildlife deterrents were removed from October 24 to 31, 2014. During the reporting period, no wildlife mortality was noted within or around the water body.

3.7 Waste Management

Transportation of materials temporarily stored in lined containment Cells C and D to the Tervita Bonnyville landfill for disposal started in August 2014. All waste material in the cells had been removed for disposal as of November 10, 2014. Between October 23 and November 11, 2014 all containment cells were decommissioned and their perimeter berms removed. The potentially impacted water treatment system at Cell D was decommissioned and removed between October 19 and 30, 2014. Post-construction confirmatory soil samples collected from the former containment cells and potentially impacted water system locations indicated that there were no impacts to the native soil from these temporary facilities.

4 Conclusions

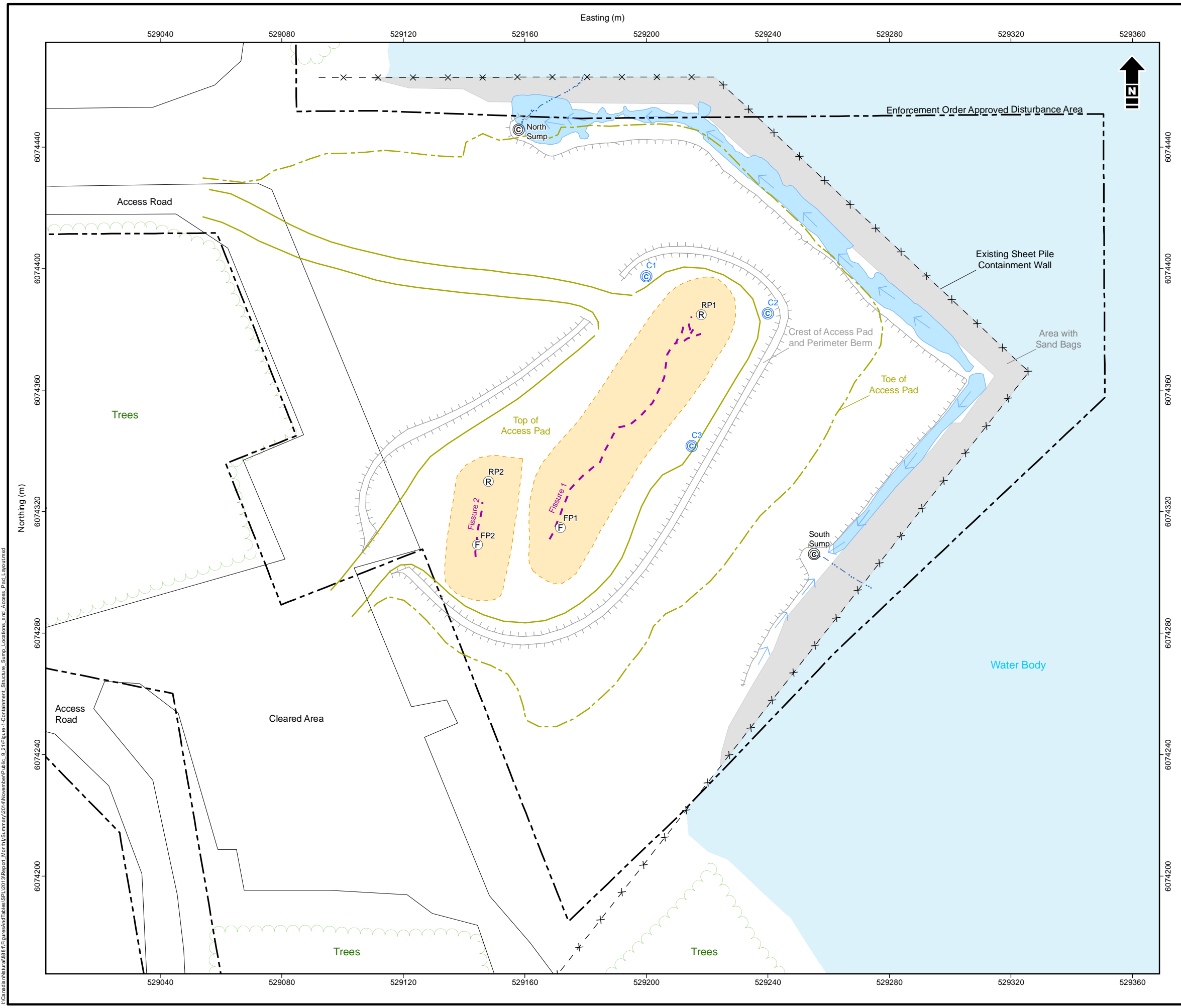
The work conducted at the 9-21 FTS site from October 21 to November 17, 2014 included:

- transporting dewatered material from containment Cells C and D to the landfill for disposal
- decommissioning and removing two containment cells and the PIW treatment system
- removing water from within the containment area
- ongoing monitoring for signs of bitumen emulsion and sheen, discharge point erosion and sedimentation related to dewatering of the contained area
- completing construction of the access pad over the fissure containment structures
- monitoring wildlife activity near the water body
- winterizing the site

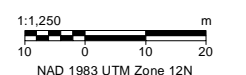
The work is progressing as planned and the objectives, as required by the EPO, are being achieved within the required time frame.

5 References

- Alberta Environment and Sustainable Resource Development (ESRD). 2014a. *Alberta Tier 1 Soil and Groundwater Remediation Guidelines, 2014 and Updates*. Final Draft. Land and Forestry Policy Branch, Policy Division. Edmonton, Alberta. May 23, 2014.
<http://esrd.alberta.ca/lands-forests/land-industrial/inspections-and-compliance/documents/AlbertaTier1Guidelines-May23-2014.pdf>
- Alberta Environment and Sustainable Resource Development (ESRD). 2014b. *Environmental Quality Guidelines for Alberta Surface Waters*. Water Policy Branch, Policy Division. Edmonton, Alberta. July 14, 2014. ISBN: 978-1-4601-1524-4.
<http://esrd.alberta.ca/water/education-guidelines/documents/EnvironmentalQualitySurfaceWaters-Jul14-2014.pdf>



- Swale
- Fissure Containment Structure
- Berm
- Discharge Line
- Direction of Flow
- Fissure within Containment Structure
- Bitumen Recovery Pipe
- Flush Pipe
- Sump with Automated Pump
- Water Collection Trench Recovery Sump



Reference: Site features provided through Matrix Solutions Inc. field efforts.

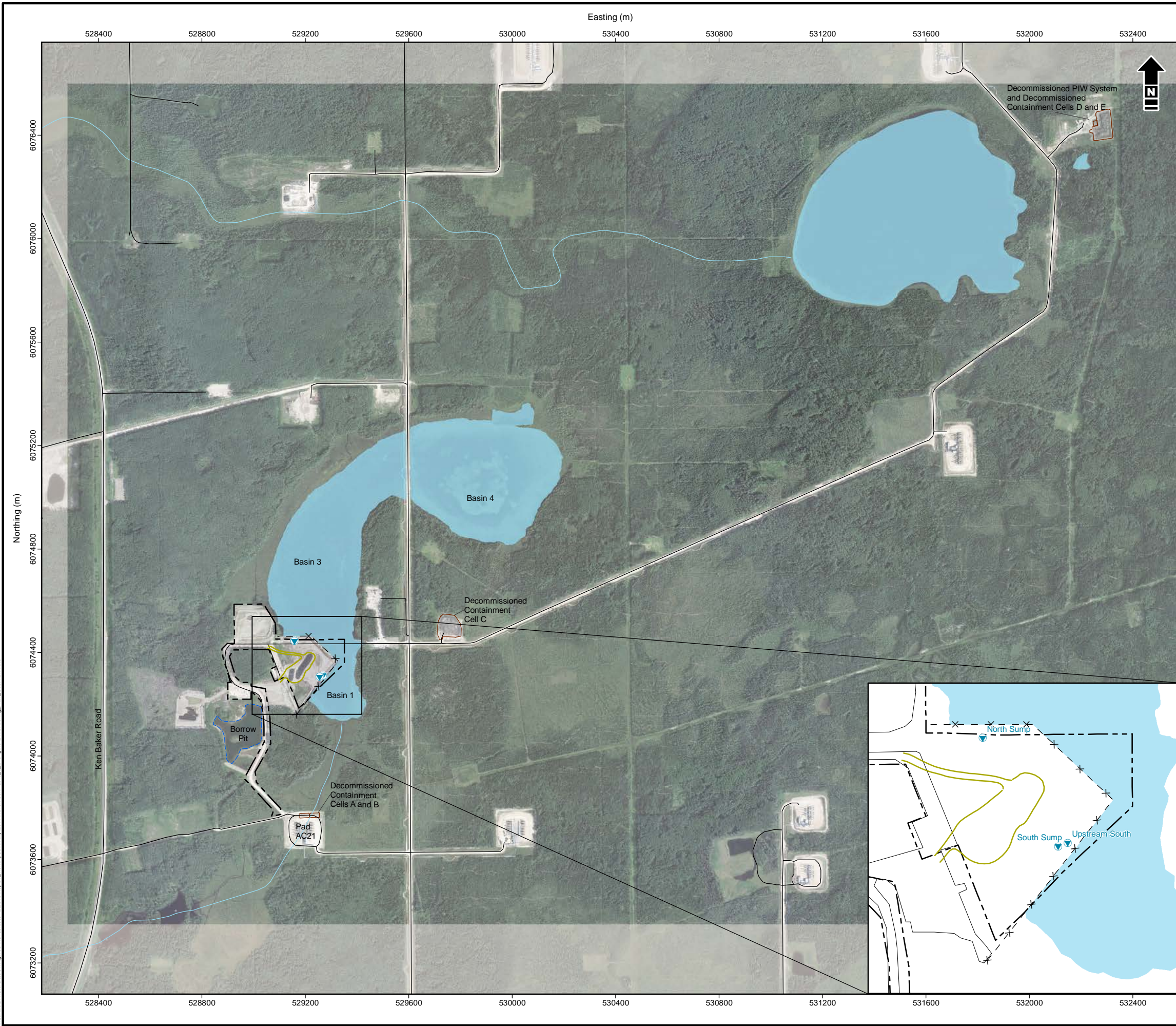


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Primrose 09-21-067-03 W4M

Containment Structure Sump Locations and Access Pad Layout

Date:	25 Nov 2014	Project:	8881-523	Technical:	A. Ward	Reviewer:	P. Hum	Drawn:	R. Keller
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- Borrow Pit
- Water Body
- Enforcement Order Approved Disturbance Area
- Road
- Watercourse
- Containment Wall
- Top of Access Pad
- Surface Water Sample Location

Reference: Data obtained from Alta.LIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2014 used under license. Site features provided through Matrix Solutions Inc. field efforts. Imagery (September 2014) obtained from Canadian Natural Resources Limited used under license.

1:15,000
 100 0 100 200 m
 NAD 1983 UTM Zone 12N

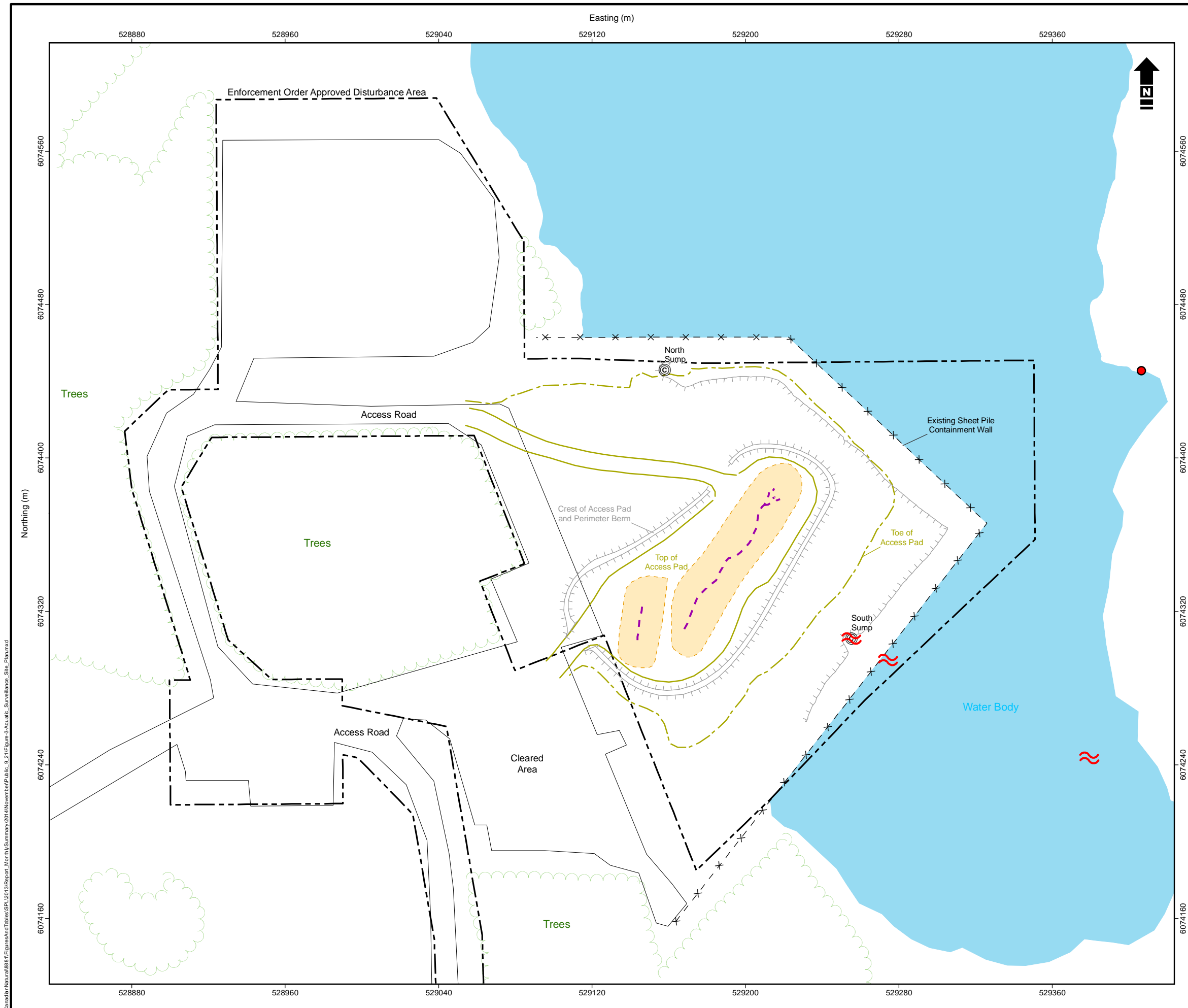


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 Primrose 09-21-067-04 W4M

Monitoring Plan Overview


Date: 25 Nov 2014 Project: 8881-523 Technical: E. Henson Reviewer: P. Hum Drawn: C. Curry

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- Fissure Containment Structure
- Berm
- Fissure within Containment Structure
- Bitumen Sheen Detected
- Bitumen Detected
- Sump with Automated Pump

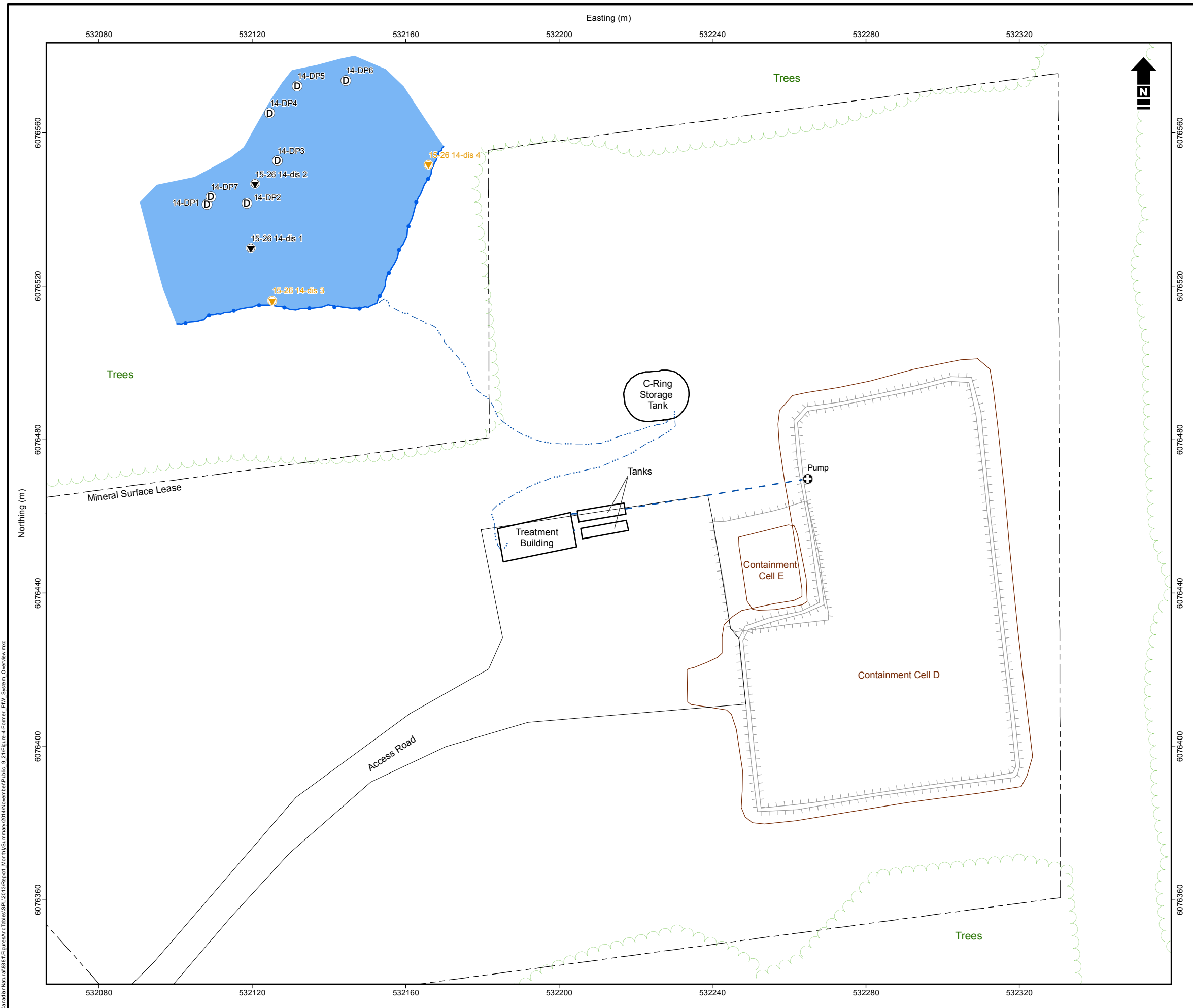
Reference: Site features provided through Matrix Solutions Inc. field efforts.


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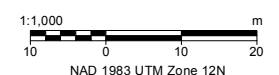
Aquatic Surveillance Site Plan

Date: 25 Nov 2014	Project: 8881-523	Technical: A. Ward	Reviewer: P. Hum
Drawn: C. Curry			Figure 3

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- Discharge Area
- Discharge Line
- Intake Line
- Soaker Line
- Berm
- Drivepoint Monitoring Well
- Baseline Soil Sample Location
- Post-Discharge Soil Sample Location
- Pump



Reference: Site features provided through Matrix Solutions Inc. field efforts.

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Primrose 09-21-067-04 W4M

Former PIW System Overview

Date: 25 Nov 2014	Project: 8881-523	Technical: A. Ward	Reviewer: P. Hum	Drawn: C. Curry
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Figure 4

I:\Canadian Natural\8881-523\Figures and Tables\SR\2013\Report_Monthly Summary\2014\November\Final_Fig_21\Figure_4-Former_PIW_System_Overview.mxd

APPENDIX A

Water Levels and Pump Volumes

TABLE A1.**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 C ₆ -C ₁₀ - BTEX mg/L	F2 C _{>10} -C ₁₆ mg/L	F3 C _{>16} -C ₃₄ mg/L	F4 C _{>34} -C ₅₀ mg/L
North Sump	10-Nov-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
South Sump	10-Nov-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
Upstream South**	10-Nov-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<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
ESRD Freshwater Aquatic Life*		0.04	0.0005	0.09	0.03	NSST	NSST	NS	NS
ESRD Agriculture - Irrigation*		NS	NS	NS	NS	NS	NS	NS	NS
ESRD Agriculture - Livestock*		NS	0.024	0.0024	NS	NS	NS	NS	NS

Notes:

--- - not analyzed

NS - guideline not specified

ST - see applicable guidelines for short-term exposure guideline

* - Environmental Quality Guidelines for Alberta Surface Waters (ESRD 2014)

** - location in south swale upstream of south sump

Italics - indicates values do not meet applicable guidelines

TABLE A2.

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	Benzo[a]anthracene µg/L	Benzo[b+.]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
North Sump	10-Nov-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
South Sump	10-Nov-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
Upstream South**	10-Nov-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	-
ESRD Freshwater Aquatic Life*		5.8	NS	4.4	0.012	0.018	NS	NS	NS	NS	0.015	NS	NS	NS	0.04	3	NS	1	NS	NS	0.4	0.025	3.4	NS
ESRD 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
ESRD 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

ND - not detected

* - Environmental Quality Guidelines for Alberta Surface Waters (ESRD 2014)

** - location in south swale upstream of south sump

Italics - indicates values do not meet applicable guidelines