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

JULY 21 TO AUGUST 24, 2015

1 Introduction

The Canadian Natural Resources Limited Primrose South in situ oil sands project is located in the Cold Lake Air Weapons Range (CLAWR) 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 located within the Canadian Natural Primrose South production area.

On September 24, 2013, Alberta Environment and Sustainable Resource Development (currently Alberta Environment and Parks) issued an Environmental Protection Order (EPO; No. EPO-2013-33/NR). Requirements of the EPO included the preparation of a Comprehensive Remedial Plan (CRP), as well as the preparation of a monthly progress report in connection with the assessment and remediation efforts carried out at the FTS site. This report addresses the requirement of the progress report and includes data collected and reported between July 21 and August 24, 2015.

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 work plans. As of August 24, 2015, the status of these plans has not changed.

3 Water Body Monitoring

In accordance with the Water Body Restoration Plan, an extensive water quality and water quantity monitoring program was implemented on March 19, 2014. Monitoring as part of this plan complements the ongoing water quality and quantity monitoring implemented in June 2013.

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

3.1 Water Quantity Monitoring

3.1.1 Basins 1, 3, and 4 and Fen

Water level staff gauges and monitoring locations are shown on Figure 1. The staff gauges have not been resurveyed since breakup and the water body elevations are approximate; these staff gauges will be resurveyed in September 2015. Staff gauges (13-SG2, 13-SG4, 13-SG11, and 13-SG12) were monitored on August 20, 2015. Staff gauge 13-SG6 was not monitored as a reading of the staff gauge from the shore was not possible. The results of the staff gauge readings and corresponding water elevations for Basins 3 and 4 are shown on Appendix A1. The results of the staff gauge readings and corresponding water elevations for the fen are shown on Appendix A2. The water level elevations within Basins 3 and 4 were approximately 699.6 m above sea level (m asl), which is within range of historical measurements before dewatering and refilling (~699.5 m asl).

3.2 Water Quality Monitoring

Water quality was compared to the *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014). Sampling locations are shown on Figure 2.

3.2.1 Basins 1, 3, and 4 and Fen

No water quality samples were collected during the reporting period as per the approved schedule.

3.2.2 Within Containment Structure and/or Trench Beneath Access Pad

The containment structure area is now flooded and considered to be part of the water body although the containment wall remains in place. Water quality samples were collected from within the flooded containment structure (14-SW81) and from within the water collection trench located beneath the access pad (East Sump C2) on August 4, 2015 (Figure 2).

Laboratory analysis of water samples was carried out for benzene, toluene, ethylbenzene, and xylenes (BTEX); petroleum hydrocarbons (PHC) fraction 1 (C_6-C_{10}, excluding BTEX), and fraction 2 ($C_{>10}$-C_{16}); and polycyclic aromatic hydrocarbons (PAH). PHC and PAH water quality results are provided in Appendix B. All water quality results were within applicable guidelines.

3.3 Aquatic Surveillance

The water body was monitored on August 7, 2015 and there were no reported occurrences of bitumen emulsion or sheen on the water body.

3.4 Erosion and Sedimentation Prevention

No activities taking place during the reporting period were expected to cause erosion or sedimentation issues and no monitoring activities were completed.

3.5 Bitumen Emulsion Containment

Construction of the fissure containment structures (FCSs) is complete and regular monitoring of the bitumen emulsion recovery pipes is ongoing. No bitumen emulsion was recovered from the FCSs during this reporting period.

3.6 Wildlife Management

No injured, distressed, or deceased wildlife were observed within or around the water body during this reporting period.

3.7 Waste Management

The recovery of fluids from the FCSs began on December 19, 2014. During this reporting period, approximately 10 m^3 of fluid was recovered from the FCSs and transported for offsite disposal at Tervita Corporation's Lindbergh facility.

4 Summary

Monthly monitoring activities at the 9-21 FTS site were completed between July 21 and August 24, 2015. The scheduled field activities completed over the reporting period included:

- surface water quality sampling within the containment structure and water collection trench
- bitumen emulsion monitoring on the water body
- recovery of fluids from the FCSs

The work completed at the 9-21 site over this reporting period was routine and scheduled. The findings were as anticipated and were consistent with those for the previous reporting period.

5 References

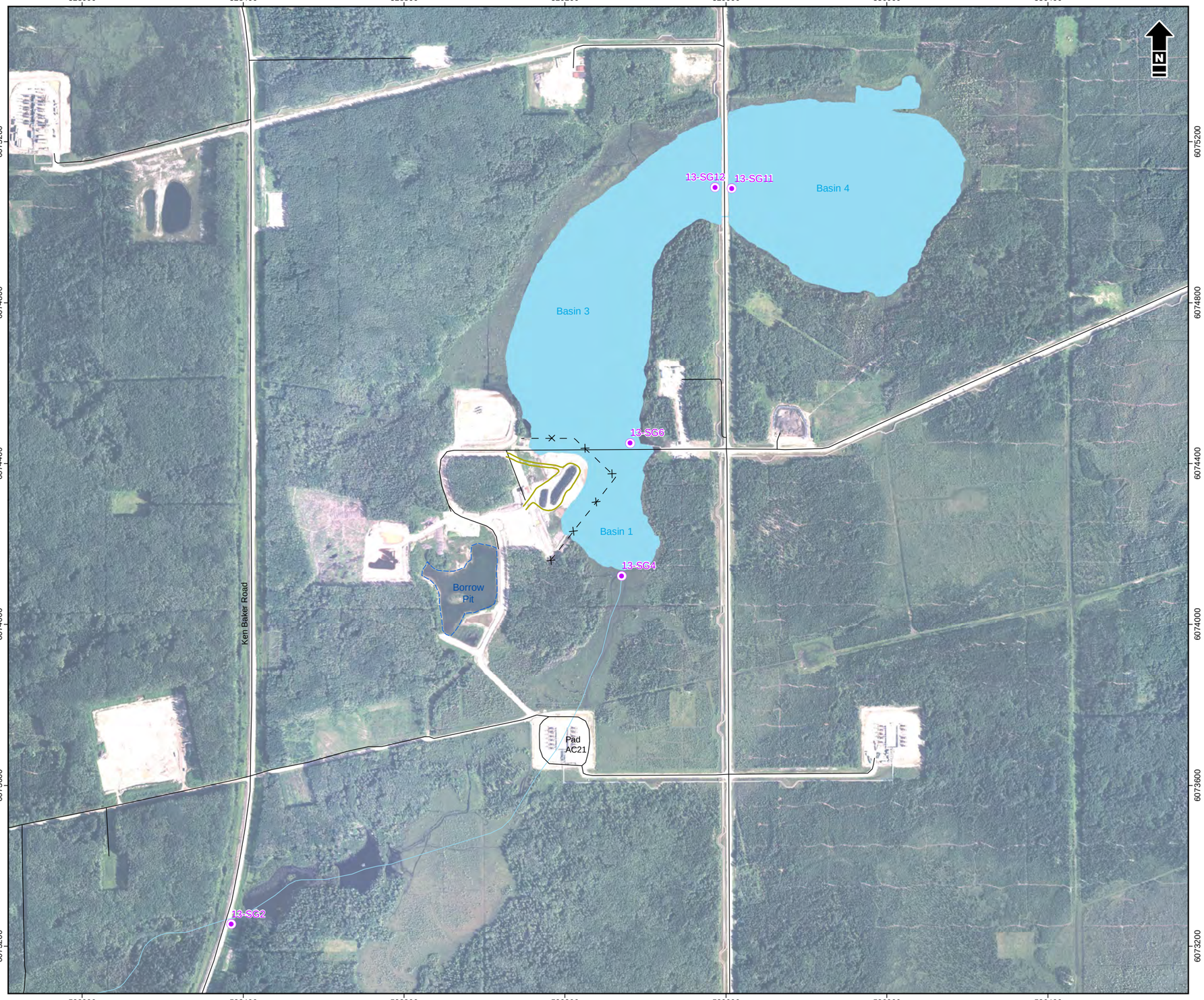
Alberta Environment and Sustainable Resource Development (ESRD). 2014. *Environmental Quality Guidelines for Alberta Surface Waters.* Water Policy Branch, Policy Division. Edmonton, Alberta. July 14, 2014. ISBN: 978-1-4601-1524-4. http://esrd.alberta.ca/water/education-guidelines/documents/EnvironmentalQualitySurfaceWaters-2014.pdf

Easting (m)

528000 528400 528800 529200 529600 530000 530400

Northing (m)

6075200 6074800 6074400 6074000 6073600 6073200



- Borrow Pit
- Water Body
- Watercourse
- Road
- Containment Wall
- Top of Access Pad
- Staff Gauge Location

Reference: Data obtained from AltaLIS © Government of Alberta and GeoBase® used under license. GDM transportation infrastructure data provided by IHS © 2015 used under license. Site features provided through Matrix Solutions Inc. field efforts. Imagery (dated August 2014) obtained from Canadian Natural Resources Limited (September 2014) used under license.

1:10,000 m
50 0 50 100
NAD 1983 UTM Zone 12N

Canadian Natural

Canadian Natural Resources Limited
Primrose 09-21-067-04 W4M

Site 9-21 Staff Gauge and Water Level Monitoring Locations

Date:	Project:	Technical:	Reviewer:	Drawn:
25 Aug 2015	8881-523	A. Ward	P. Hum	K. Andruchow

Figure 1

I:\Canadian Natural\8881\Figures And Tables\SPL\2013 Report_Monthly Summary\2015\August\Public_9_21\Figure 1-Site_9_21_Staff_Gauge_and_Water_Level_Monitoring_Locations.mxd

Easting (m)

529040 529080 529120 529160 529200 529240 529280 529320 529360

Northing (m)

6074440 6074400 6074360 6074320 6074280 6074240 6074200

N

Access Road

14-SW81

MW15-6A
MW15-6B

C1

MW15-1A
09-21C
MW15-1B
RP1
C2 East Sump C2

Existing Sheet Pile Containment Wall

Crest of Access Pad and Perimeter Berm

Toe of Access Pad

Trees

MW15-2A
MW15-2B
MW15-2C
09-21D

Top of Access Pad

C3

RP2
MW15-3A
MW15-3B

10-21M
FP1

MW15-5A
MW15-5B
FP2

10-21N
10-21L
MW15-4B
MW15-4A

10-21 WOBS 1WK

10-21 WOBS 1WF

10-21 WOBS 1WH

Access Road

Cleared Area

09-21B

Water Body

Basin 1

09-21A

10-21 WOBS 1WJ

10-21 WOBS 1WI

10-21 WOBS 1WG

MW15-7A
MW15-7B

Borrow Pit

Trees

Trees

- Fissure Containment Structure
- Borrow Pit
- Water Body
- Berm
- Containment Wall
- Fissure within Containment Structure
- Top of Access Pad
- Toe of Access Pad
- Bitumen Emulsion Recovery Pipe
- Flush Pipe
- Water Sample Location
- Water Collection Trench Recovery Sump
- Phase II Shallow Monitoring Well

Deep Quaternary Monitoring Well (Screened Formation)

- Ethel Lake Formation Monitoring Well
- Sand River Formation Monitoring Well

1:1,250

m 10 0 10 20

NAD 1983 UTM Zone 12N

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

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Canadian Natural Resources Limited
Primrose 09-21-067-04 W4M

Site 9-21 Containment Structure and Access Pad Layout

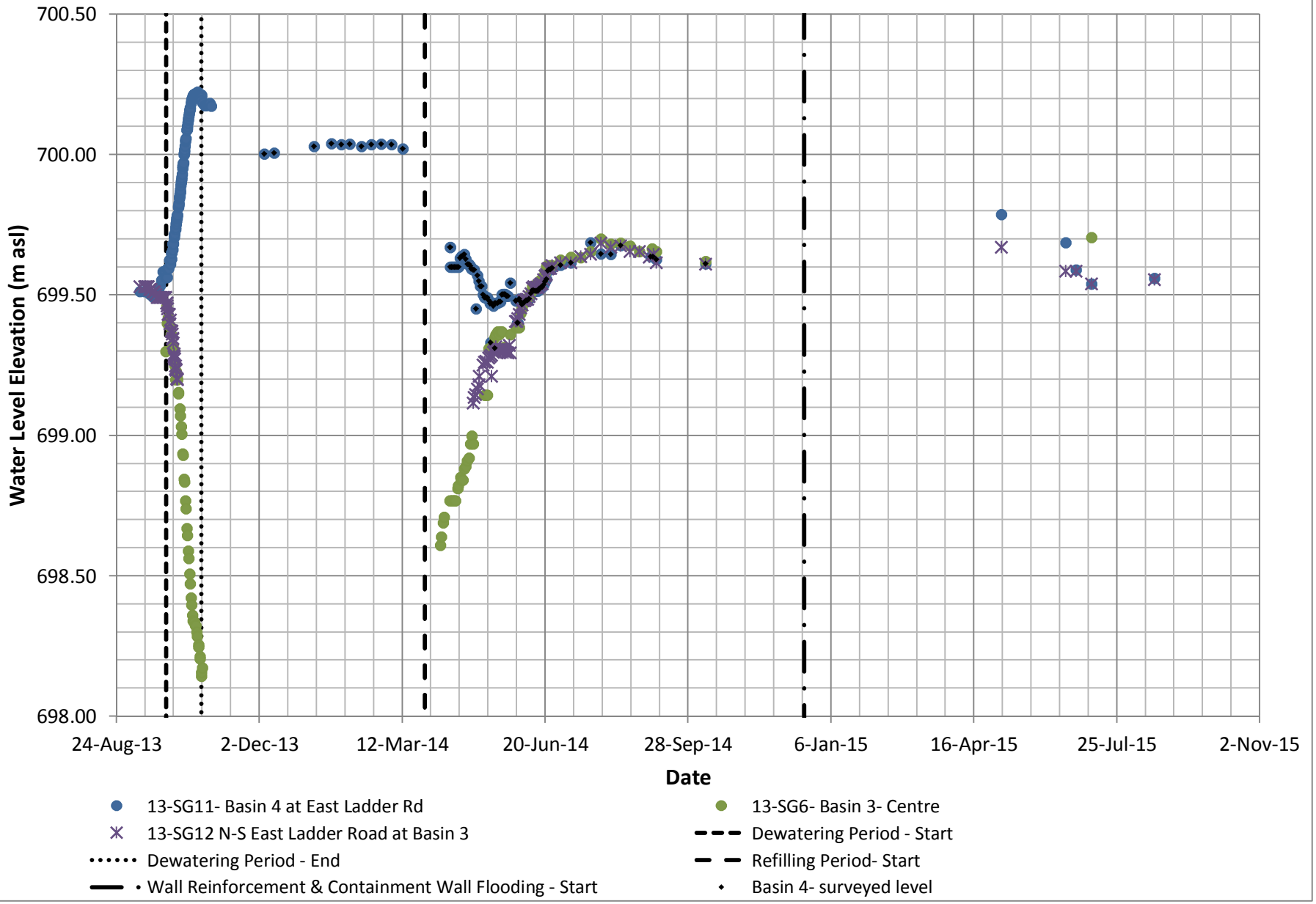
Date:	Project:	Technical:	Reviewer:	Drawn:
21 Aug 2015	8881-523	A. Ward	P. Hum	R. Keller

Figure 2

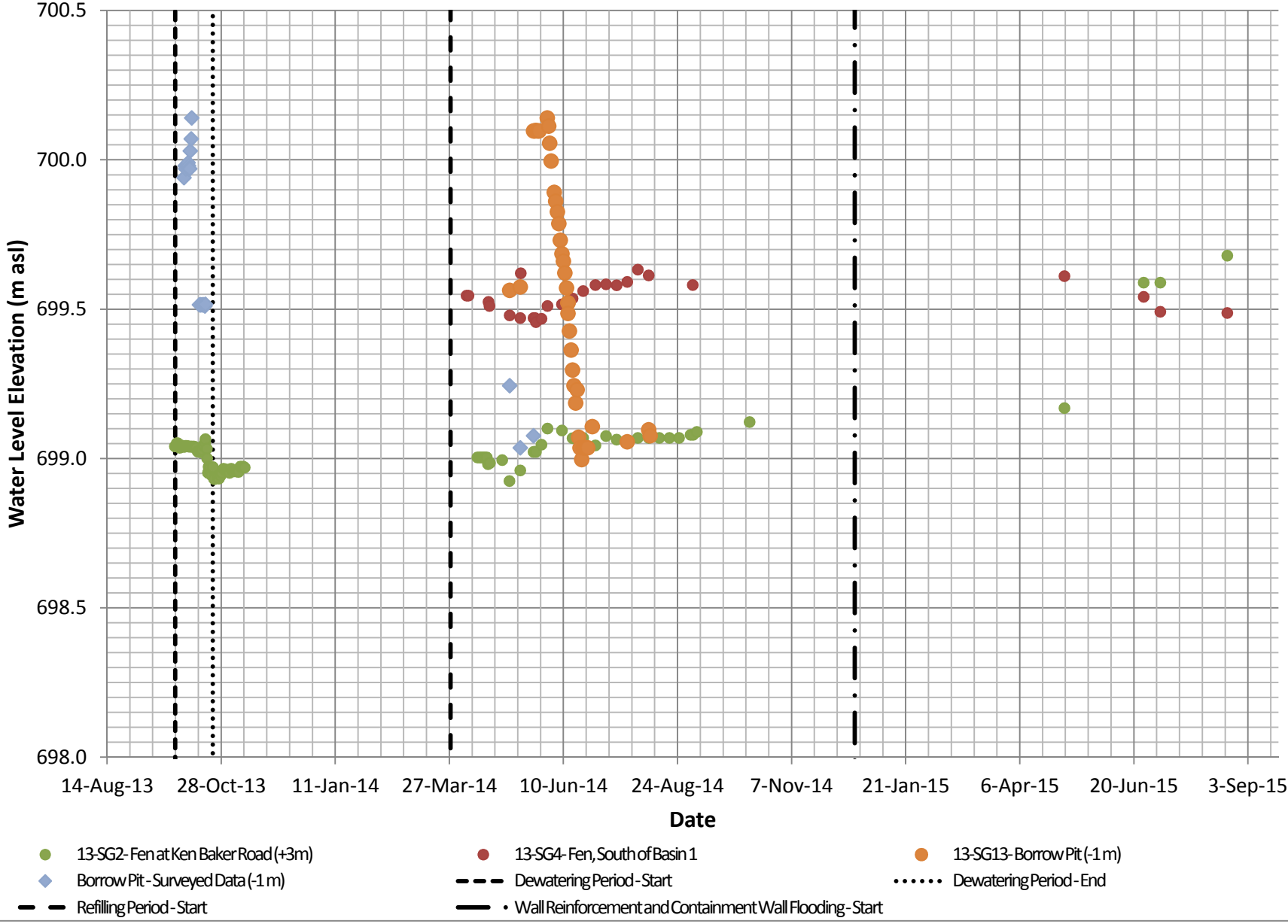
I:\Canada\Natural\8881\Figures\And\Tables\SPL\2015\Report_Monthly\Summary\2015\August\Public_9_21\Figure-2-Site_9_21_Containment_Structure_and_Access_Pad_Layout.mxd

APPENDIX A
Water Levels

Appendix A1: Water Levels at 9-21 Water Body



Appendix A2: Water Levels in the Downstream Fen and Borrow Pit



APPENDIX B
Water Quality Results

APPENDIX B1.

WATER QUALITY RESULTS - DISSOLVED HYDROCARBONS

Canadian Natural Resources Limited

09-21-067-04 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
Containment Structure Samples									
14-SW81	02-Jun-14	<0.0004	<0.0004	<0.0004	<0.0008	<0.1	<0.10	<0.20	<0.20
14-SW81	09-Jun-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
14-SW81	16-Jun-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	23-Jun-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	01-Jul-14	<0.00040	<0.0020	<0.00040	<0.0040	<0.10	0.2	---	---
14-SW81	08-Jul-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	05-Aug-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	09-Oct-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	05-May-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	26-Jun-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	07-Jul-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
14-SW81	04-Aug-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
Water Collection Trench Recovery Sumps									
East Sump C2	19-Feb-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
East Sump C2	07-May-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
East Sump C2	11-Jun-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
East Sump C2	26-Jun-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
East Sump C2	04-Aug-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
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)

Italics - indicates values do not meet applicable guidelines

APPENDIX B2 .

WATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Canadian Natural Resources Limited

09-21-067-04 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
Containment Structure Samples																								
14-SW81	02-Jun-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
14-SW81	09-Jun-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
14-SW81	16-Jun-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
14-SW81	23-Jun-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
14-SW81	01-Jul-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.020	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
14-SW81	08-Jul-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
14-SW81	05-Aug-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
14-SW81	09-Oct-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
14-SW81	05-May-15	<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
14-SW81	07-Jul-15	<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
14-SW81	26-Jun-15	<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
14-SW81	04-Aug-15	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	0.035	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	0.035
Water Collection Trench Recovery Sumps																								
East Sump C2	19-Feb-15	<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
East Sump C2	07-May-15	<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
East Sump C2	11-Jun-15	<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
East Sump C2	26-Jun-15	<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
East Sump C2	04-Aug-15	<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)

Italics - indicates values do not meet applicable guidelines