Long Lake and Kinosis Oil Sands Project Scheme Approval 9485, as amended

2022 Annual Performance Presentation

This presentation contains information that complies with the Alberta Energy Regulators' *Directive 054 – Performance Presentations, Auditing, and Surveillance of In Situ Oil Sands Schemes*

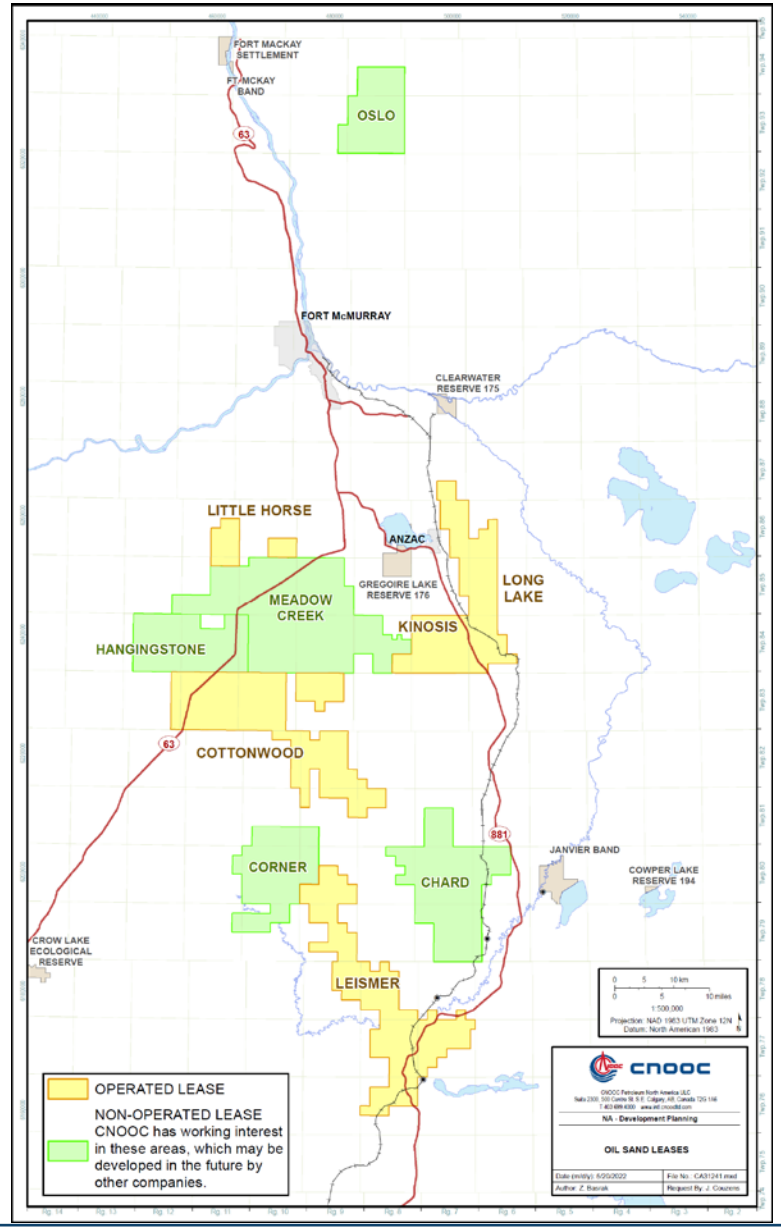
June 30, 2023

Agenda

Section 1 - Introduction

Corporate Ownership

- CNOOC Petroleum North America ULC (formerly Nexen Energy ULC) (“CPNA”) is an upstream oil and gas company responsibly developing energy resources in North America.
- CPNA is a wholly-owned subsidiary of the China National Offshore Oil Company Limited (CNOOC).



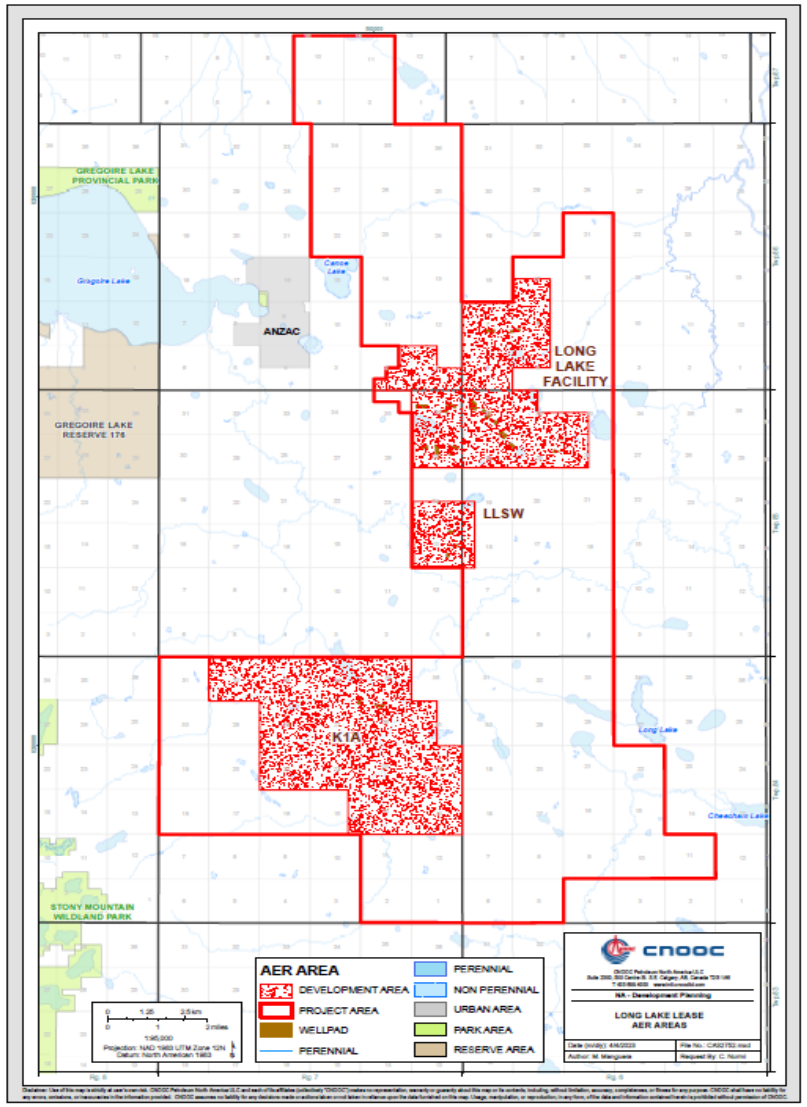
Long Lake Scheme Description

- Located approximately 40 km southeast of Fort McMurray.
- An integrated SAGD and Upgrader oil sands project producing from the Wabiskaw-McMurray deposit.

	Design (LLK)	
	m^3/d	bbl/d
Bitumen	11,130	72,000
Steam	37,000	233,000
SOR	3.3	

	Design (K1A*)	
	m^3/d	bbl/d
Bitumen	3,180	20,000
Steam	9,540	60,000
SOR	3.0	

*K1A – First 20K of 70K which is Phase 1A of Kinosis



Long Lake Scheme History

Year	Activity
2000	EIA and regulatory submissions for the commercial Long Lake Facility (LLK)
2003	Regulatory approvals for the commercial LLK Facility
2003 - 2007	Production at the Long Lake SAGD Pilot Plant
2004	Construction begins for the commercial LLK Facility
2007	Start of commercial bitumen production for the Long Lake Facility
2009	Regulatory approvals issued for Kinosis Project (formerly Long Lake South), Start of operation of the LLK Upgrader
2012	Regulatory approvals and construction begins for Pads 14, 15 and K1A Pads 1 and 2
2013	Increased production from LLK well pads, begin circulation at Pad 14
2014	K1A Pads 1, 2 and Pads 14, 15 start production
2015	Diluent Recovery Project start up; Pipeline leak ceases production at K1A; 7N Infills on production
2016	Hydro-Cracker Unit (HCU) Incident; Wildfire shut down Long Lake operations for ~2 months
2017	Commenced drilling infills on Pads 5 and 8
2018	Pads 5, 8 Infills on production; Drilling commenced on Pad 3,6 Infills & LLSW SAGD well pairs
2019	Pad 1,3,5,6,13 Infills on production; D&C completed on LLSW SAGD well pairs
2020	Completed construction of LLSW sustaining pads
2021	LLSW Pad 16 on production; LLNW Pad 19 DA & PA expansion filed
2022	LLSW Pad 17/18 on production; reinstatement of K1A Pad 1

2022 Summary

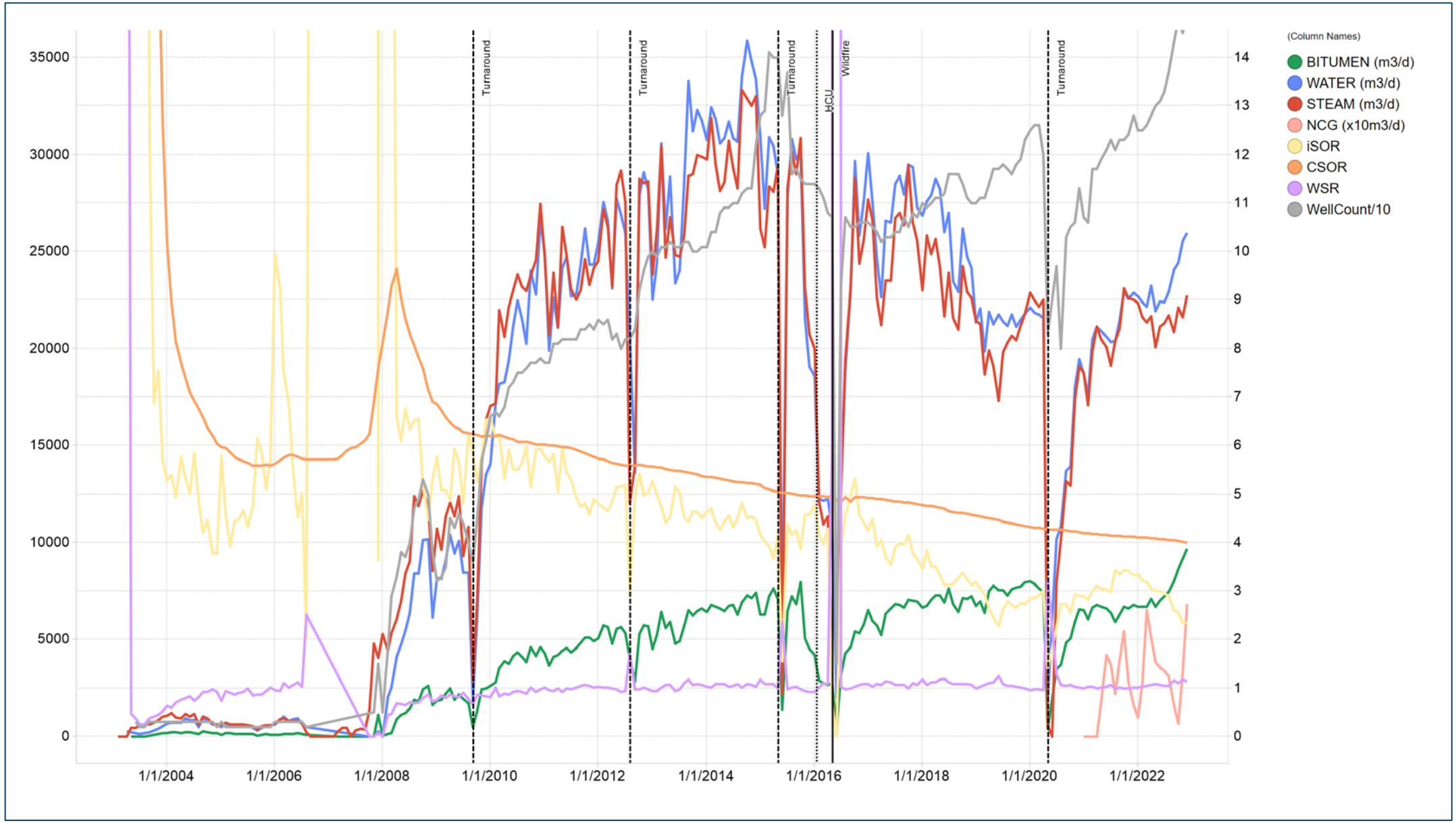
- K1A Recovery Project
  - Completed construction and commissioning of Boiler Feed Water (BFW) & Produced Emulsion (PE) lines
  - Pipeline operations began Q4 2022
  - K1A Steam Generation Facility (SGF) commissioned and returned to production
- Upgrader Partial Re-Start Project
  - Upgrader completed equipment cleaning, inspection and repair
  - OrCrude and SRU transitioned to start-up and commissioning
- Received regulatory approval for LLNW (Pad 19) August 16, 2022
- Continued to progress brownfield drilling program to increase production

Sections 2 to 7- Subsurface

cnooc

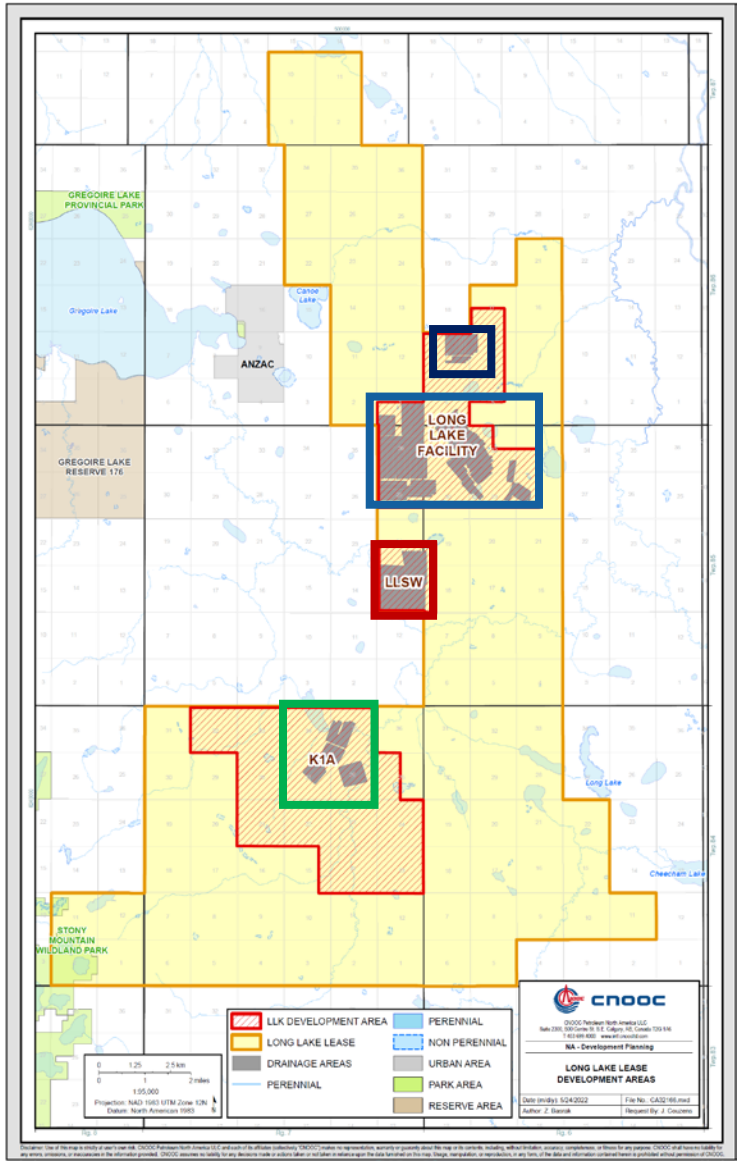
Section 2 – Scheme Performance

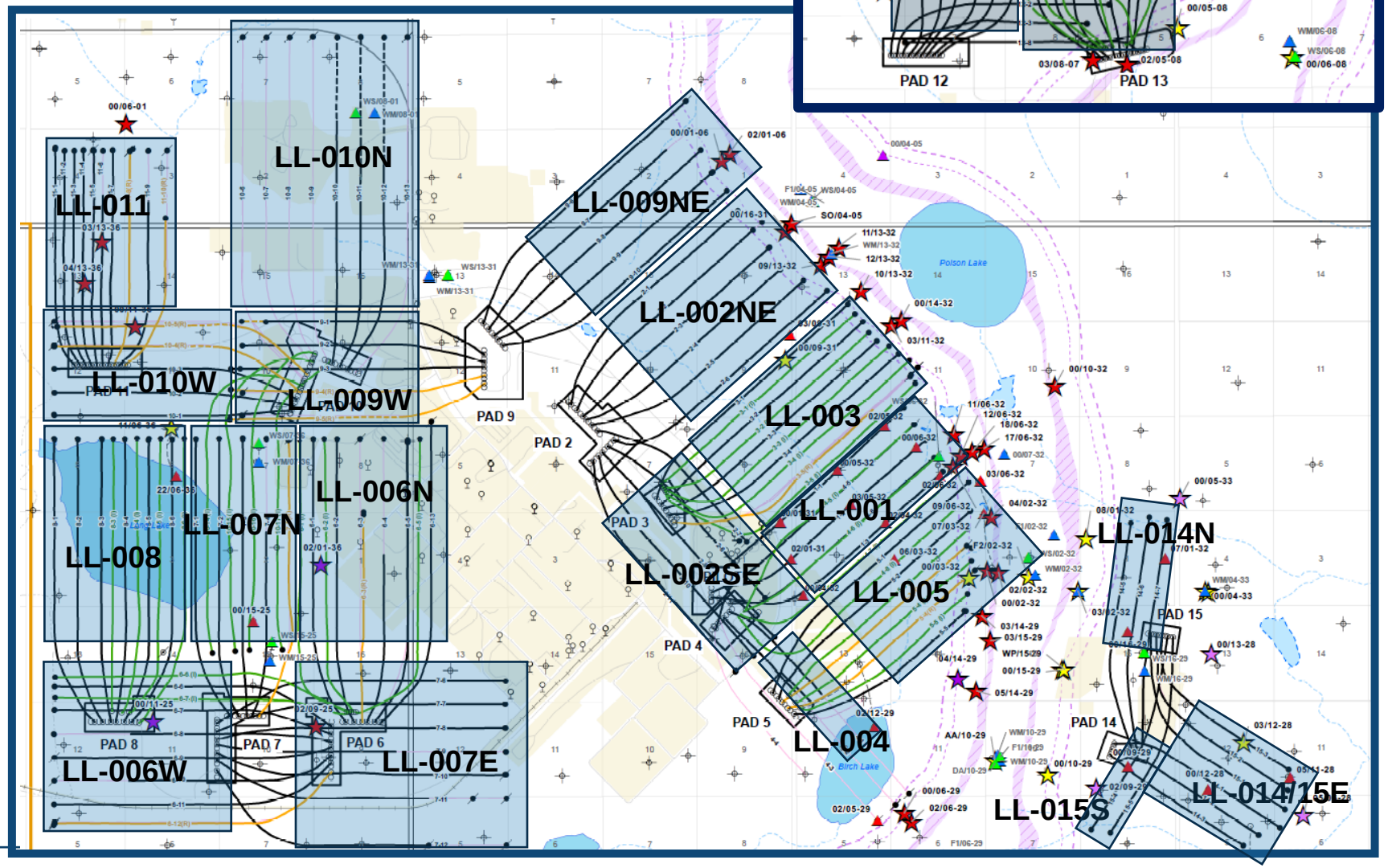
Production History

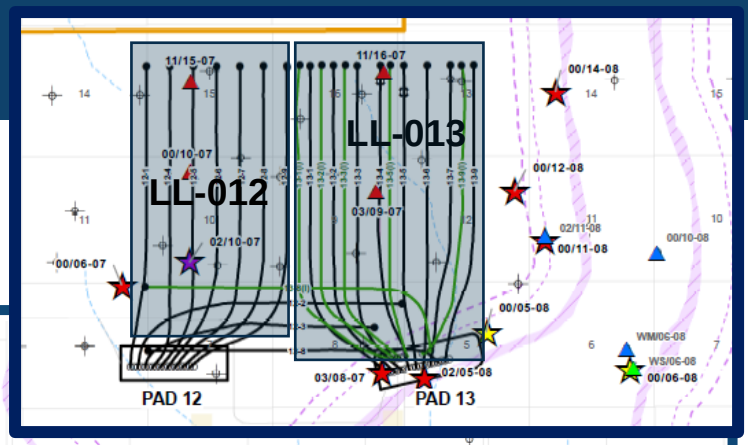


Section 3 – Development Maps

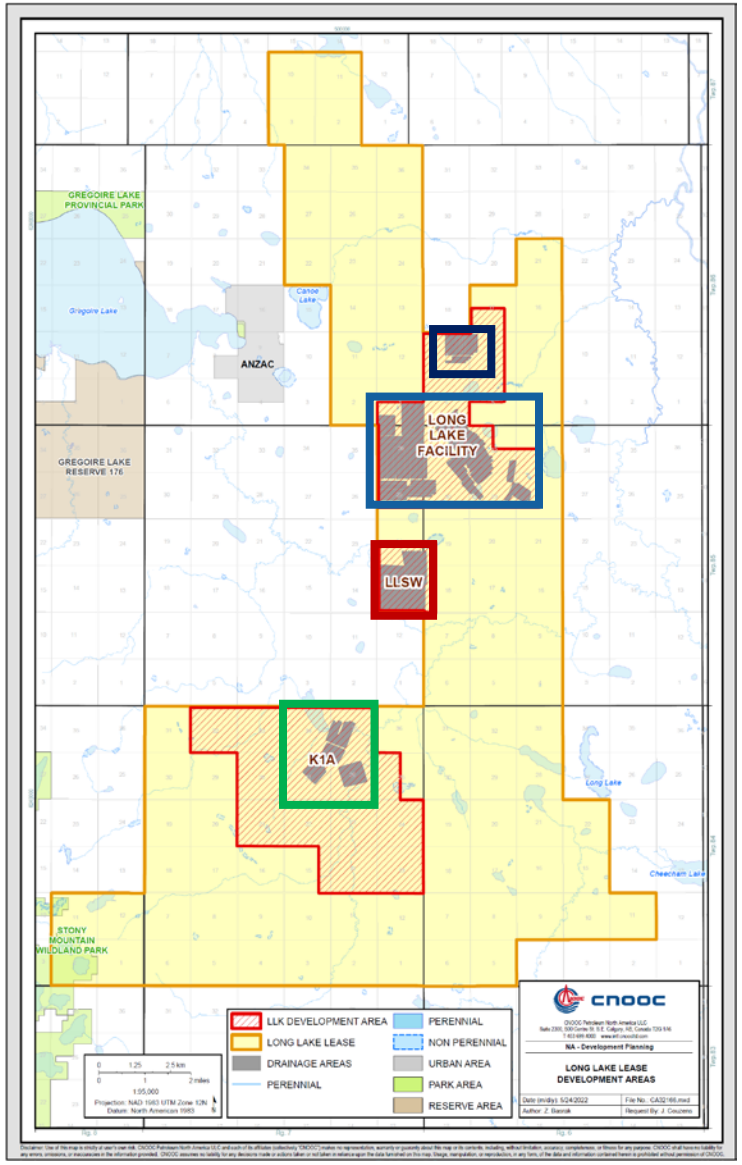
Development Area with Drainage Patterns

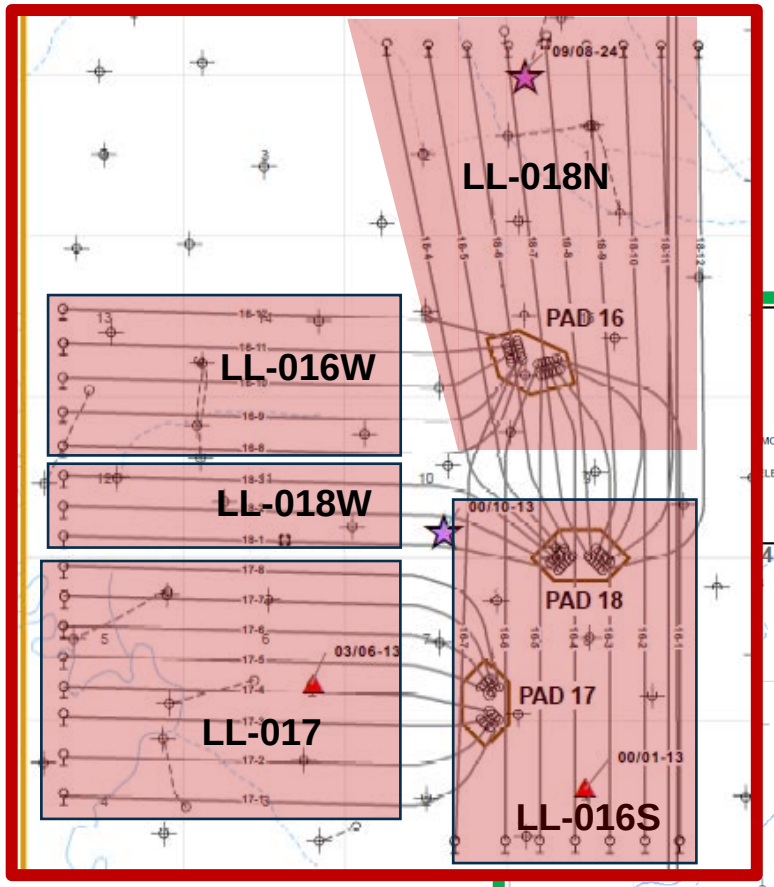


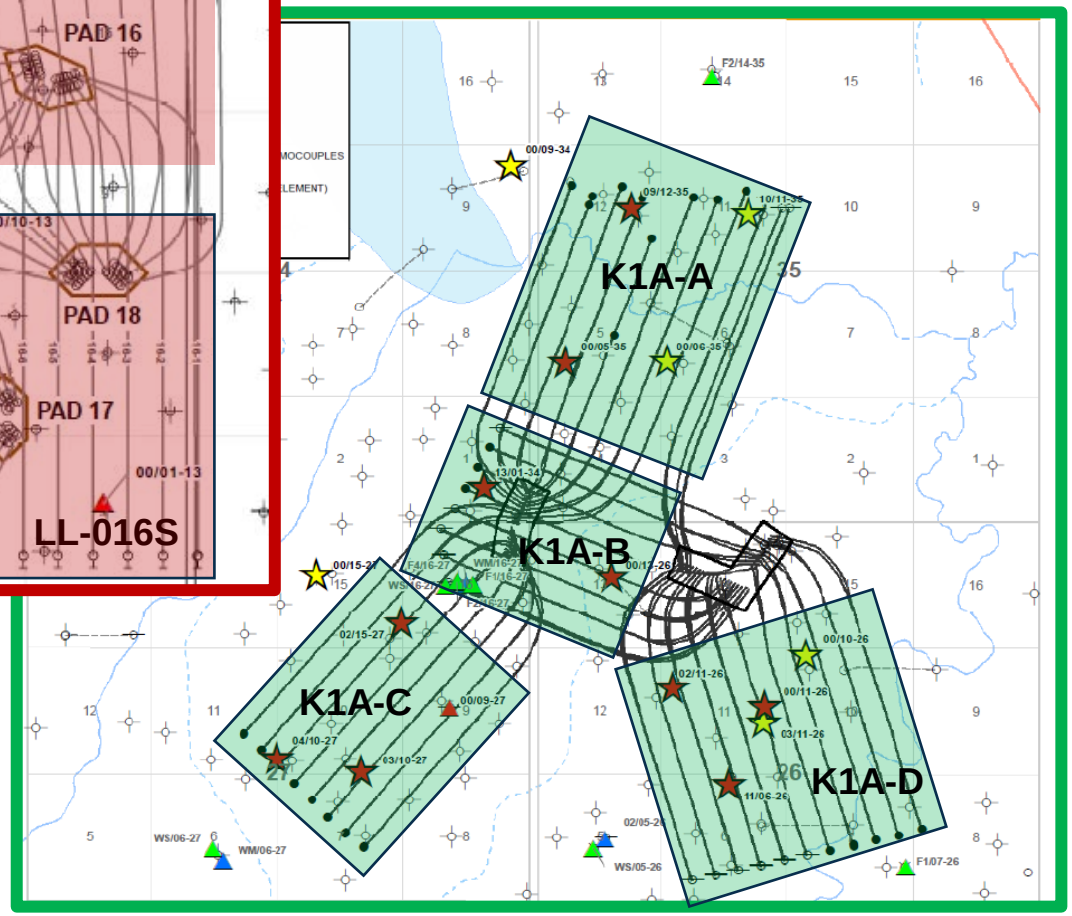




Development Area with Drainage Patterns

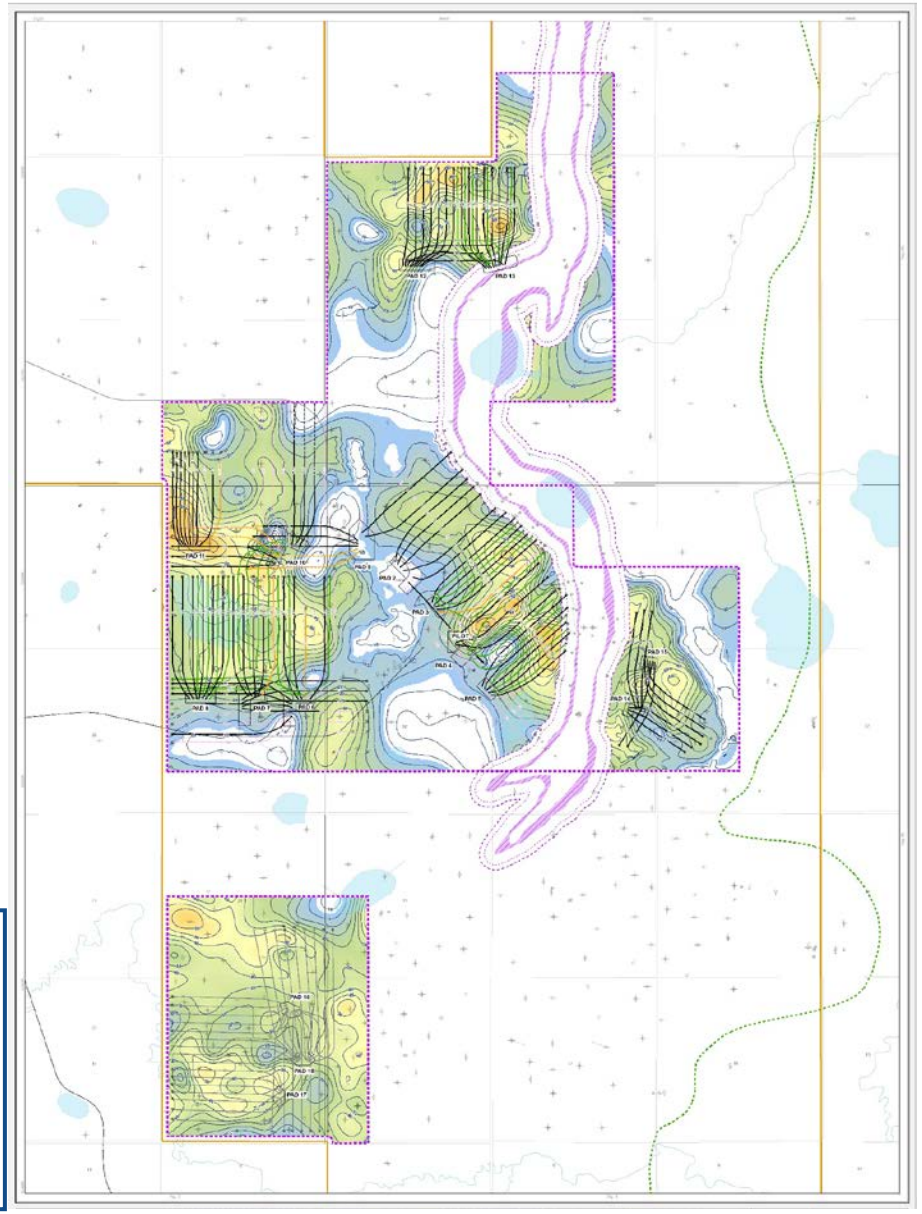




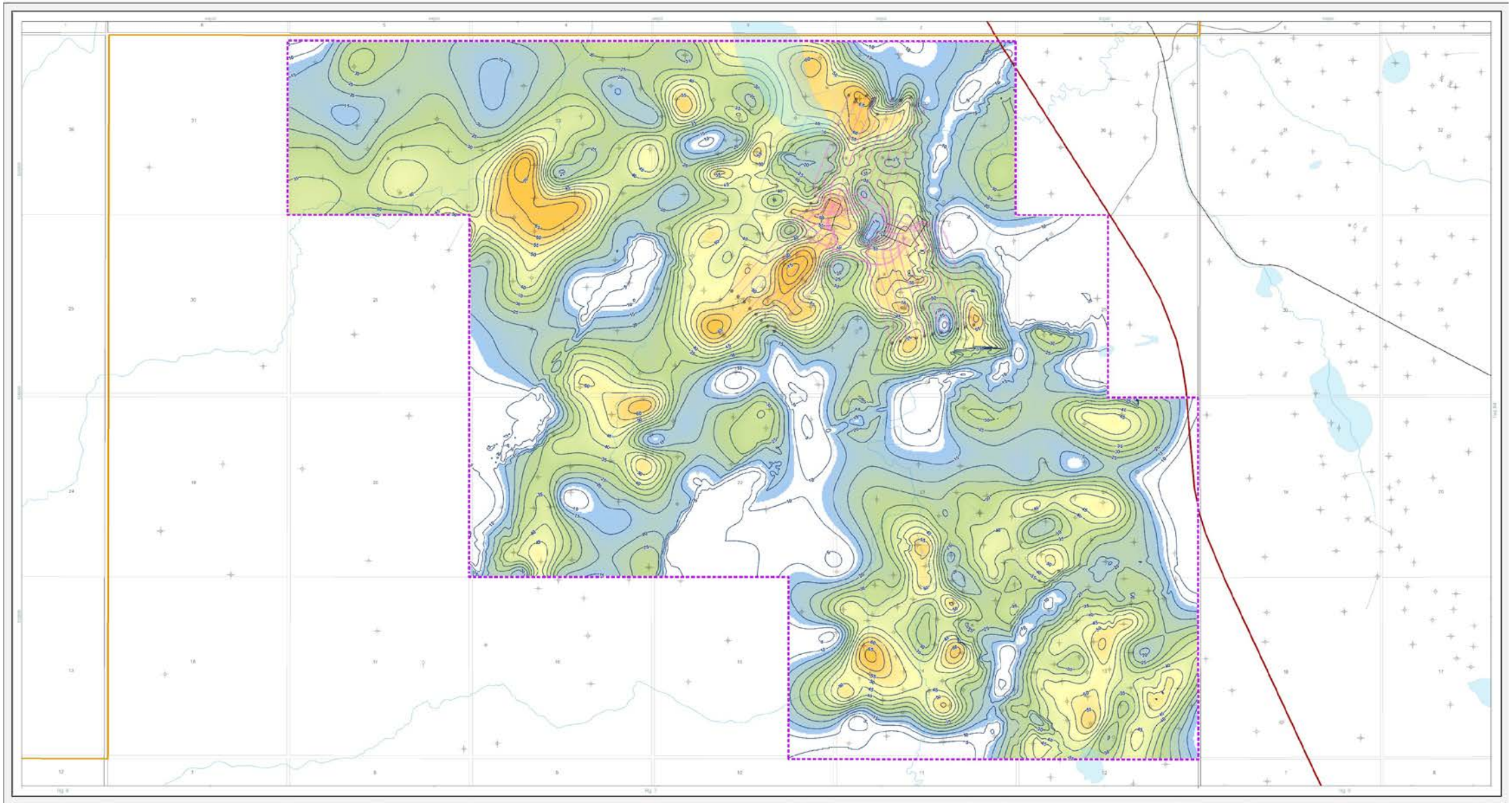


SAGDable Bitumen-In-Place (SBIP) Pay Isopach – Long Lake

- 5m contour interval
- SBIP with resource cut-off
  - ➢ Colour-fill cut-off at minimum 12m thickness

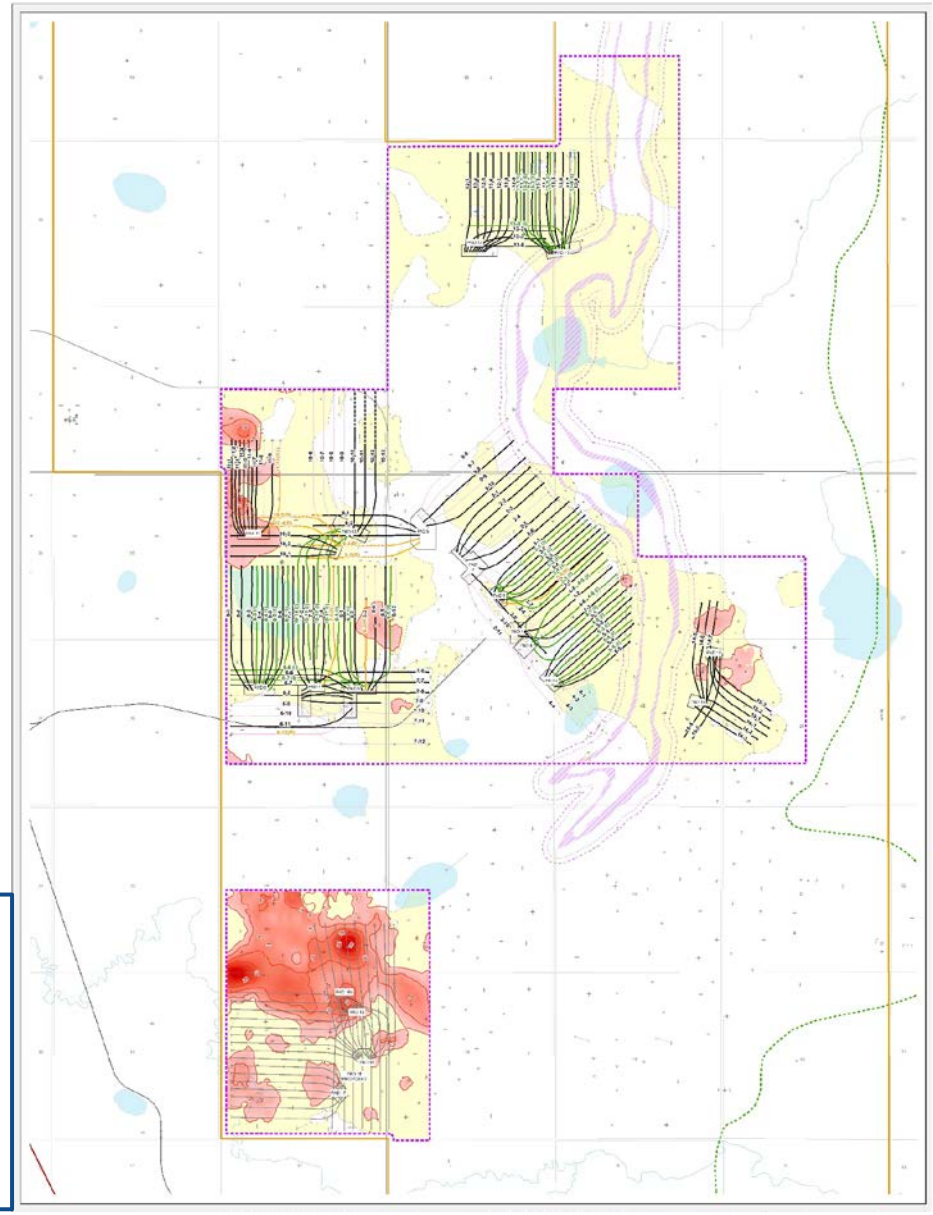


SBIP Pay Isopach - Kinosis

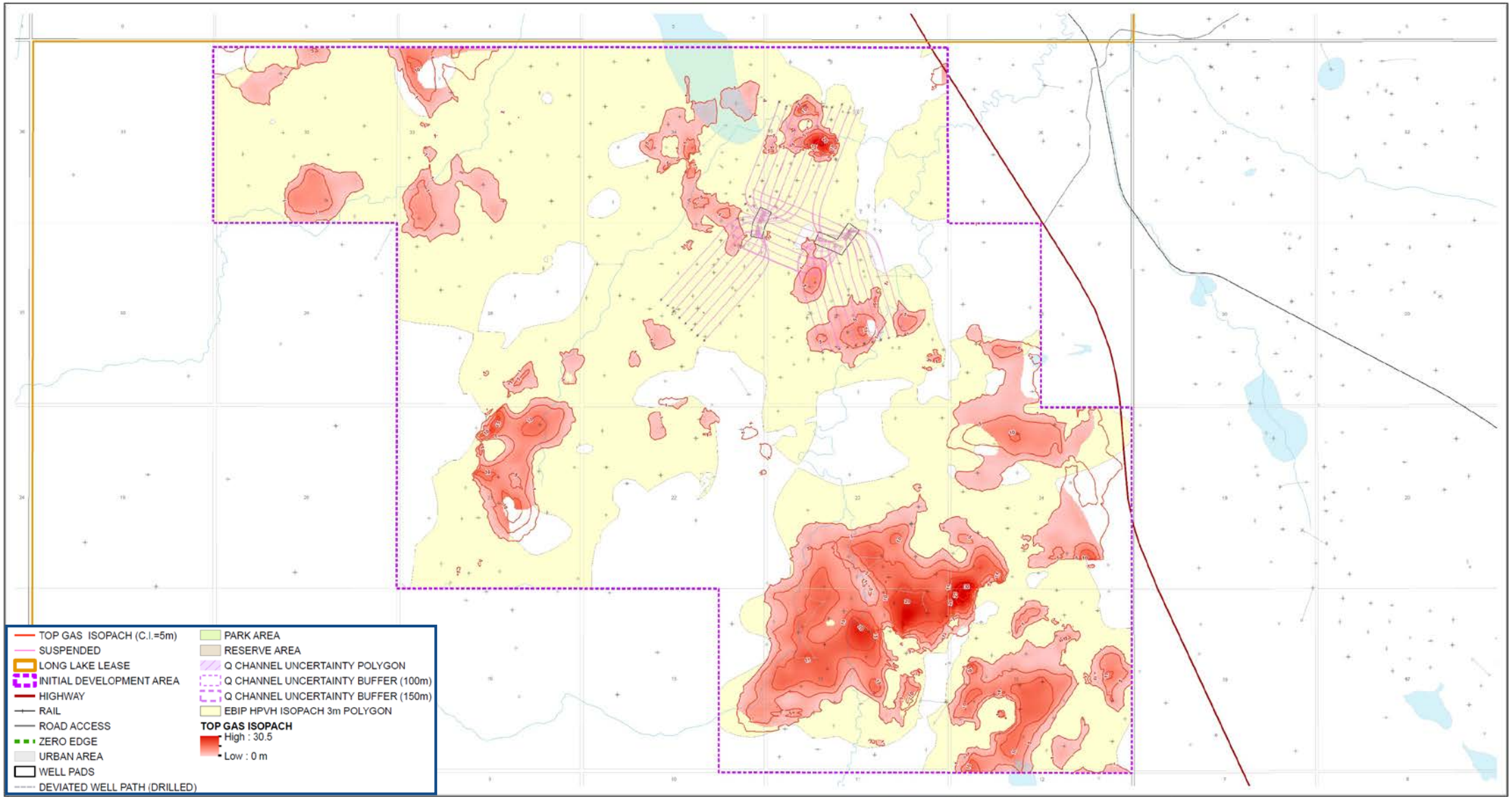


Long Lake Gas Interval in Communication with Pay

- 5m contour interval
- Gas defined by neutron-density porosity cross-over
- Gas associated with SBIP Interval;
  - Directly in contact with top water or top of SBIP interval
  - Colour-fill clipped to area in communication with SBIP pay

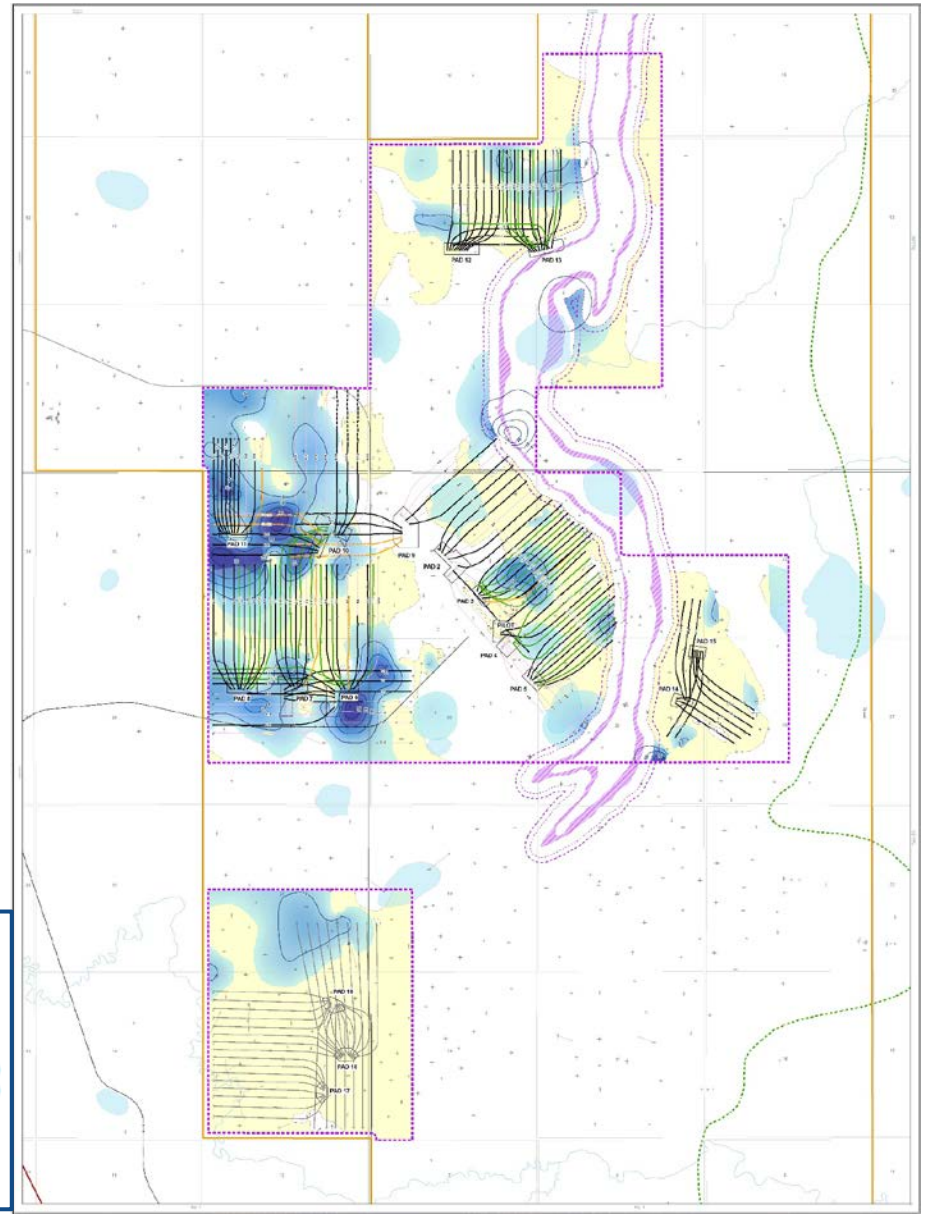


Kinosis Gas Interval in Communication with Pay

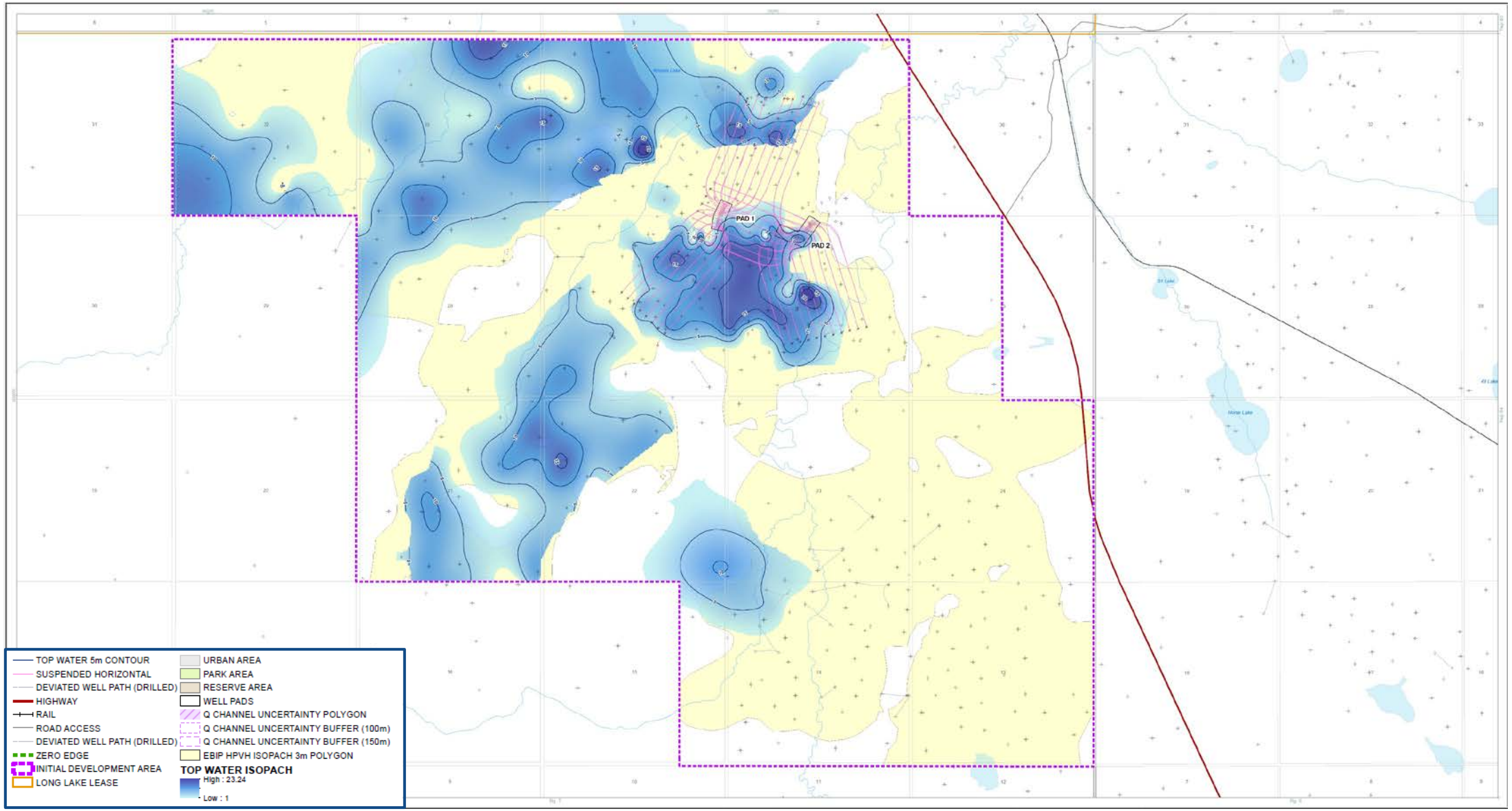


Long Lake Top Water in Communication with Pay

- 5m contour interval
- Top water defined as:
  - Effective water saturation >50% and,
  - Volume Shale <30%
- Top water associated with SBIP Interval;
  - Colour-fill clipped to area in communication with SBIP pay

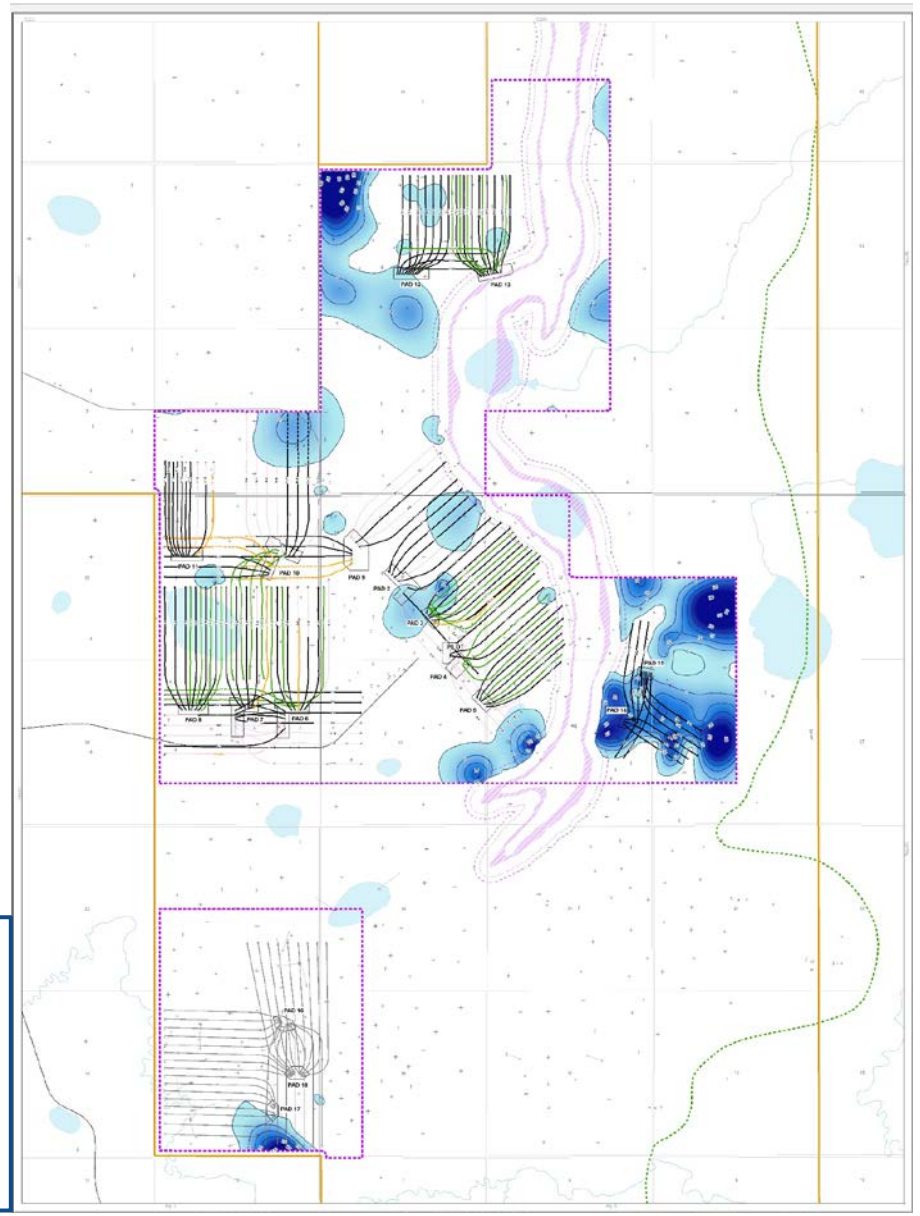


Kinosis Top Water in Communication with Pay

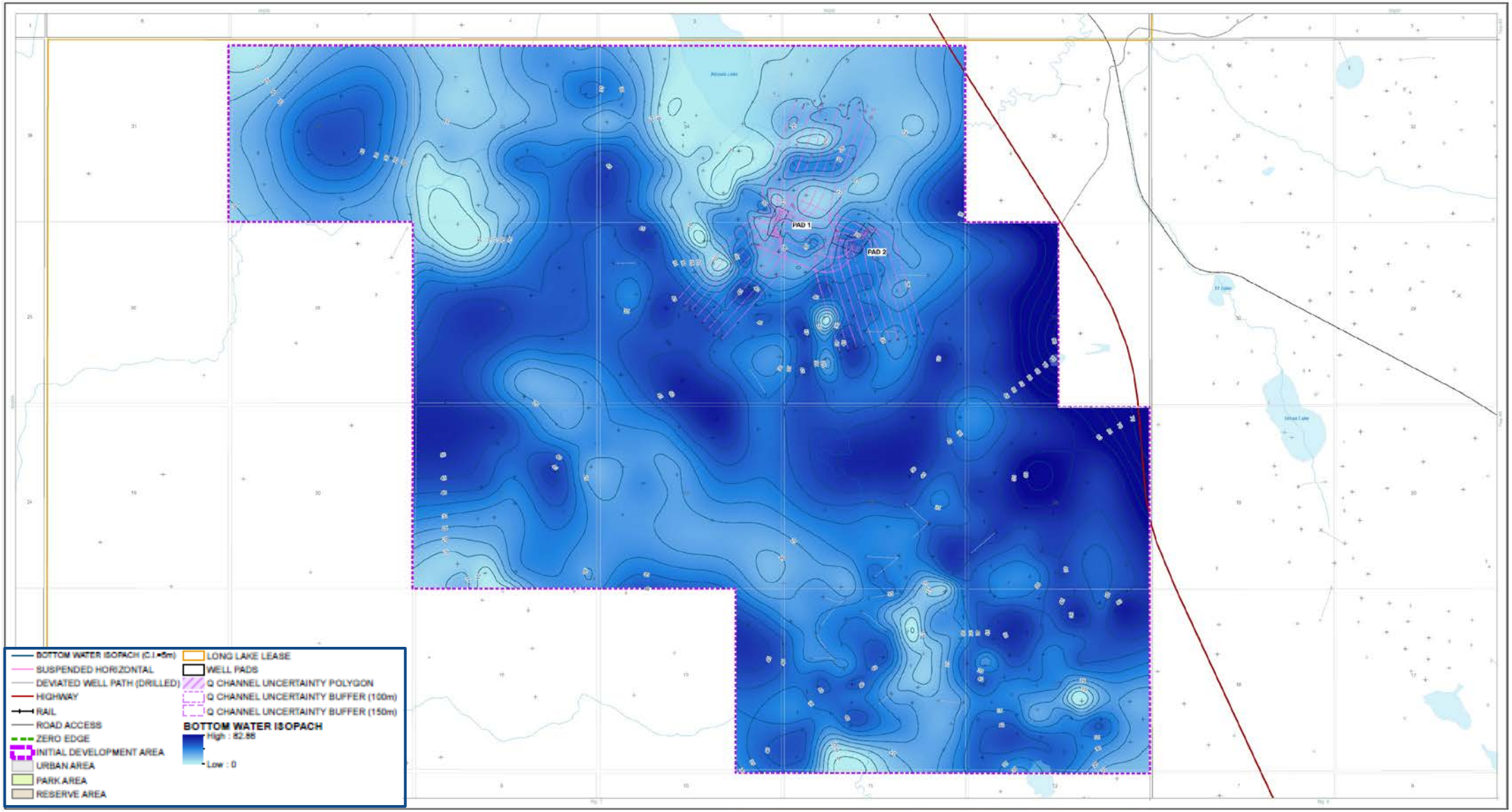


Long Lake Bottom Water Isopach

- 5m contour interval
- Bottom water defined as:
  - Effective water saturation >50% and,
  - Volume Shale <30%

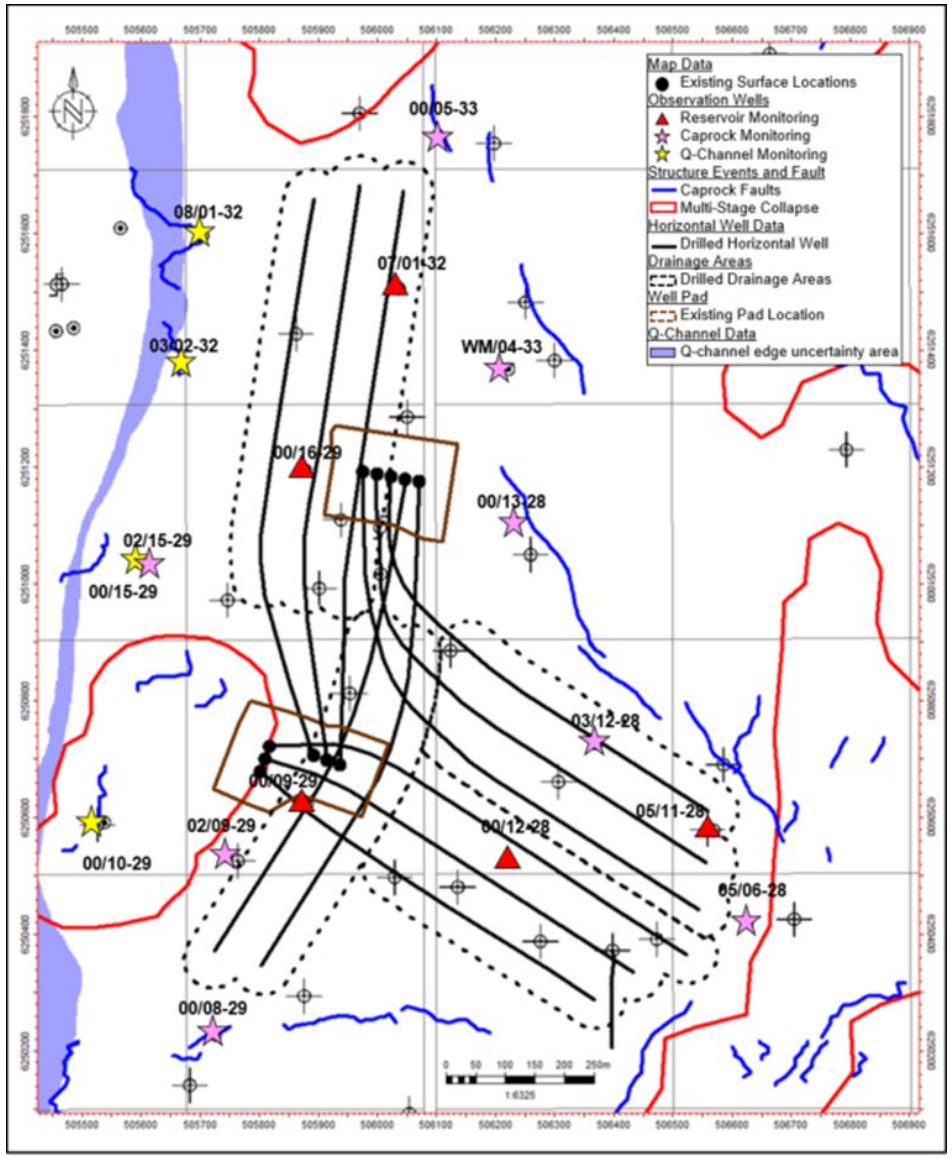


Kinosis Bottom Water Isopach



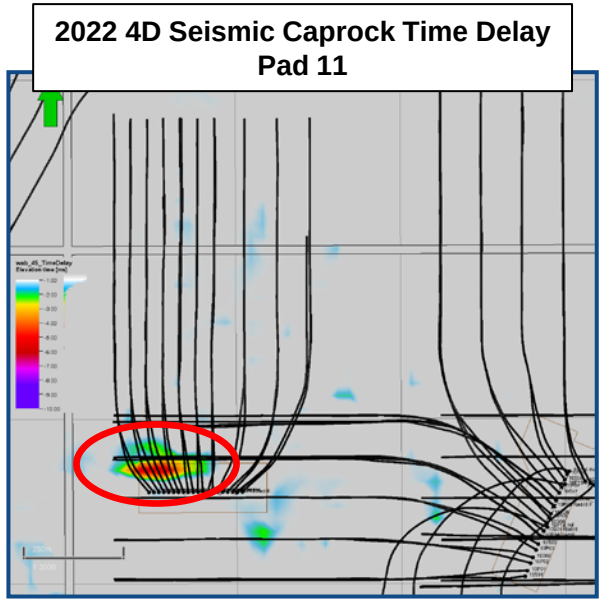
Pads 14/15 Geomechanical Anomalies

- No changes to geomechanical anomalies over Pads 14/15 in 2022

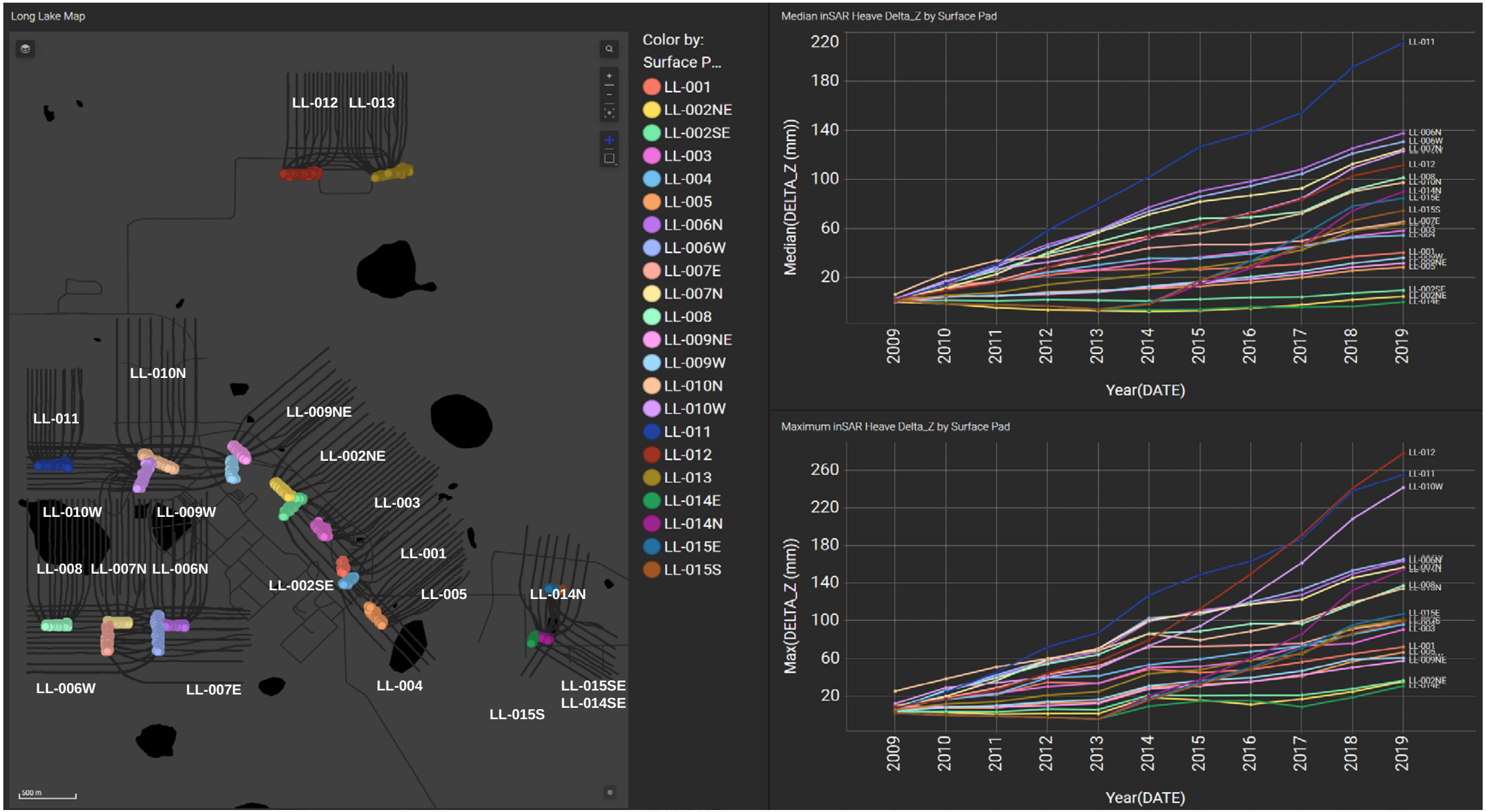


Pad 11 4D Seismic Time Delay Anomaly

- In 2022, CPNA completed a 4D seismic acquisition over the Long Lake West Development Area as part of ongoing steam chamber development monitoring
- The processed 4D seismic showed a time delay anomaly in the caprock zone (Clearwater) directly adjacent to the Pad 11 build sections
- August 2022: Reduced Steam to minimum rates at Pad 11 & Pad 10W
- CPNA continues to produce bitumen from these pads
- In 2023 CPNA will continue efforts to characterize the anomaly in more detail



inSAR Surface Heave 2009-2019



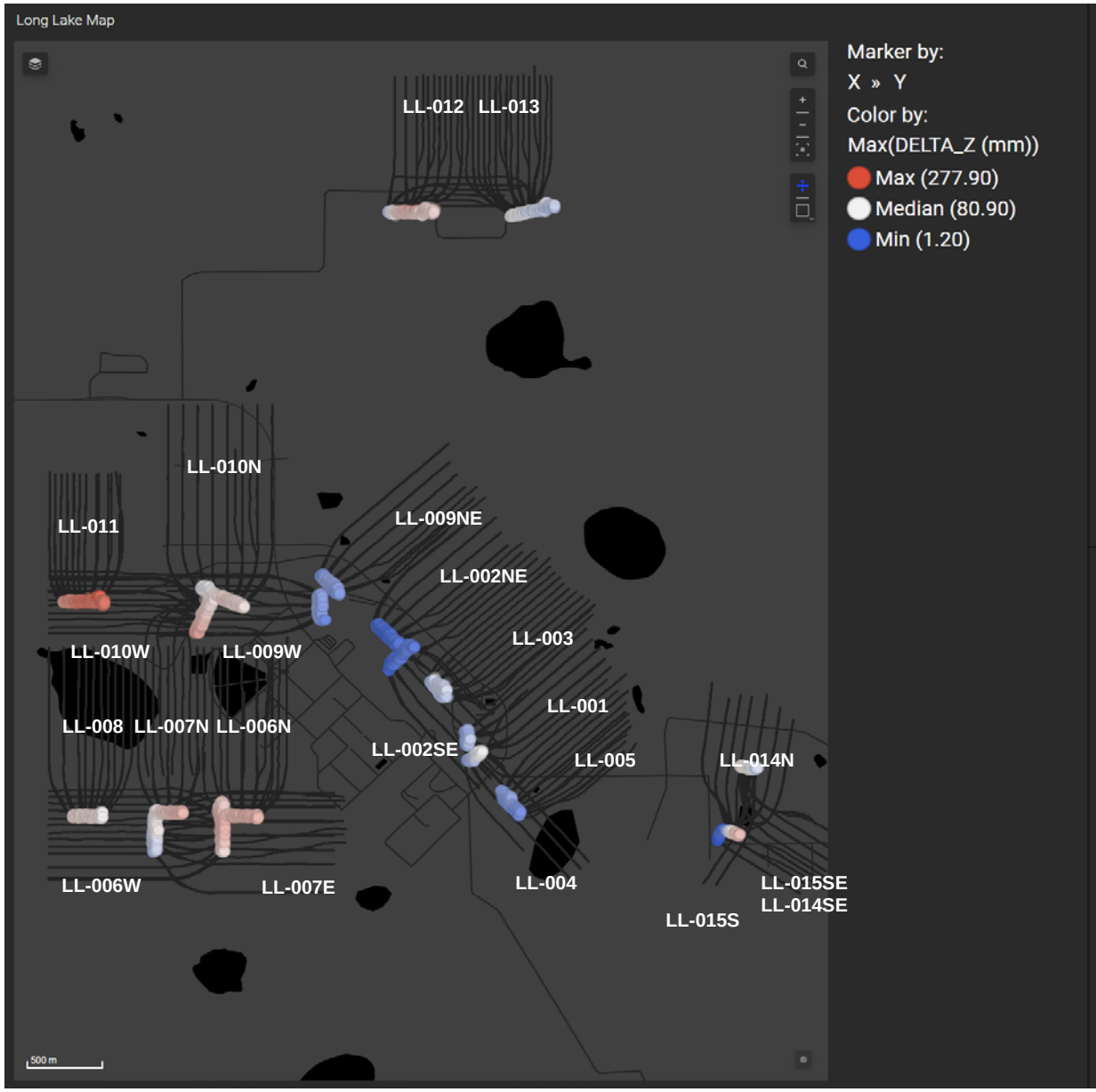
inSAR surface heave data from 2009-2019

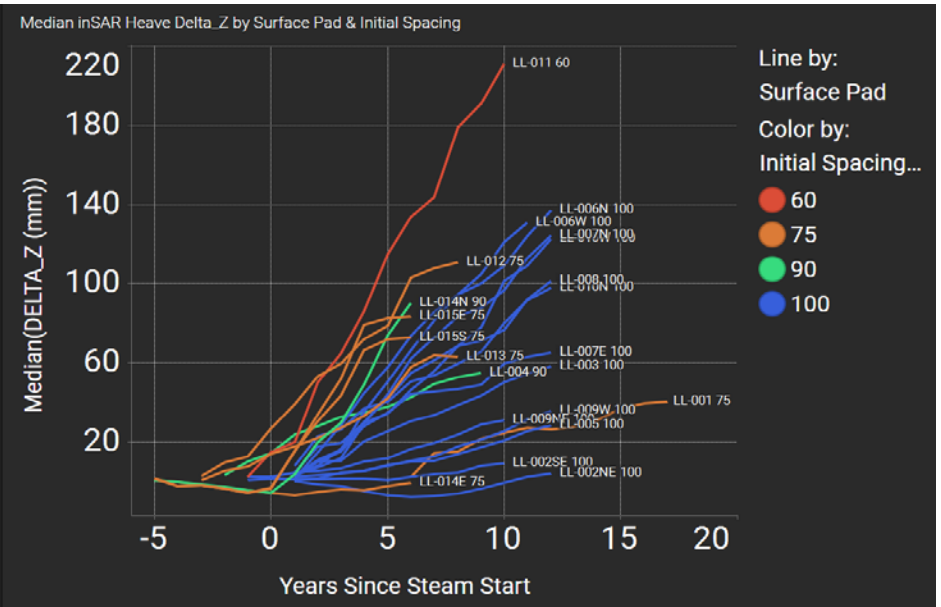
Data has been isolated to reflectors on surface pad facilities

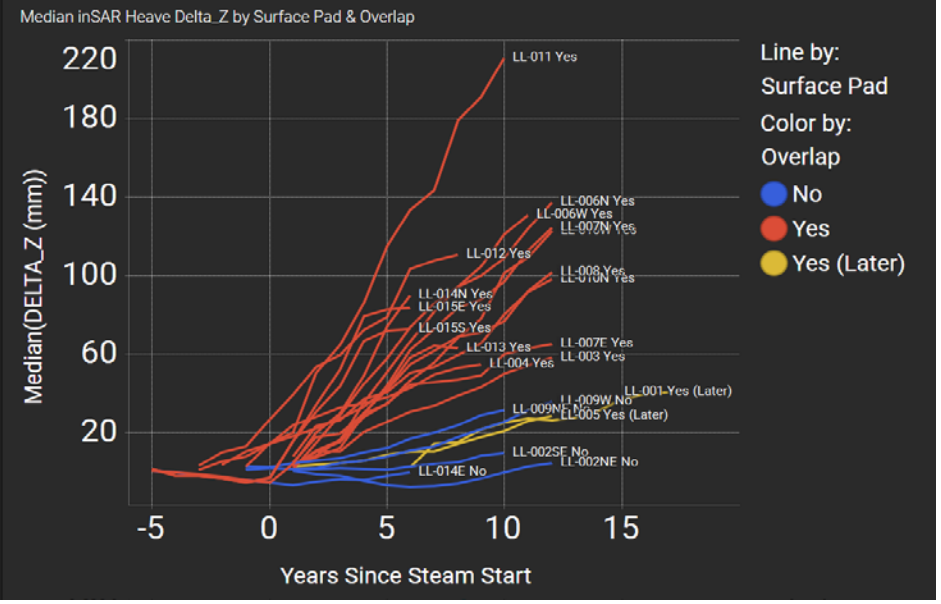
Highest med. heave at Pad 11, 211.1mm

Highest max. heave at Pad 12, 277.9mm

inSAR Surface Heave 2009-2019







Highest inSAR surface heave appears related to:

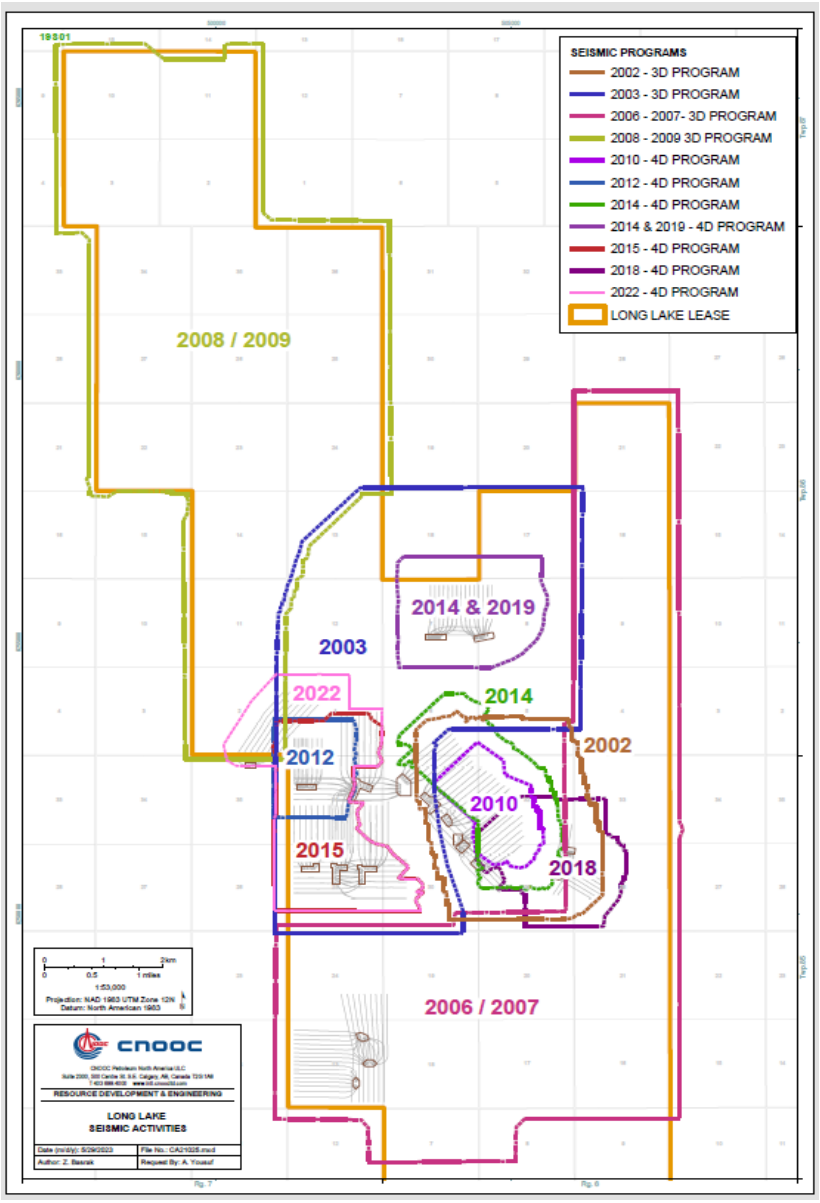
Wells with closer initial spacing (measured at horizontal legs)

Wells with overlapping well laterals

We expect a closer relationship to spacing if we consider distance between wells through build sections

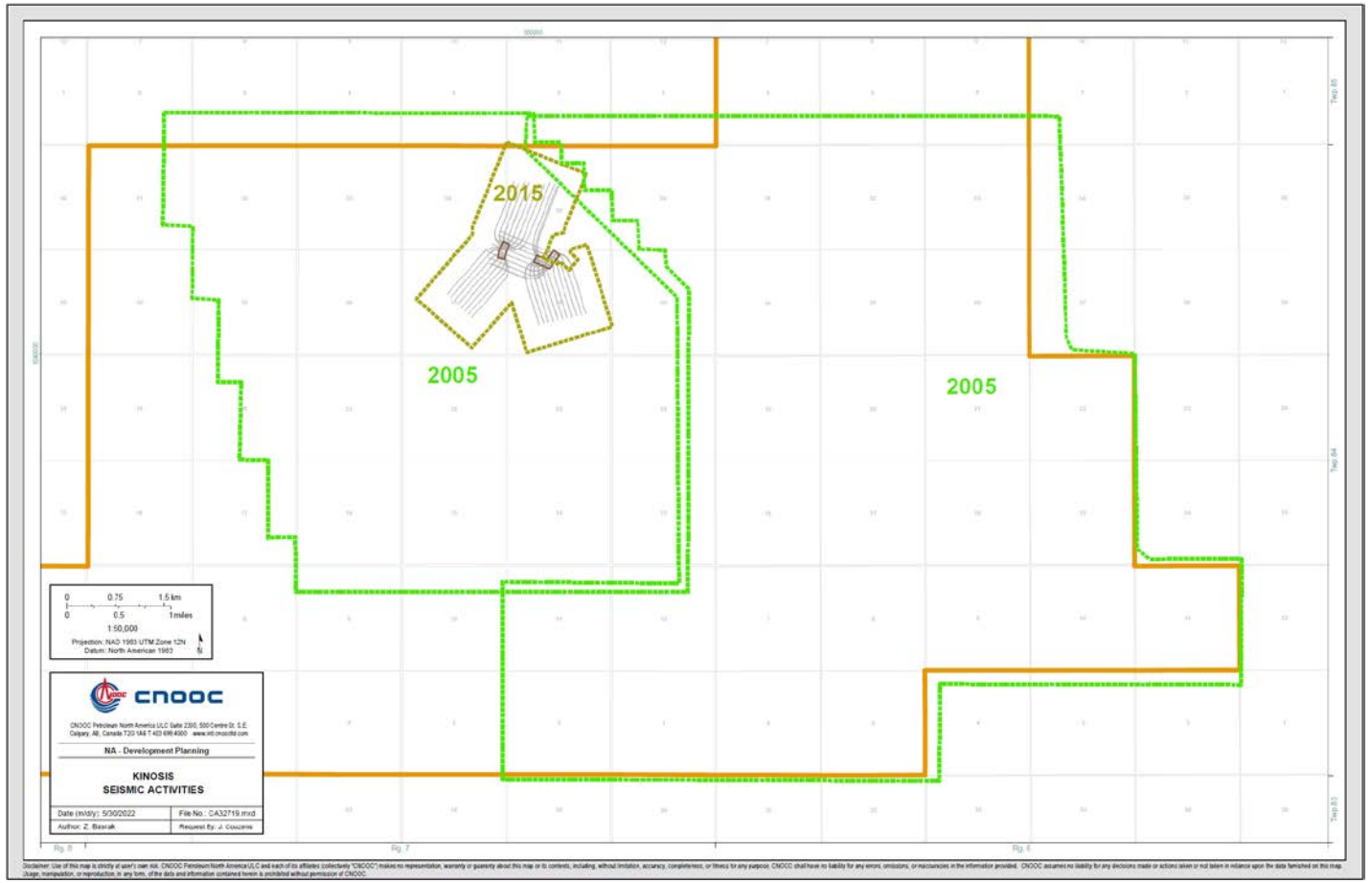
Seismic Acquisition – Long Lake

- Seismic was acquired over Long Lake west pads in 2022



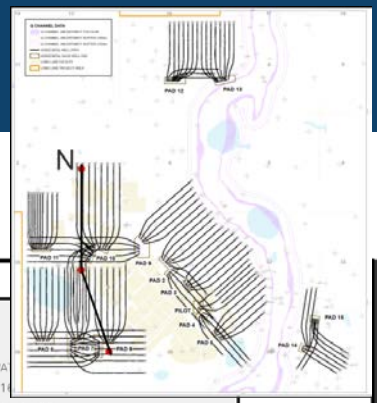
Seismic Acquisition – Kinosis

- No seismic was acquired in 2022 in Kinosis region



Section 4 – Representative Cross-Sections

Representative structural cross-section of the West Side of Long Lake (South - North)



S

Well: 1AA092508507W400
OPTI CANADA ETAL CHEECHAM 9-25-85-7
MEASUREMENT REF.: KB
ELEVATION MEAS. REF.: 491.30
DRILLED DEPTH: 257.10
SURFACE ELEVATION: 488.30
RIG RELEASE: 28-JAN-2000
VERTICAL SCALE: 1:500

Well: 1AA073608507W400
OPTI CANADA ET AL CHEECHAM 7-36-85-7
MEASUREMENT REF.: KB
ELEVATION MEAS. REF.: 497.10
DRILLED DEPTH: 265.50
SURFACE ELEVATION: 494.10
RIG RELEASE: 03-MAR-2000
VERTICAL SCALE: 1:500

Well: 1AA070108607W400
OPTI CANADA ETAL CHEECHAM 7-1-86-7
MEASUREMENT REF.: KB
ELEVATION MEAS. REF.: 488.40
DRILLED DEPTH: 261.00
SURFACE ELEVA
RIG RELEASE: 1
VERTICAL SCALE: 1:500

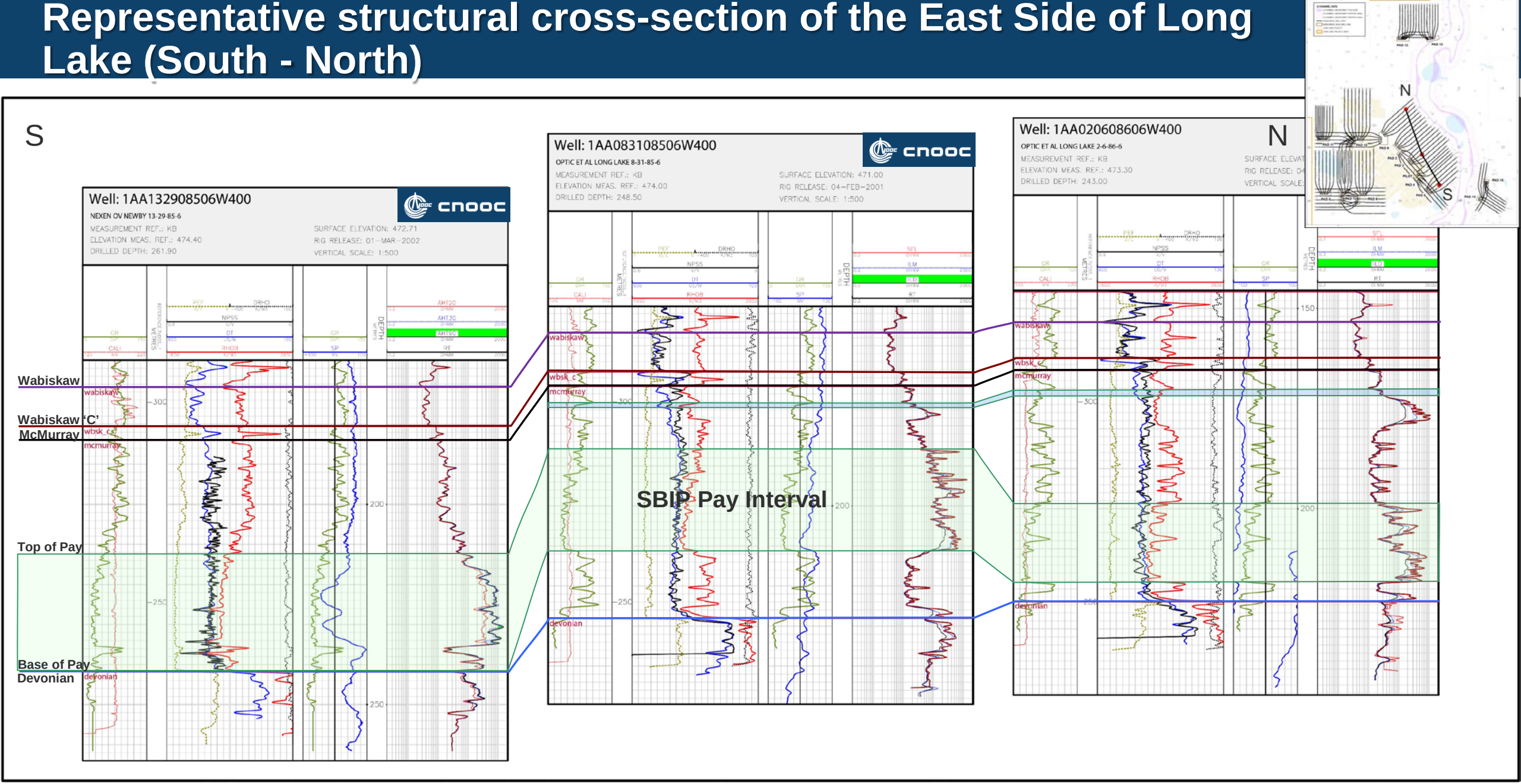
N

Wabiskaw_C'
McMurray
Top of Pay
Base of Pay
Devonian

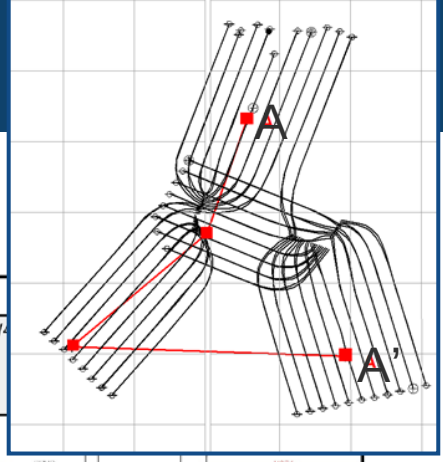
Top Water

SBIP Pay Interval

Representative structural cross-section of the East Side of Long Lake (South - North)



Representative structural cross-section of K1A



A

A'

Well: 1AB053508407W400

Well: 1AE132608407W400

Well: 1AC102708407W400

Well: 1AH062608407W4

Wabiskaw

Wabiskaw 'C'

McMurray

Top of Pay

Base of Pay

Devonian

Top Water

SBIP Pay Interval

Bottom Water

Top Gas

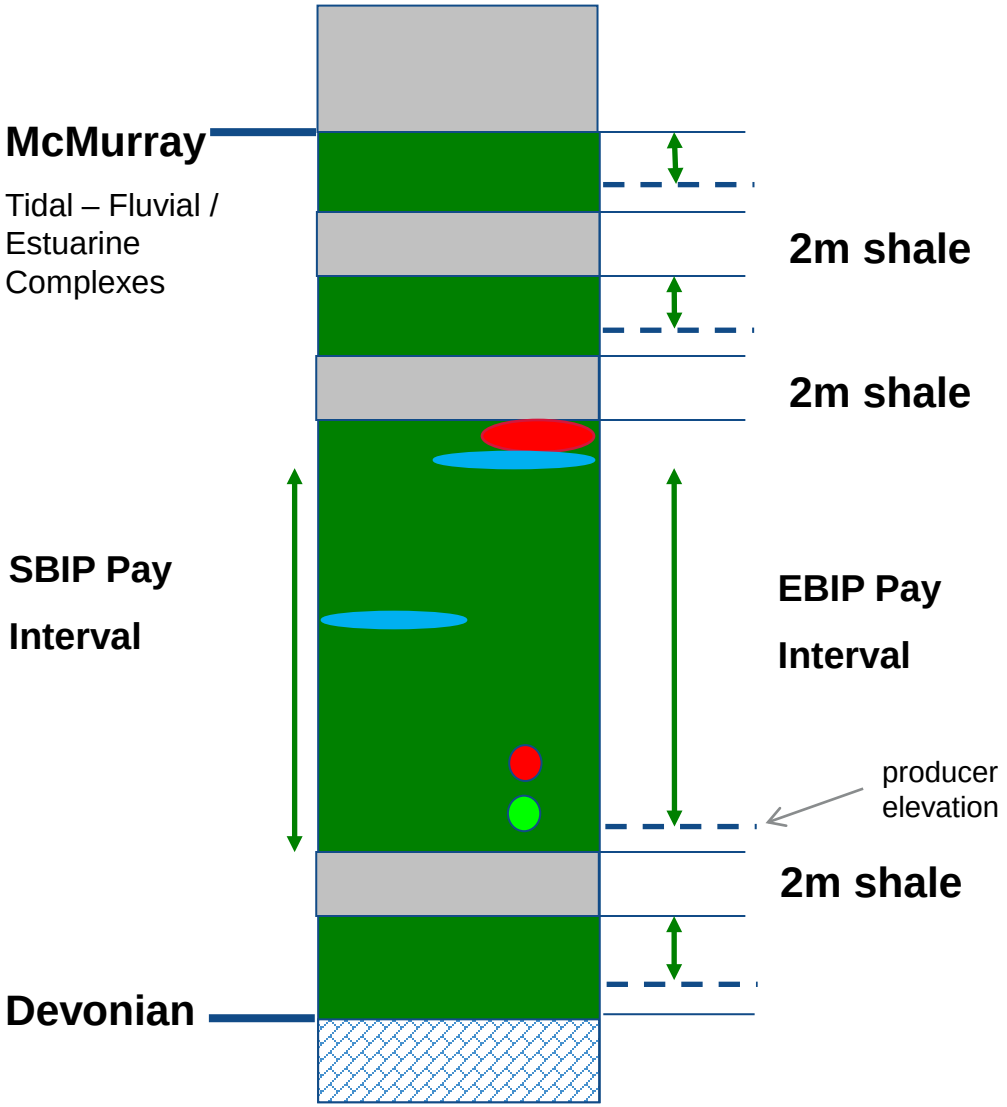
Section 5 – OBIP and Recoverable Tables

Pay and Exploitable Bitumen-in-Place Mapping Methodology

- Pay cut-offs:
  - Top of pay interval is a 2m shale with > 30% Vshale
  - Focus on low Vshale intervals with thinner and fewer shale beds
  - Account for standoff from bottom water or non-reservoir
- Top of SADGable (SBIP*) and Exploitable Bitumen in Place (EBIP) Pay Interval:
  - Single shale interval (> 30% Vshale) of 2m
  - Cumulative shale interval (> 30% Vshale) of 4m
- Base of SBIP Pay Interval:
  - Base of bitumen pay/reservoir rock
- Base of EBIP Pay Interval:
  - Depth of an existing or planned horizontal well pair (EBIP pay base = producer well depth)
  - Stand-off from bitumen/water contact or non-reservoir
- Gas Interval(s) Associated with EBIP/SBIP Pay Interval
  - Gas identified by neutron/density crossover
- High Water Saturation Interval(s) Associated with EBIP/SBIP Pay Interval
  - > 50% Swe (effective water saturation) and < 30% Vshale
- EBIP will be calculated from a hydrocarbon pore volume height (HPVH) map.
  - Minimum EBIP HPVH and Pay Interval Contour ($3m^3/m^2$ EBIP HPVH = 12m EBIP Pay Interval)

*SAGDable Bitumen In Place (SBIP) estimation is representative of OBIP

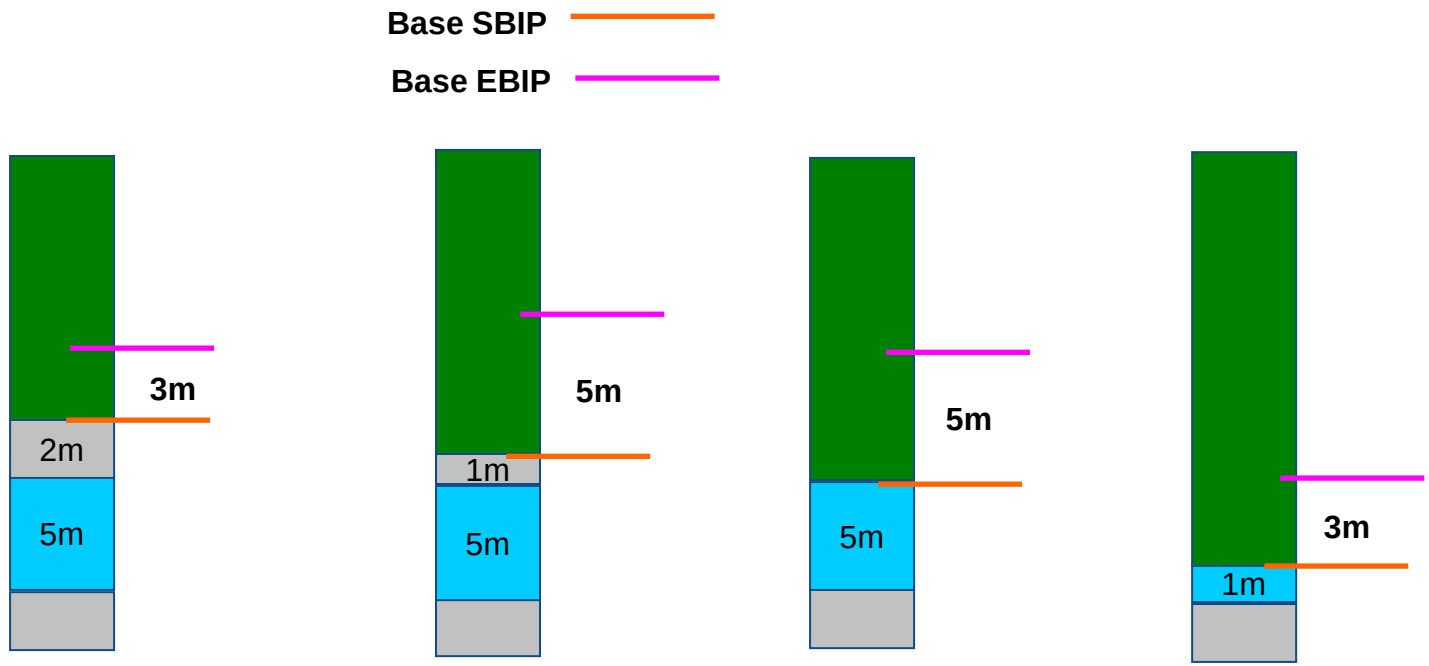
Pay and Bitumen-in-Place Mapping Methodology



- SBIP Pay Interval:
  - < 30% V_{shale}
  - < 50% S_{we}
- May have associated:
  - gas interval(s)
  - high water saturation interval(s)
- Primary zone defined as the thickest pay interval unless:
  - an existing (or planned) horizontal well pair is within an interval
  - geologists have interpreted continuity of an interval across an area
- Reservoir Rock:
  - Sand
  - Breccia
  - IHS with < 30% Vshale

Pay and Exploitable Bitumen-in-Place Mapping Methodology

- Base of EBIP Pay Interval:
  - Depth of an existing or planned horizontal well pair (EBIP Pay Interval base = producer well depth)
  - 3m stand-off if no bottom water (minimum shale of 2m thickness)
  - 5 m stand-off if in contact with bottom water (minimum bottom water thickness of 2m)



Long Lake Development Areas: EBIP and Reservoir Parameters

Project Area	Development Area	Cumulative Production, YE 2022 (e6m3)	EBIP	SBIP	SBIP	Reservoir Parameters			
			(e6m3)	(e6m3)	Current RF (%)	Avg Thickness (m)	Avg Porosity (%)	Avg Eff Sw (%)	Permeability: Kmax/Kvert (mD)
Long Lake	Long Lake	27.4	105	131	21%	22	0.31	0.32	4470/2270
	LLSW	0.4	31	37	1%	24	0.32	0.26	3730/2320
	Kinosis	0.2	205	239	0%	23	0.31	0.23	4030/2340

*EUR contained within the table is the (Estimated) Ultimate Recovery of OBIP

Section 6 – Well Pad Parameters and Performance

CNOOC

Well Pad Parameters and Performance

Project Area	Development Area	Existing Pad	Well Count	Cumulative Production, YE 2022 (e6m3)	EUR	EBIP	SBIP	SBIP	Reservoir Parameters				
					(e6m3)	(e6m3)	(e6m3)	Current RF (%)	Avg Thickness (m)	Avg Porosity (%)	Avg Eff Sw (%)	Permeability: Kmax/Kvert (mD)	Area (ha)
Long Lake	Long Lake	LL-001*	5	1.8	2.2	2.9	3.4	53%	33	0.32	0.34	4470/2270	35
		LL-002NE*	6	1.0	1.4	2.6	3.2	33%	23	0.30	0.30	4470/2270	52
		LL-002SE	5	0.3	0.4	1.2	1.5	21%	18	0.30	0.40	4470/2270	39
		LL-003*	10	1.8	2.0	3.1	3.9	47%	28	0.31	0.33	4470/2270	49
		LL-004	2	0.1	0.1	0.1	0.2	61%	14	0.31	0.33	4470/2270	25
		LL-005*	10	2.8	3.4	3.5	3.7	76%	35	0.31	0.32	4470/2270	42
		LL-006N*	9	1.4	2.3	4.0	4.2	34%	30	0.30	0.27	4470/2270	60
		LL-006W*	9	1.1	1.9	2.4	2.7	42%	16	0.31	0.31	4470/2270	67
		LL-007E*	7	1.1	1.8	2.3	2.7	39%	21	0.30	0.35	4470/2270	60
		LL-007N*	9	3.1	3.5	4.4	4.4	71%	36	0.30	0.25	4470/2270	50
		LL-008*	10	2.9	3.7	4.2	4.9	59%	36	0.29	0.32	4470/2270	59
		LL-009NE	5	0.3	0.4	1.2	1.9	17%	15	0.30	0.41	4470/2270	47
		LL-009W*	5	0.6	0.7	1.9	2.0	32%	25	0.29	0.28	4470/2270	39
		LL-010N	8	0.6	0.7	2.7	3.7	16%	14	0.31	0.28	4470/2270	96
		LL-010W	5	1.7	2.4	3.0	3.2	53%	46	0.31	0.46	4470/2270	39
		LL-011	10	2.1	2.4	2.9	3.2	66%	36	0.32	0.35	4470/2270	41
		LL-012*	9	1.7	2.4	3.7	4.9	34%	32	0.32	0.30	4470/2270	50
		LL-013*	15	1.6	3.0	3.8	4.9	32%	31	0.32	0.32	4470/2270	50
		LL-014/15E*	6	0.5	0.8	1.3	1.9	30%	19	0.32	0.20	4470/2270	27
		LL-014N	3	0.5	0.6	1.5	1.8	26%	30	0.33	0.21	4470/2270	19
		LL-015S	2	0.3	0.4	0.8	0.9	30%	28	0.31	0.20	4470/2270	12
	LLSW	LL-016S	7	0.2	2.0	3.6	4.5	3%	24	0.32	0.24	3730/2320	63
		LL-016W	5	0.1	1.5	2.7	3.0	3%	28	0.33	0.30	3730/2320	42
		LL-017	8	0.1	2.5	4.2	6.0	1%	28	0.32	0.24	3730/2320	66
		LL-018N	9	0.0	3.1	6.1	6.6	0%	33	0.32	0.32	3730/2320	84
		LL-018W	3	0.1	1.0	1.6	1.8	6%	28	0.33	0.26	3730/2320	23
	Kinosis	K1A-A	9	0.0	2.5	4.6	5.6	0%	33	0.33	0.24	4030/2340	64
		K1A-B	8	0.0	2.2	3.9	4.5	0%	37	0.32	0.23	4030/2340	42
		K1A-C	8	0.1	3.0	5.1	6.5	2%	42	0.33	0.23	4030/2340	48
		K1A-D	11	0.0	3.0	5.6	6.7	1%	33	0.33	0.20	4030/2340	64

*includes infills/redrills

Section 7 – Co-Injection

CNOOC

Co-injection Projects Update

PAD 7E NCG:

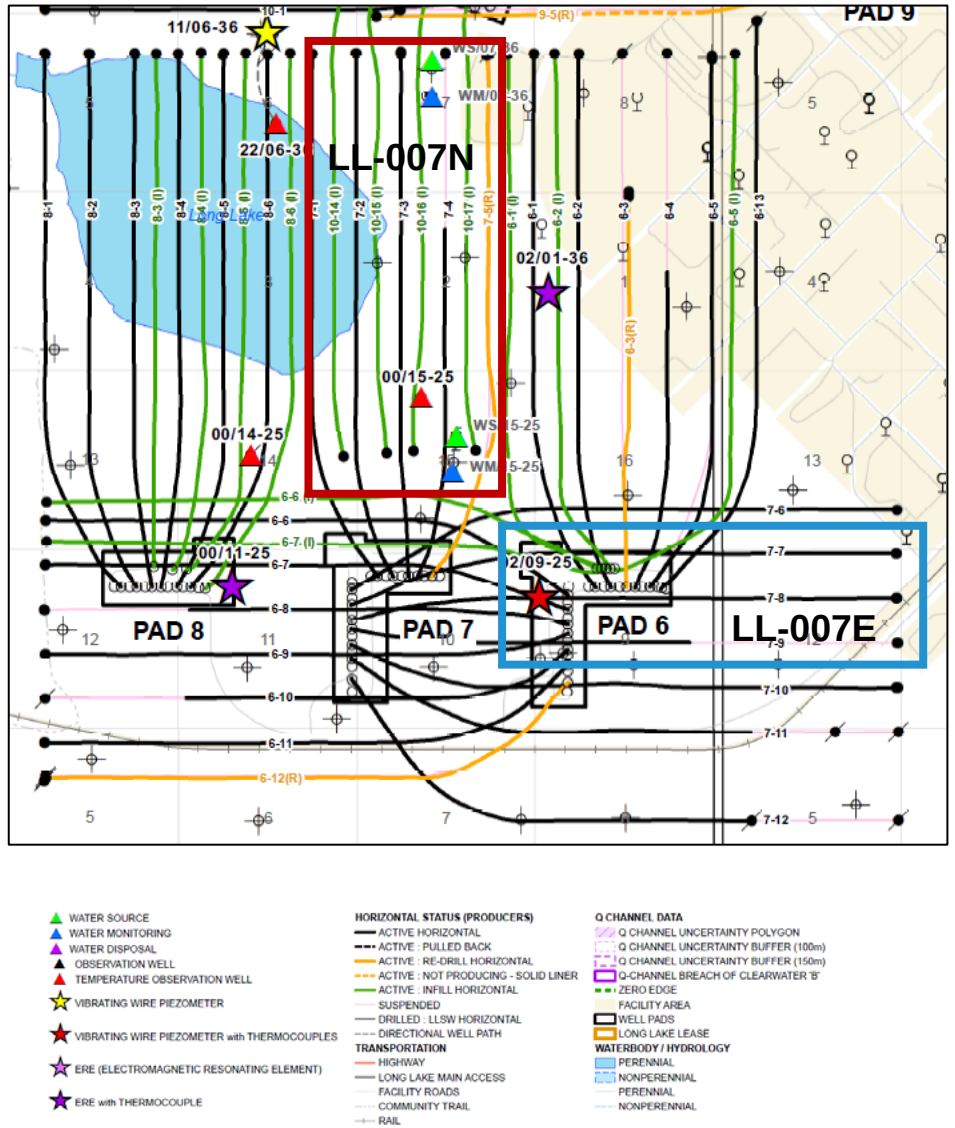
- Application approval 9485R received in Q3 2012
  - Natural gas injection started Q4 2014 at 7P7 – 7P9
  - Gas injection suspended after 2015 turnaround
    - No NCG injection through 2020-2021
  - NCG injection reinstated Mar-2022

PAD 7N NCG:

- Application approval 9485CC received in Q2 2014
  - Construction of co-injection surface facilities complete Q2 2015 on 5 well pairs planned
  - Short term NCG injection around 2015 facility turnaround
  - NCG injection reinstated Jun-2021

LLK FIELD NCG:

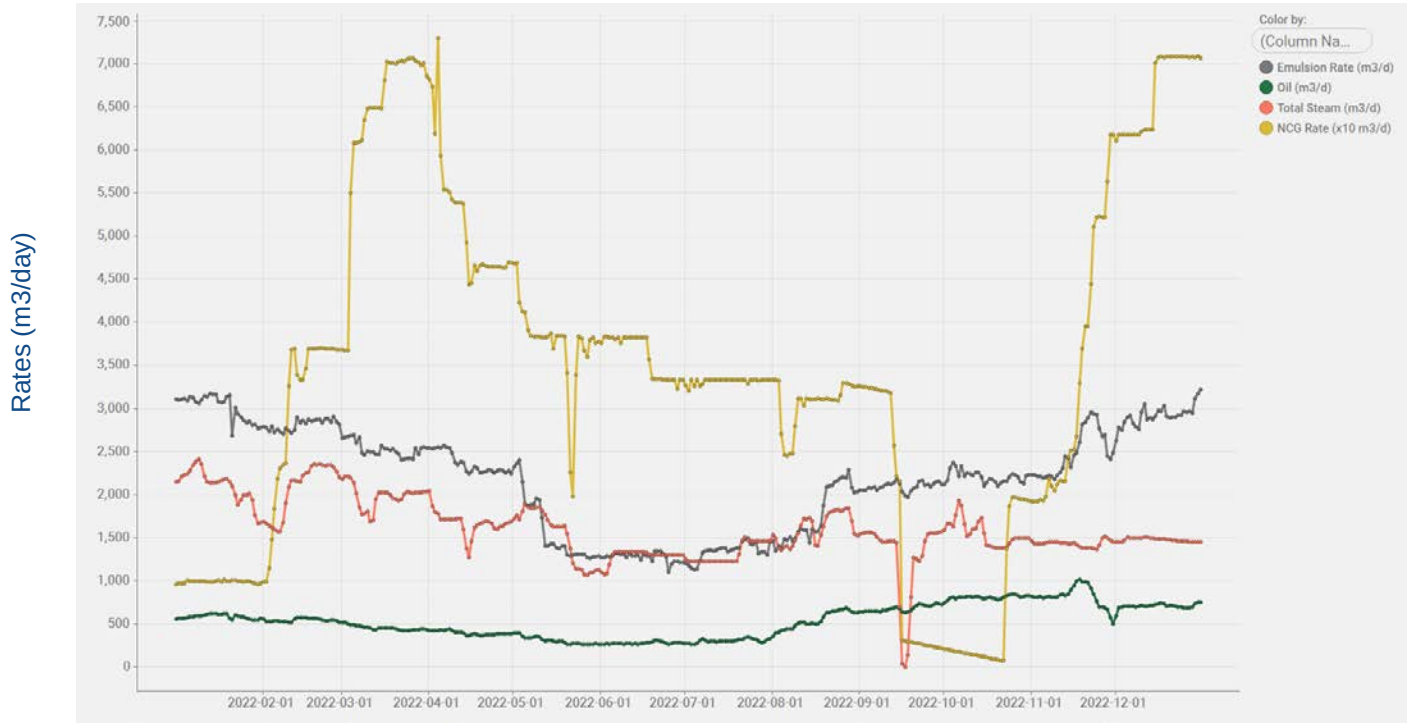
- Approval 9485PPP received in Q4 2022
  - Implementation planned for Q2 2023

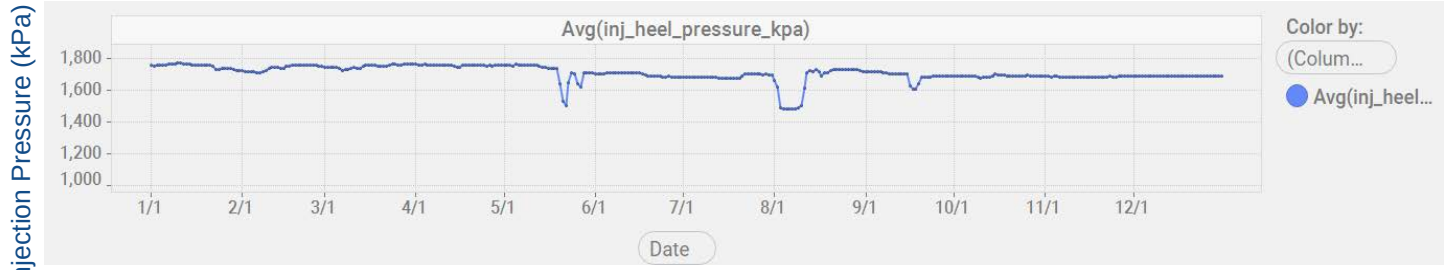


Pad 7N & 7E NCG Injection Results

- Injection Strategy to maintain target down-hole operating pressure

- Positive impacts of steam savings and SOR reduction; no negative impacts observed at this time on bitumen rates or recovery



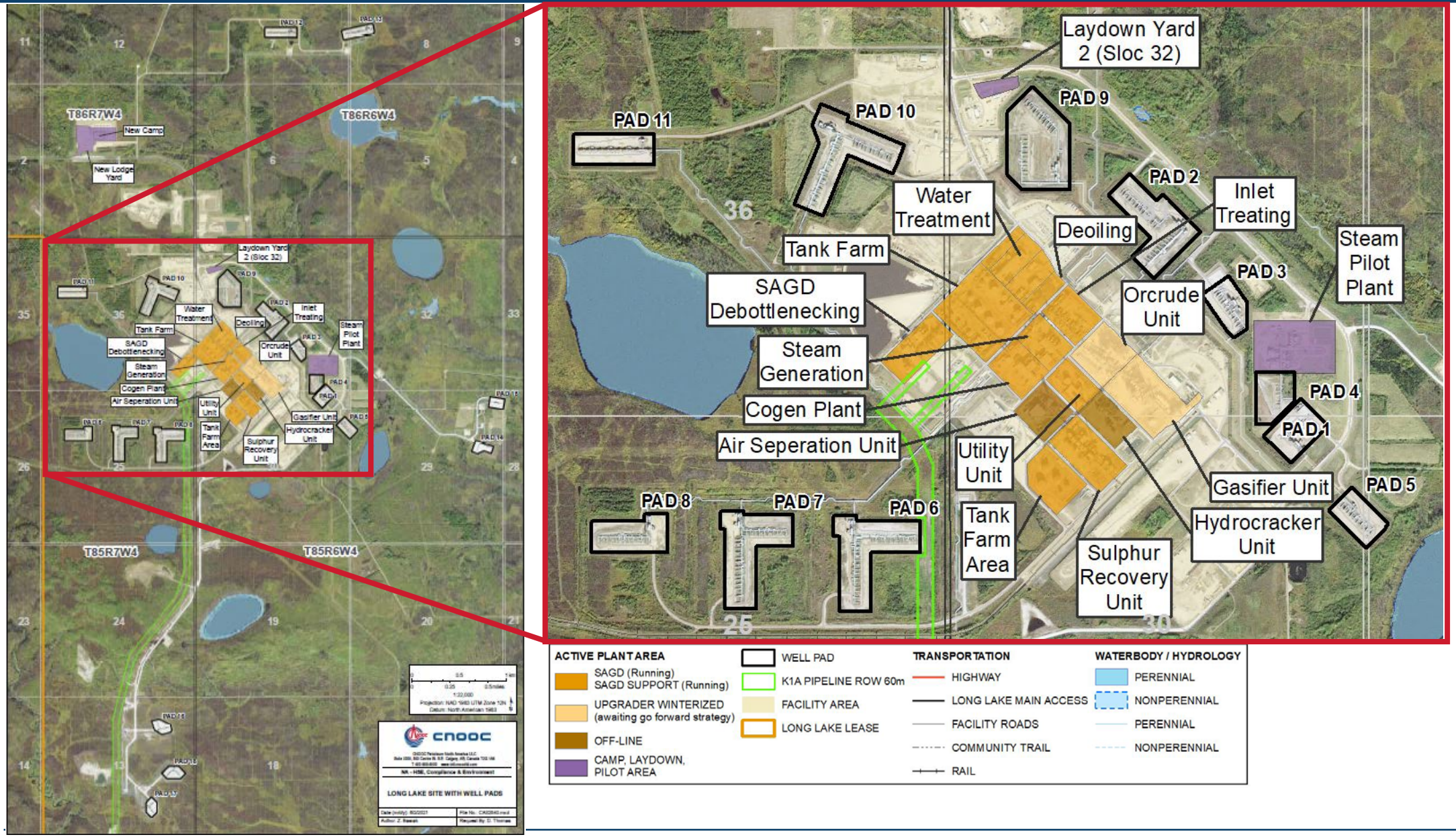


Sections 8 to 12 - Surface

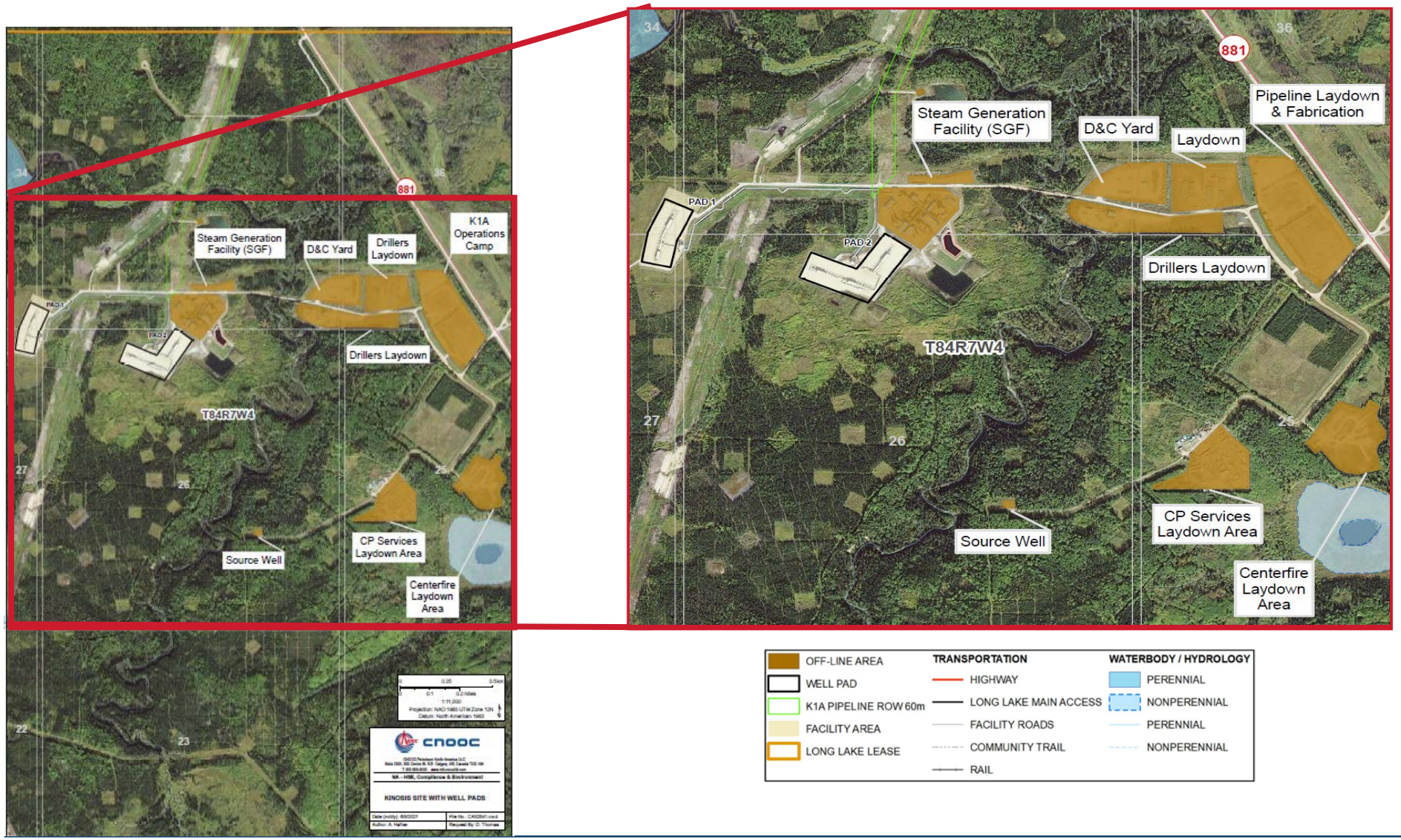
CNOOC

Section 8 – Surface Infrastructure

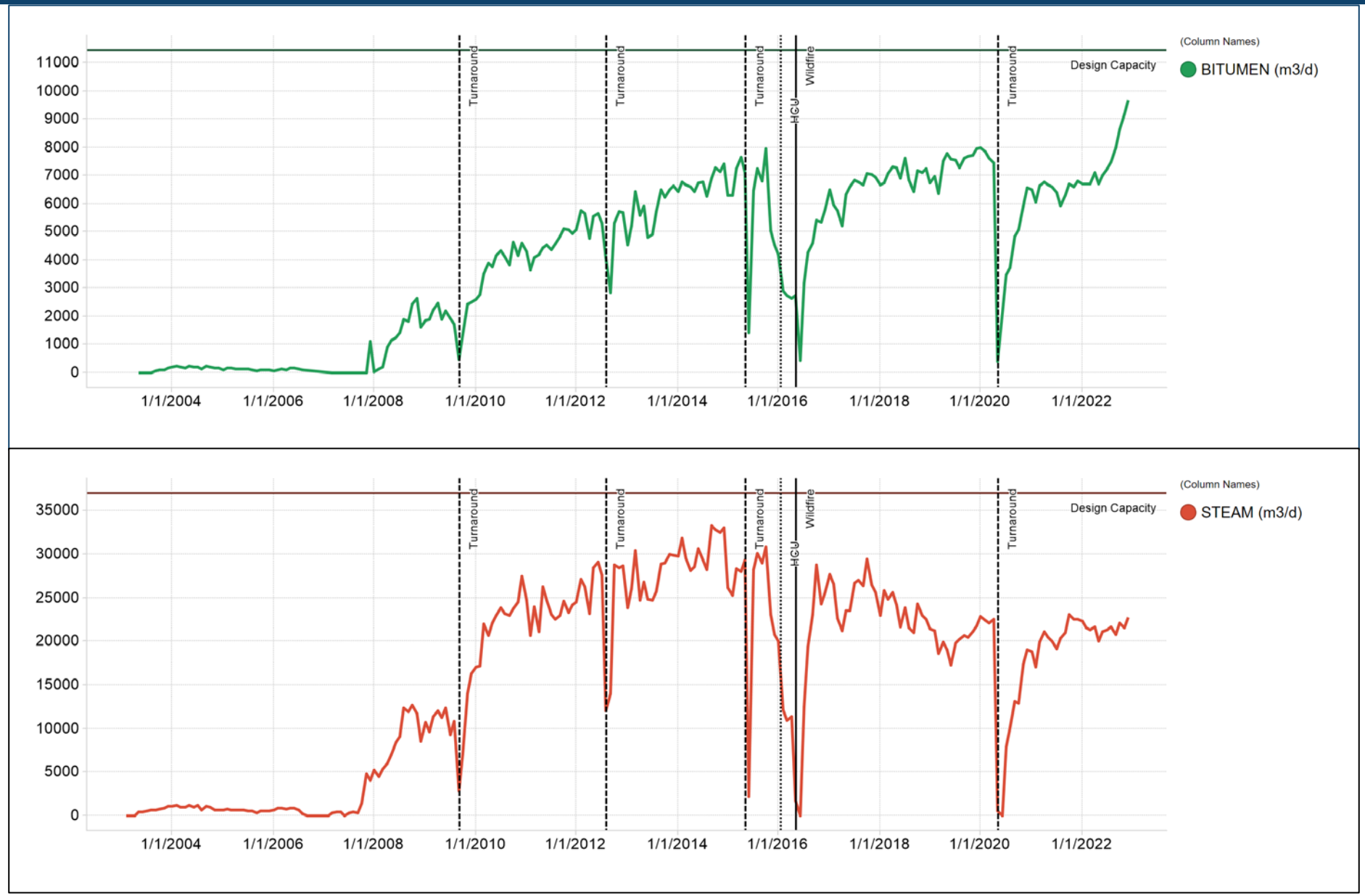
Long Lake Facilities Map



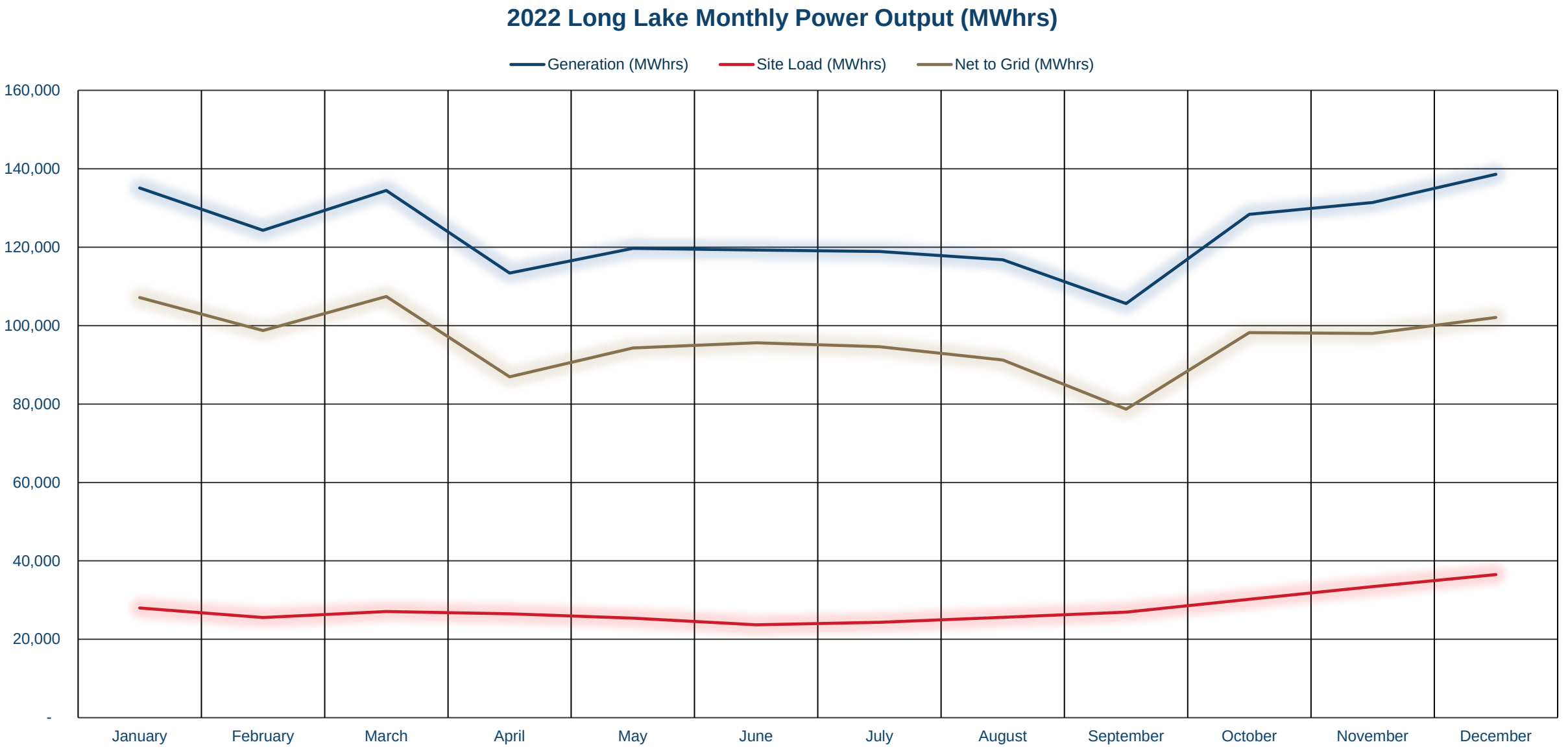
Kinosis Facilities Map



Annual Operational Rates vs Design



2022 Cogen Output



Section 9 – Historical and Upcoming Activities

Suspension and Abandonment Activity

Well Pattern / Drainage Area	Suspensions	Abandonments
N/A	No Activity in 2022	No Activity in 2022

Summary of Recent Regulatory and Operational Changes

- Successes
  - Constructed and commissioned replacement K1A PE and BFW pipelines
  - K1A pipeline operations began Q4 2022
  - Achieved 1st oil at K1A PE line December 23, 2022
  - K1A Steam Generation Facility commissioned and returned to service

- Pilots
  - None

- Major Technical Innovations
  - Drilled longest producer (9P4 redrill) at Long Lake; total depth 1961mMB; 453m longer than any previous well in Long Lake

Upgrader Update

- 2022 Q1: Hazop, design review, equipment cleaning and inspection
- 2022 Q2: cleaning, inspection and construction
- 2022 Q3: same as Q2
- 2022 Q4: started commissioning as system handovers were completed

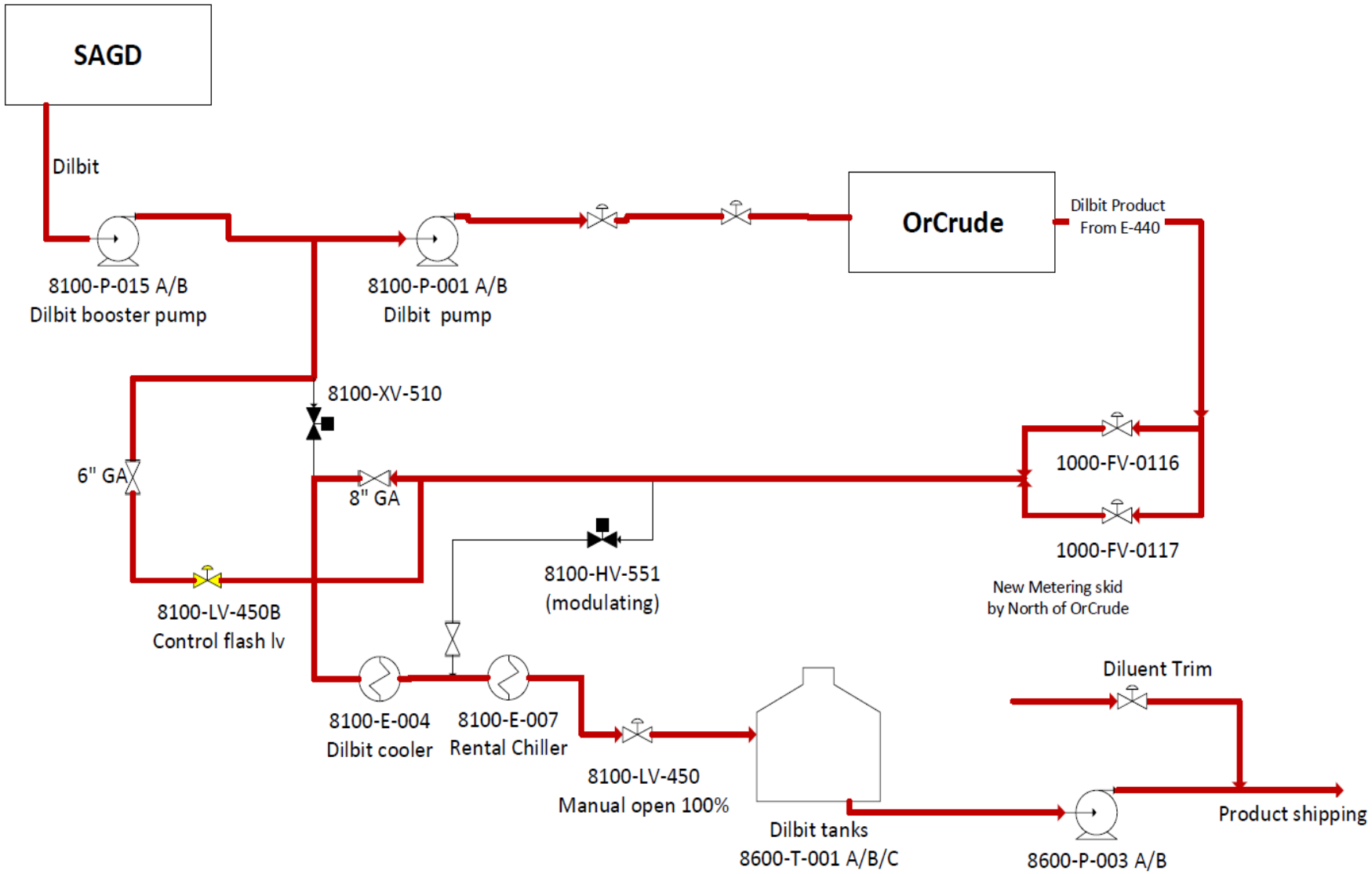
2023

- OrCrude started in March 2023, at low temperature
- SRU was commissioned in June 2023
- OrCrude processing 30K bpd

Challenges and Successes

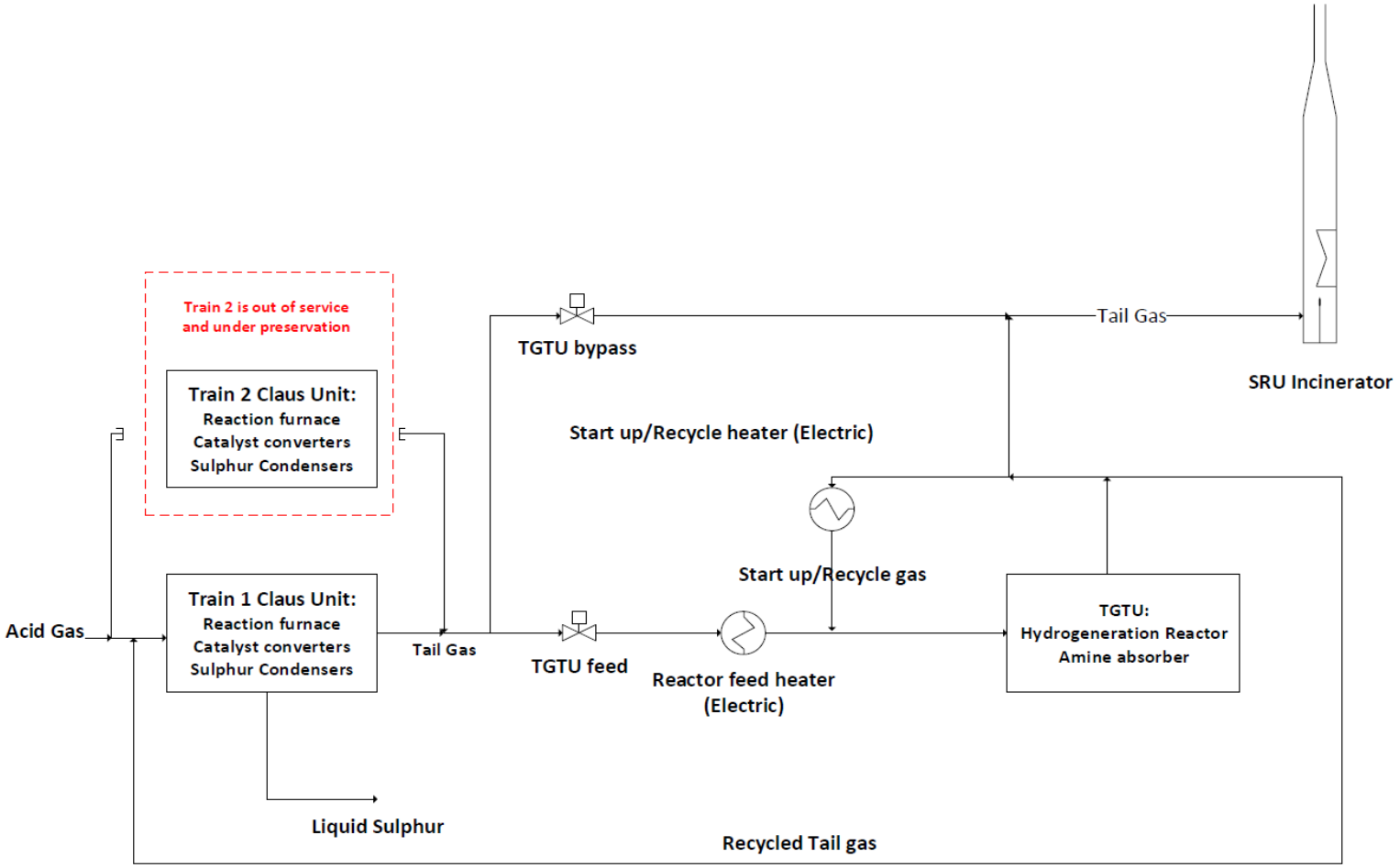
- Commissioned without safety incident
- Diluent reduction
- Reliability issues

Partial Upgrader Restart 2022



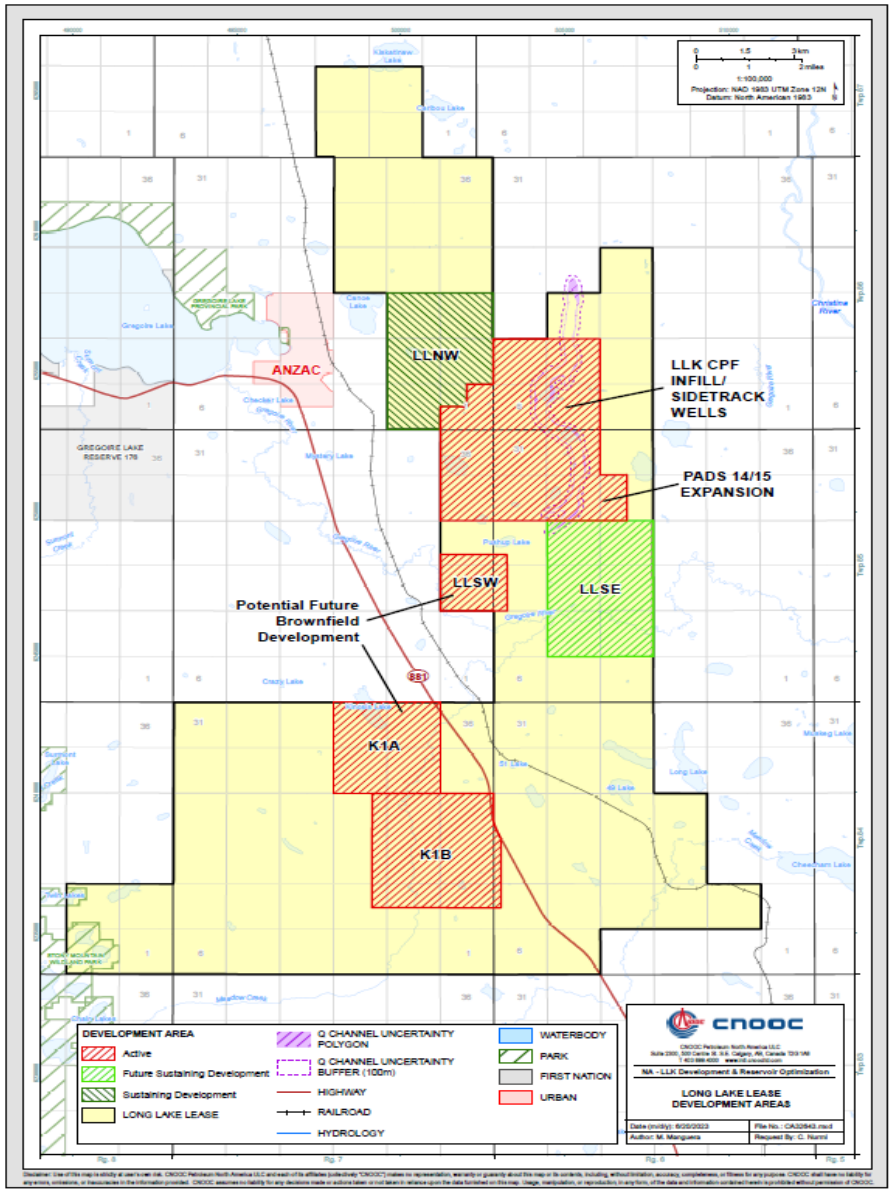
- 8% diluent saving
- Provide additional cooling for dilbit shipping
- Remove BS&W
- Max Bitumen proccesed 40k bpd

SRU Update



- For Partial UPG, due to the extreme low H_2S production from the UPG, the SRU cannot run based on the original design. Sulphur recovery train 2 is shut down, and tail gas is recycled back to Train 1 feed gas in order to meet the minimum turn down condition.
- From original SRU design, Train 1 is designed to treat 310 T/day of Sulphur. With partial UPG configuration, SRU is treating less than 15 T/day of Sulphur.
- With the SRU running in turn-down condition, the unit is able to meet the tail gas emission limit (<0.22 Ton/hr of SO_2)

Planned Development - Next 5 years



Section 10 – Regulatory and Operational Changes

Regulatory Applications/Approvals (Scheme 9485)

Application No.	Registered	Description	Approved
1934199	Sept 2, 2021	LLNW (Pad 19) Addition Expansion of DA & PA Cat III	Aug 16, 2022
1934799	Nov 3, 2021	Partial Upgrader Restart (reinstate reporting requirements)	April 13, 2022
1935317	Dec 16, 2021	LLSW FUSE Start-Up Pads 16, 17, 18 Cat II	Withdrawn
1935541	Jan 18, 2022	Pad 7 NCG Increase Cat II	Feb 17, 2022
1935672	Jan 31, 2022	K1A Re-start MOP Request Cat II	April 26, 2022
1935867	Feb 16, 2022	2022 Sidetracks Phase 1 Cat I	Feb 23,2022
1936049	Mar 8, 2022	Pads14 and 15 Expansion Well Pairs - Tapered MOP Cat II	July 29, 2022
1936292	Mar 30, 2022	Sidetracks Phase 2 Cat I	Apr 20, 2022
1938469	Jun 24, 2022	Sidetrack Pad 15 Pair 03 Cat I	Jun 27, 2022

Regulatory Applications/Approvals Continued

Application No.	Registered	Description	Approved
1938888	Aug 2, 2022	Administrative proceeding – correction of error in scheme clause 23	Aug 11, 2022
1939343	Sept 16, 2022	Directive 017 variance	Withdrawn
1939532	Oct 4, 2022	NCG Field-Wide Cat II	Oct 18, 2022
1940961	Nov 9, 2022	GMP OSCA/EPEA Cat II	Withdrawn
1941467	Dec 16, 2022	Sidetracks and Multilateral 2023 CatI	Jan 18, 2023

Summary of 2022 Events Material to Performance

- Construction and commissioning completed for K1A pipelines
- K1A pipeline (PE & BFW) operations began Q4 2022
- K1A Steam Generation Facility commissioned and returned to service
  - First oil achieved Dec 23rd
- 19 redrills completed
- LLSW production ramp-up (Pads 16, 17, 18)

Section 11 – Compliance History

Reportable Incidents Summary

Incident Type	Reference #	Date	Approval/ Directive	Description	Corrective Actions/Follow-up
Regulatory Notification	Reference # 2145849	April 13, 2022	License # 0433948	Surface casing corrosion observed on 13S07 well	• Near surface excavation/inspection/evaluation/coating of intermediate casing • Replacement of damaged surface casing section • Inspection of weld on surface casing by QA / QC team • Coating of surface casing to reduce rate of future corrosion • Back-fill of excavation around the well
Regulatory Notification	EDGE #0401763 Incident 20221689	July 22, 2022	Pipeline Rules	While excavating an area on a pipeline right of way the bucket of the excavator came in contact with a 6" low pressure steam condensate line. There were no releases. Damage to the line consisted of scratches and a small dent without any punctures.	• Held AER review meeting to discuss findings and corrective actions. • Ground Disturbance re-training, learnings, Focus Audit and utilize on a bi-weekly basis • Personnel involved with Ground Disturbance activities re-reviewed all applicable documents
Regulatory Notification	N/A	Aug 25, 2022	EPEA Approval # 137467	CPNA notified the AER that on July 27, 2022, Trigger 1 was confirmed in the Heat Source Well on Pad 13.	CPNA will adhere to the requirements of the Assessment of Thermally-Mobilized Constituents in Groundwater for Thermal In Situ Operations Directive and has been instructed by the AER to include an update in the annual Groundwater EPEA Groundwater Monitoring Report.
Regulatory Notification	Incident # 2167070	Sept 1, 2022	Lic # 468781	A casing failure was reported to the AER for well 10P14 (14-25-085-07W4, Lic #468781), which was identified on August 28 when debris (from corrosion) was initially discovered around the wellhead. Repairs required to be completed within 90 days of detection	The repair was completed on September 14, 2022 and a DDS AER Casing Failure closure submission was made on September 27, 2022.
Regulatory Notification	N/A	Dec 8, 2022	Disposal Approval No. 10023K	Data loss notification – 102/01-21-085-06W4/00. On November 8, it was confirmed that data had been missing from 102/02-21 monitoring well since October 19, 2022. On December 8, 2022, CPNA notified the AER of data loss at the 102/01-21-085-06W4/00 monitoring well.	Troubleshooting in the field identified a battery failure and the situation was resolved on November 16, 2022. CPNA affirms there is no risk to the McMurray basal aquifer resulting form this data loss, as there is currently no disposal activity at this location.

Voluntary Self Disclosures Summary

Incident Type	Reference #	Date	Approval/ Directive	Description	Corrective Actions/Follow-up
Regulatory or Permit Violation	VSD 11532	December 16, 2022	Directive 017	Voluntary Self-Disclosure (VSD) to AER for diluent trucking measurement not meeting D017 requirements	CPNA completed and submitted the VSD proposed actions by the deadline, and the submissions were accepted by the AER.

- On December 16, 2022, CPNA submitted a Voluntary Self-Disclosure (VSD) to the AER for truck transfers related to diluent well loading at the K1A facility
- To support the ability to inject corrosion inhibitor into the SAGD production wells at the K1A facility, 386.5 m^3 of diluent was trucked from the storage tanks at the Upgrader to mixing tanks at K1A. It was subsequently discovered through the internal enhanced production audit program (EPAP) process that the relevant truck transfers of diluent were not performed in compliance with *Directive 017: Measurement Requirements for Oil and Gas Operations*

Corrective Actions

- EPAP Procedural Aids have been updated to ensure adequate truck measurement, and the EPAP Control Matrix has been reviewed to ensure required roles and responsibilities are assigned to relevant Control Performers.
- Focused training was provided, as required, to the parties involved in truck and other product movements at the Long Lake and K1A facilities.

Contraventions

Incident Type	Reference #	Date	Approval/ Directive	Description	Corrective Actions/Follow-up
Regulatory or Permit Violation	Application #s 4459579, 4459525, 4459536, 4459537, and 4459504	Aug 24, 2022	OGCA Section(16)	AER Notice of Non-compliance for expired crown mineral rights for inactive water wells (5)	Submission made to the regulator on September 23, 2022.
Regulatory or Permit Violation	Inspection ID: 523593	Sep 19, 2022	Pipeline Rules	AER Unsatisfactory (High Risk) Inspection - Non-compliances (2) with Pipeline Rules following pipeline strike	Submission made to the regulator on October 6, 2022.

Section 12 – Future Plans

Future Plans

2023 Planned Activity:

- Continue LLSW production ramp-up (Pads 16, 17, 18)
- Continue K1A start-up and production ramp-up
- Continue redrill/brownfield program
- LLNW (Pad 19):
  - Initiate field construction activities beginning with piling works in Q4
  - Complete surface development / civil activities
  - Complete drilling of the development wells (8 wells) and start well completions activities
- Complete execution of Pad 14/15 expansion wellpairs project; first steam in 2023
- Upgrader completed equipment cleaning, inspection and repair; OrCrude and SRU transitioned to start-up and commissioning

Future applications to be submitted:

- Field-Wide Brownfield Drilling
- Steam Strategy Pad 11 & Vicinity

THANK YOU