Lindbergh SAGD PROJECT
2020 ANNUAL PERFORMANCE PRESENTATION
Scheme Approval 6410W

2021 06 30

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Introduction

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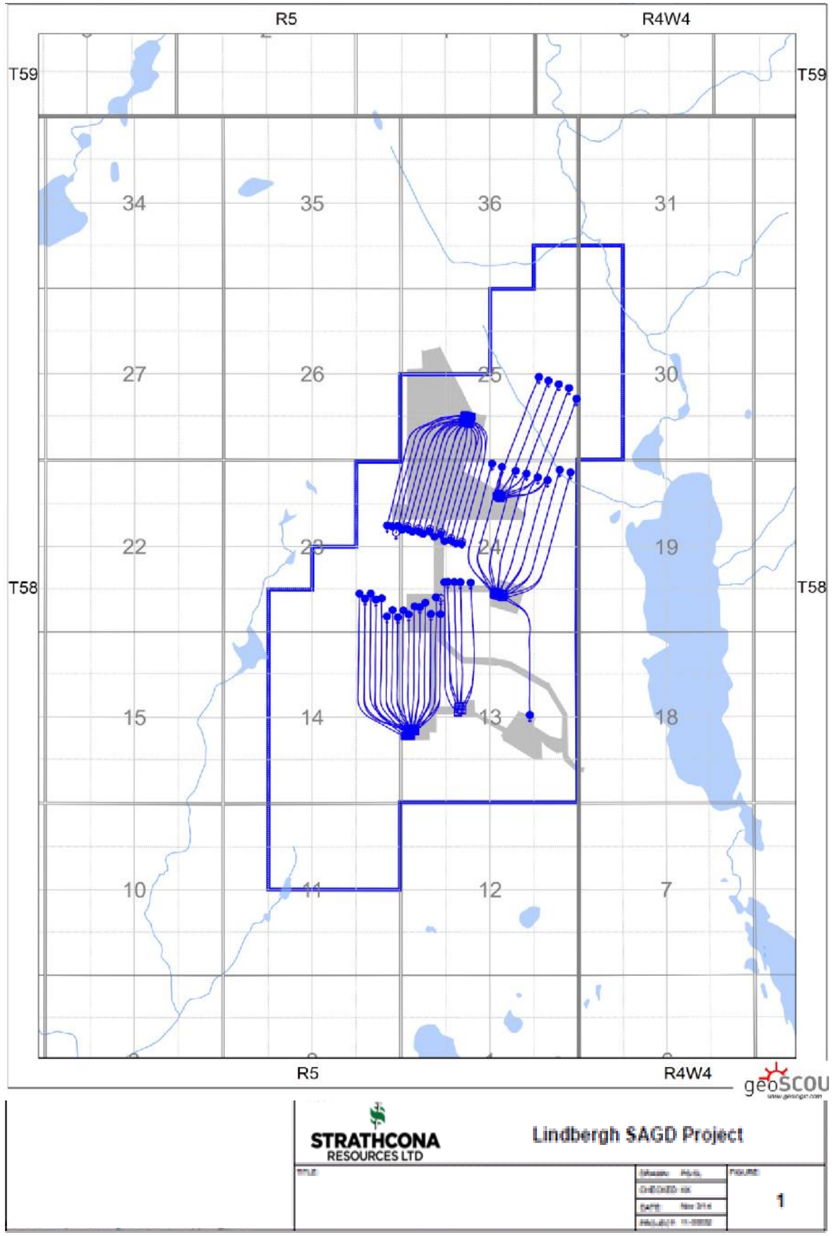
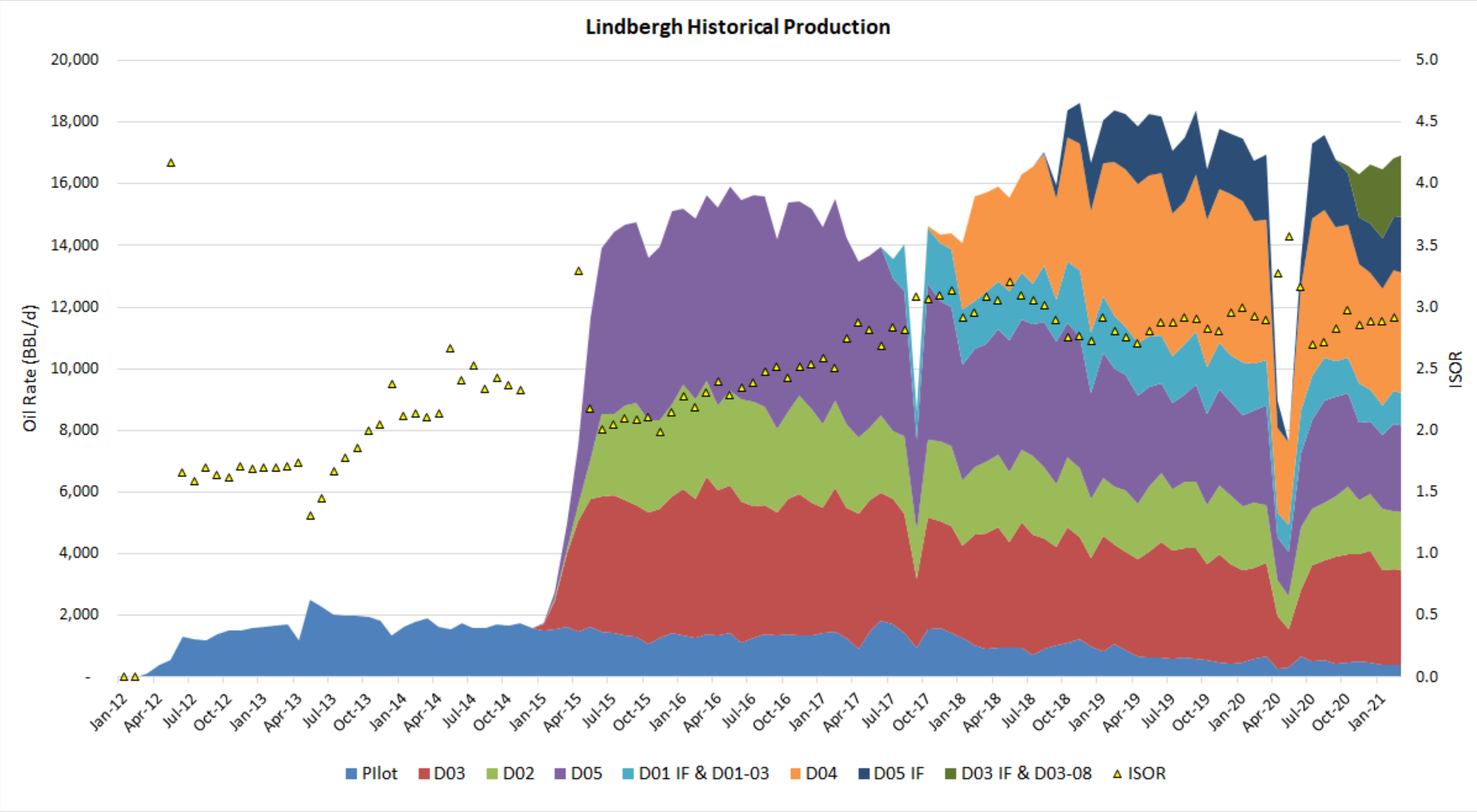
Project Location



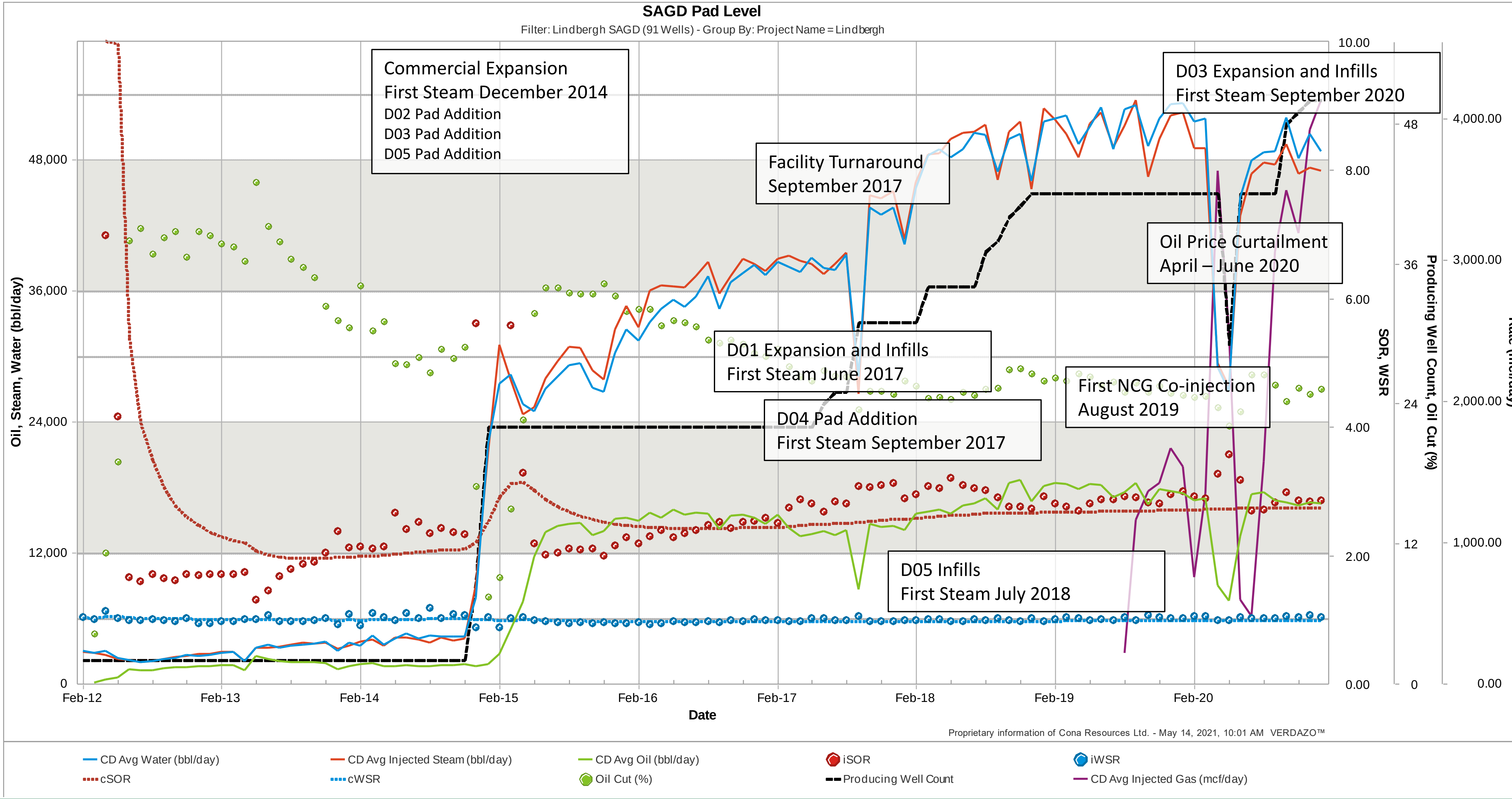
Lindbergh History

- **1972-1998**: Murphy Oil piloted and commercialized CSS production in the Lloyd & Rex
- **2004**: Pengrowth acquired the Lindbergh lease, all CSS wells abd
- **2012**: Lindbergh Thermal SAGD Pilot Project started with two wells drilled and produced 900 bb/d each ("Pilot")
- **2014/2015**:
  - –CPF constructed to 12,500 BBL/d capacity at SOR 3.61
  - –Phase 1 Commercial on production with Pads D02, D03 & D05 (20 WP)
- **2017**: Pilot infills & D01-03 and Pad D04 on prod (2 infills & 10 WP)
- **2018**: D05 Infills on production (10 infills)
- **Jan 2020**: Cona acquisition
- **Sept 2020**: D03 infills (x7) & 1 WP (D03-08) began steam circulation
- Currently facility is processing in excess of design capacity at 17,500 BBL/d, SOR 2.77

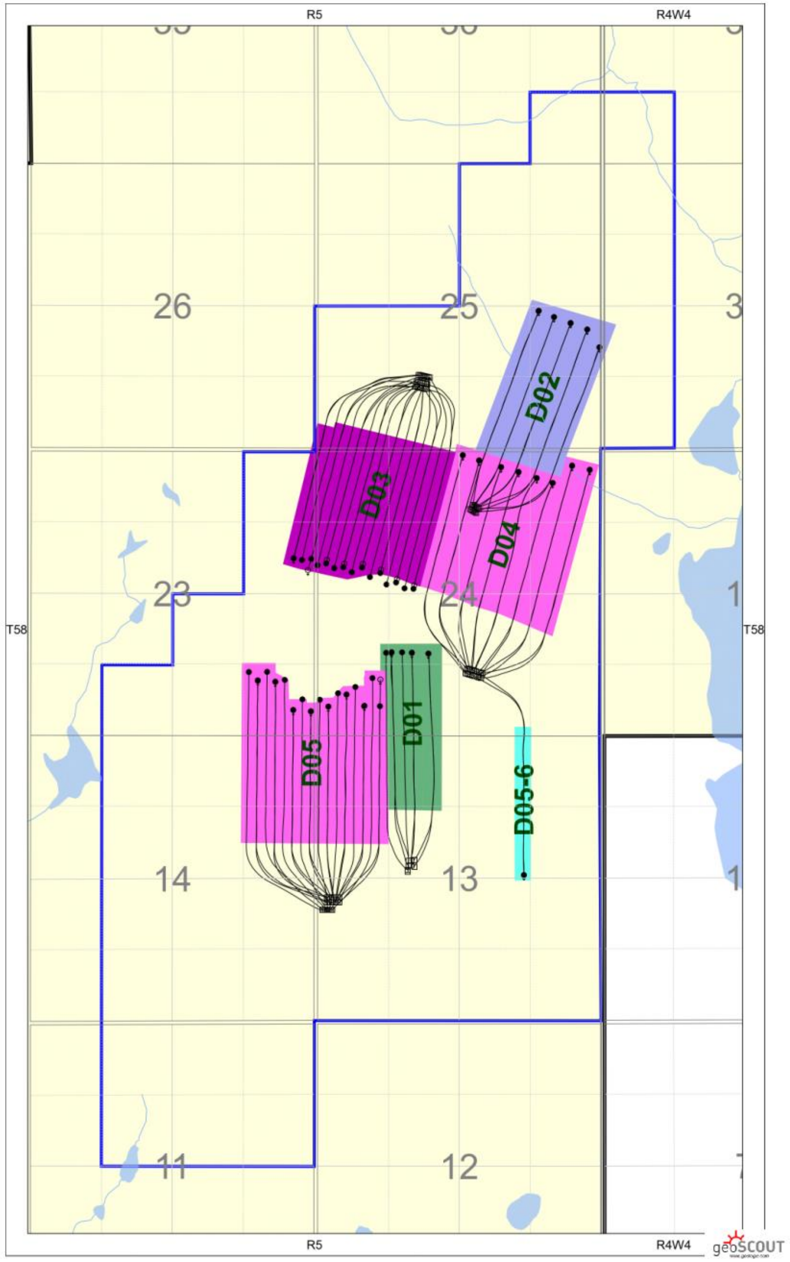


Subsurface

Lindbergh Performance



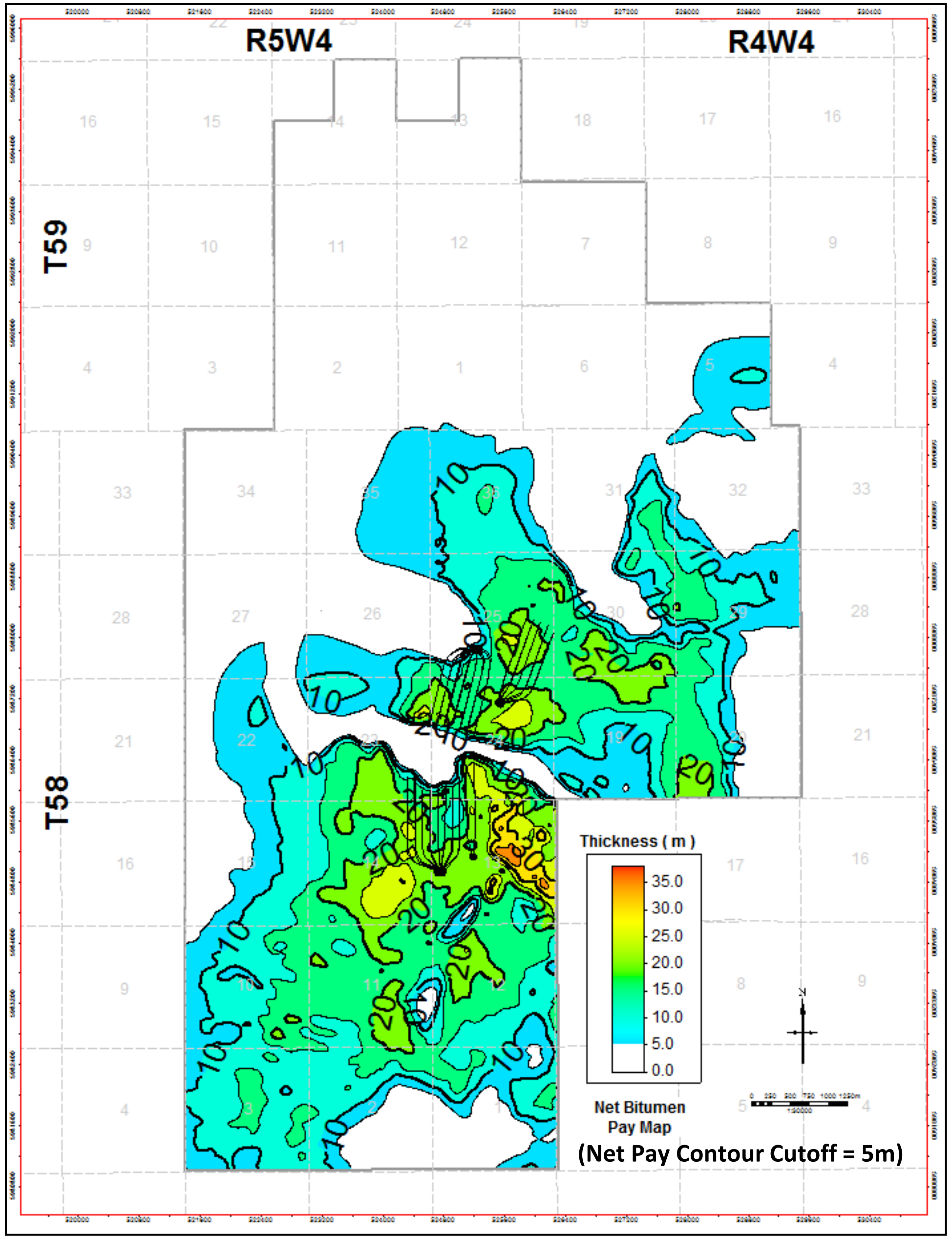
Lindbergh Pads and Drainage Areas



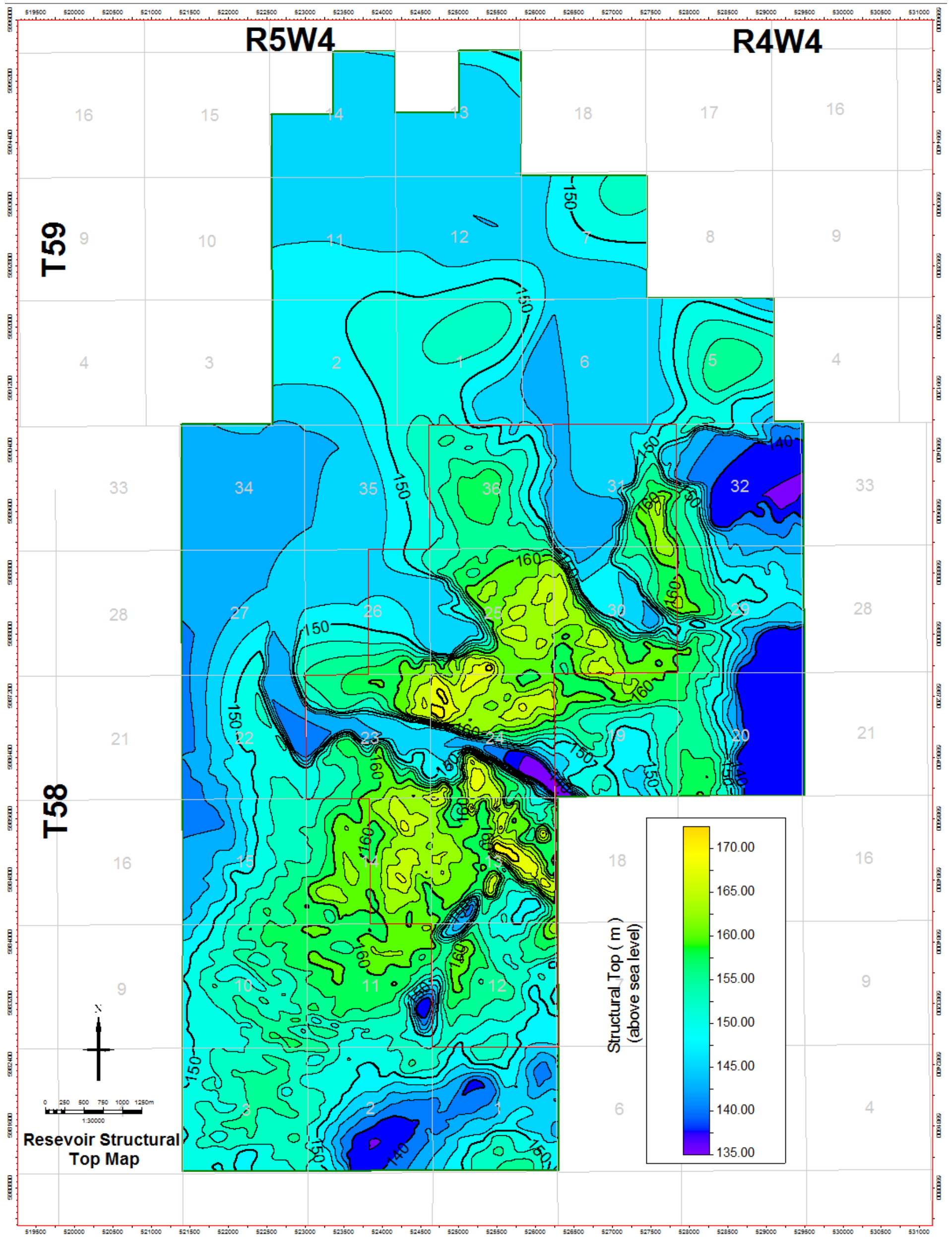
Approved Development Area

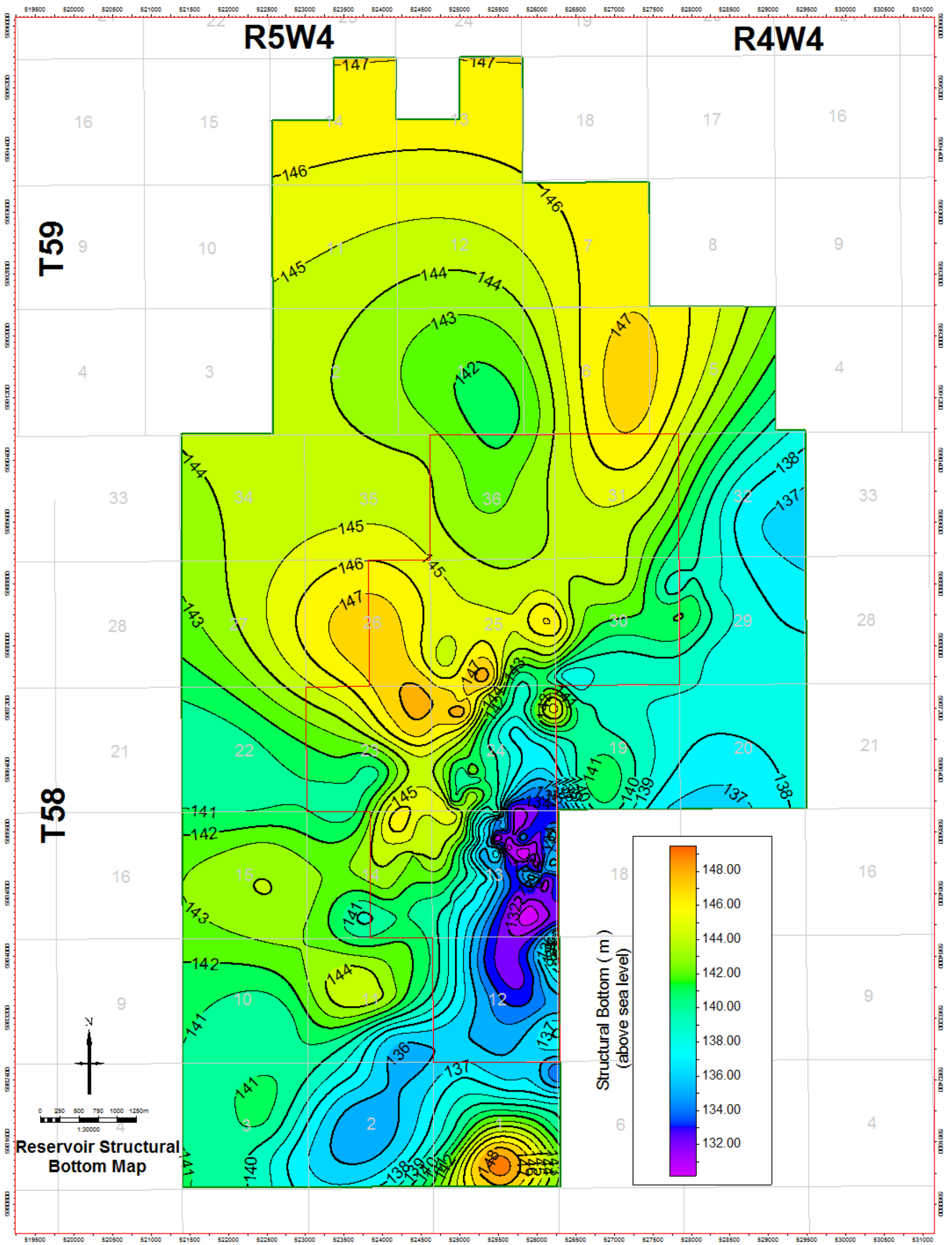
SAGD/Infill Wells

Net Bitumen Pay

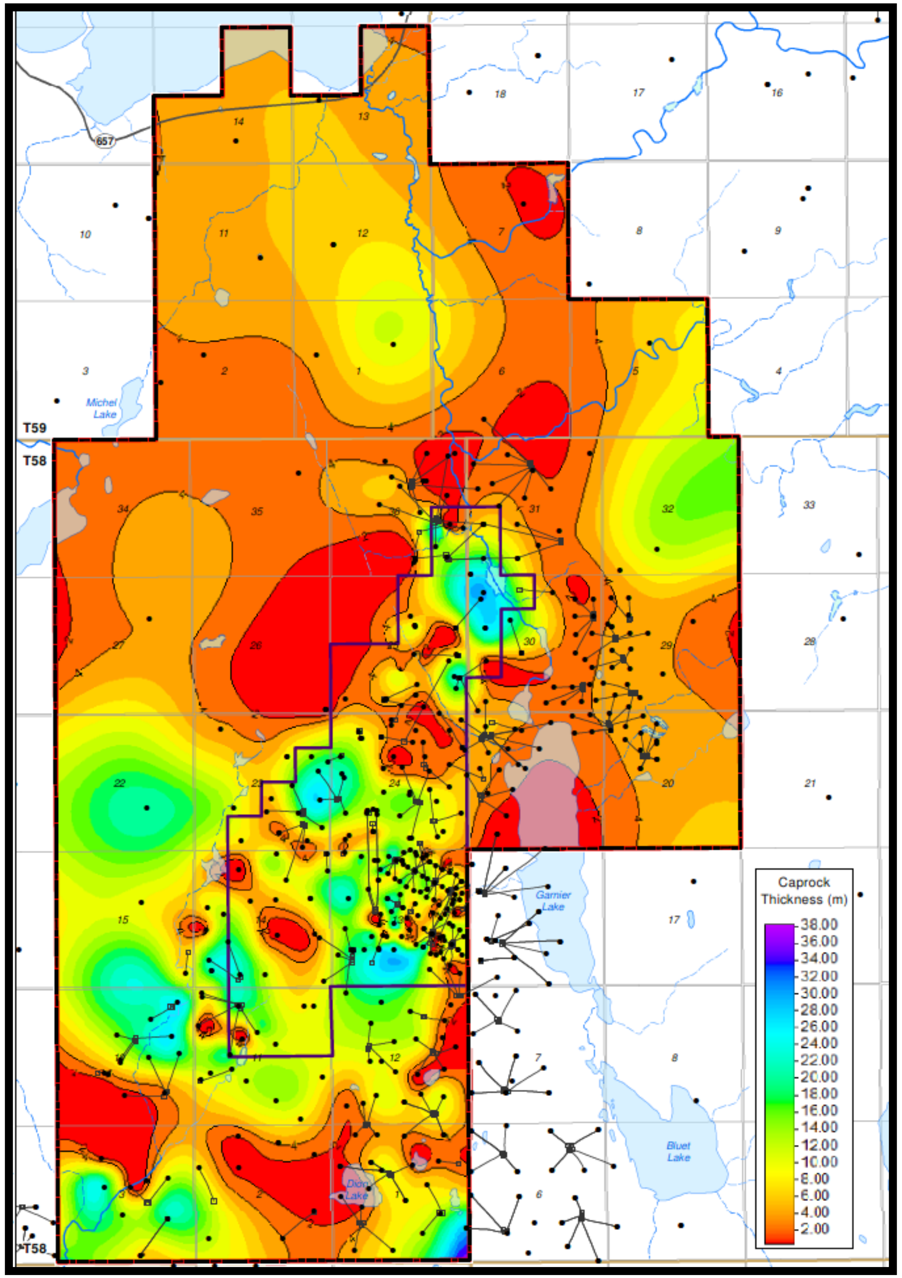


Structural Top and Bottom of Bitumen Reservoir



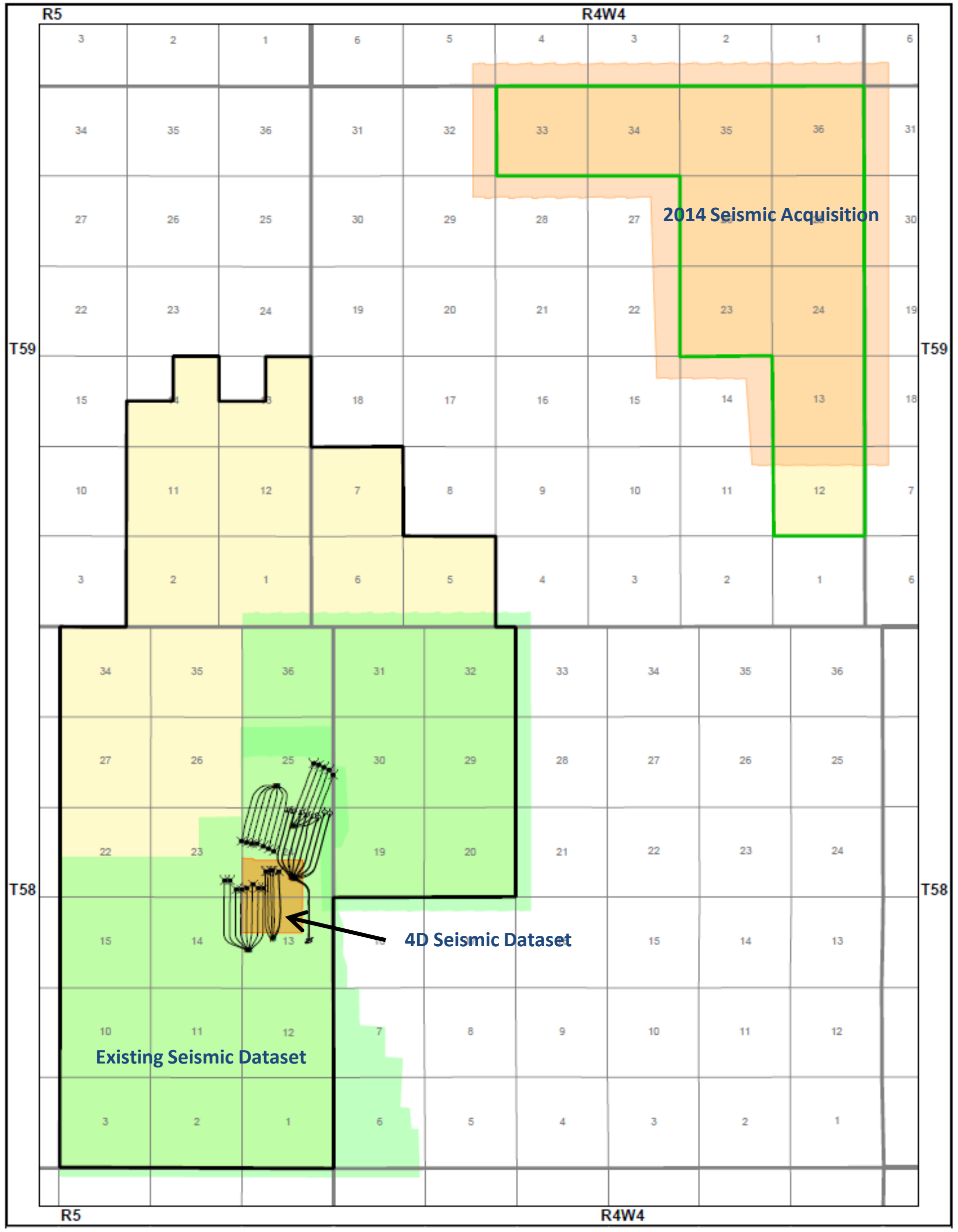


Caprock Thickness Map



Lindbergh Seismic

- 102 sq km of 3D data exist over most of the Lindbergh and Muriel Lake leases with exploitable resource
- 1.32 sq km 4D Seismic over D01 wellpad:
  - ○ Baseline acquired Feb 2012
  - ○ First monitor acquired Dec 2013
  - ○ Second monitor acquired Dec 2016
- No new seismic acquired in 2020



Representative Composite Well Log

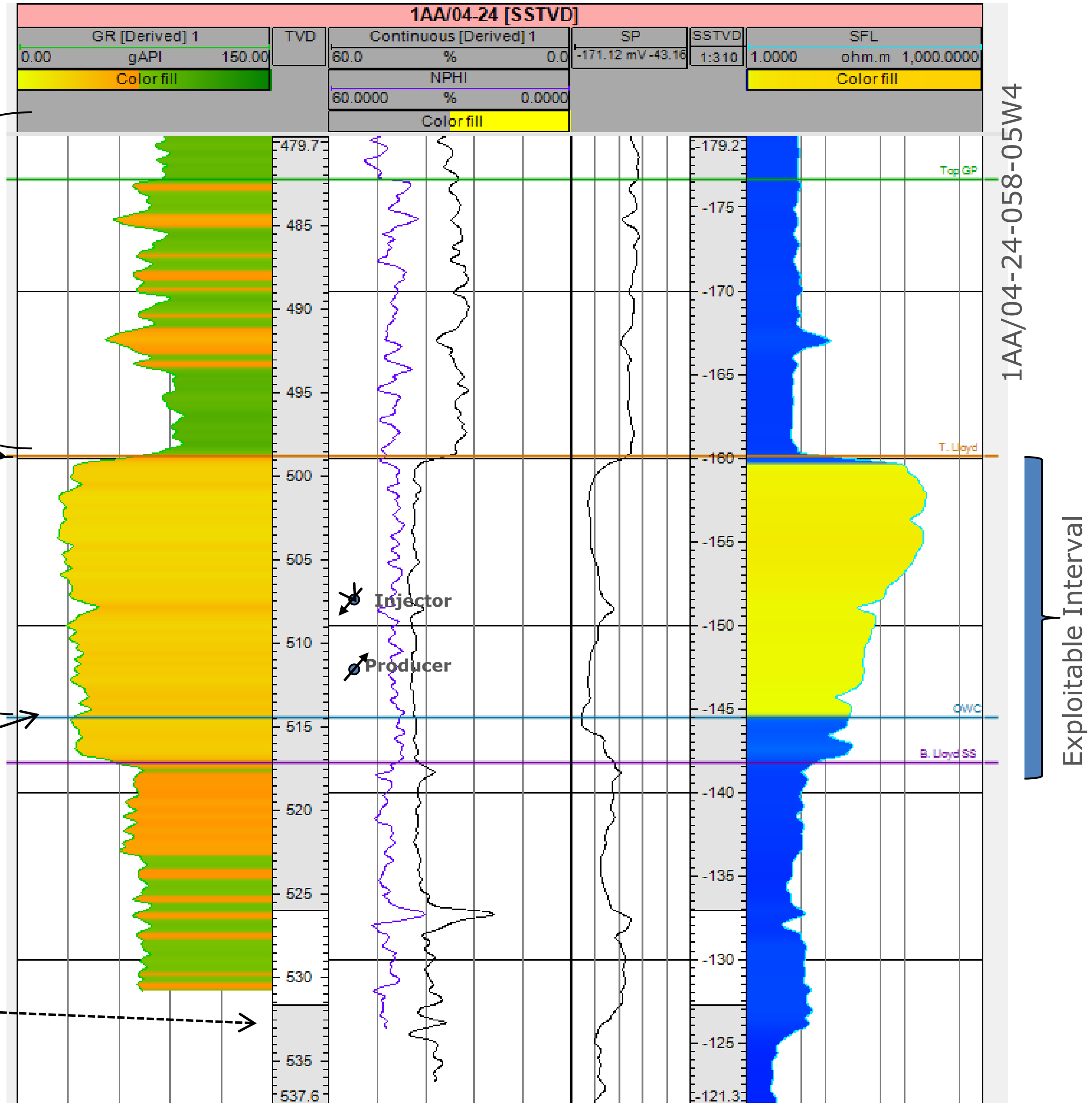
Average Pay Thickness = 20m
Average Producer to Injector Spacing = 5 m
Average O/W to Producer Distance = 3 m

Cap Rock

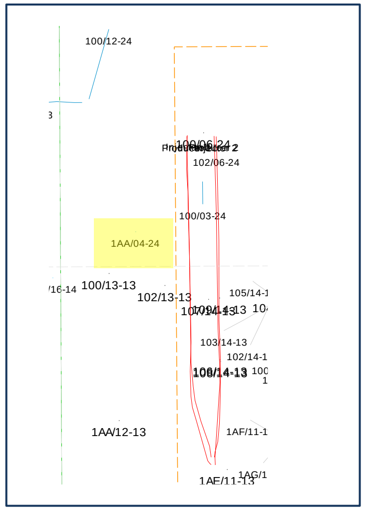
Top Lloydminster Fm Reservoir

Oil/Water Contact Defined at 10 Ωm

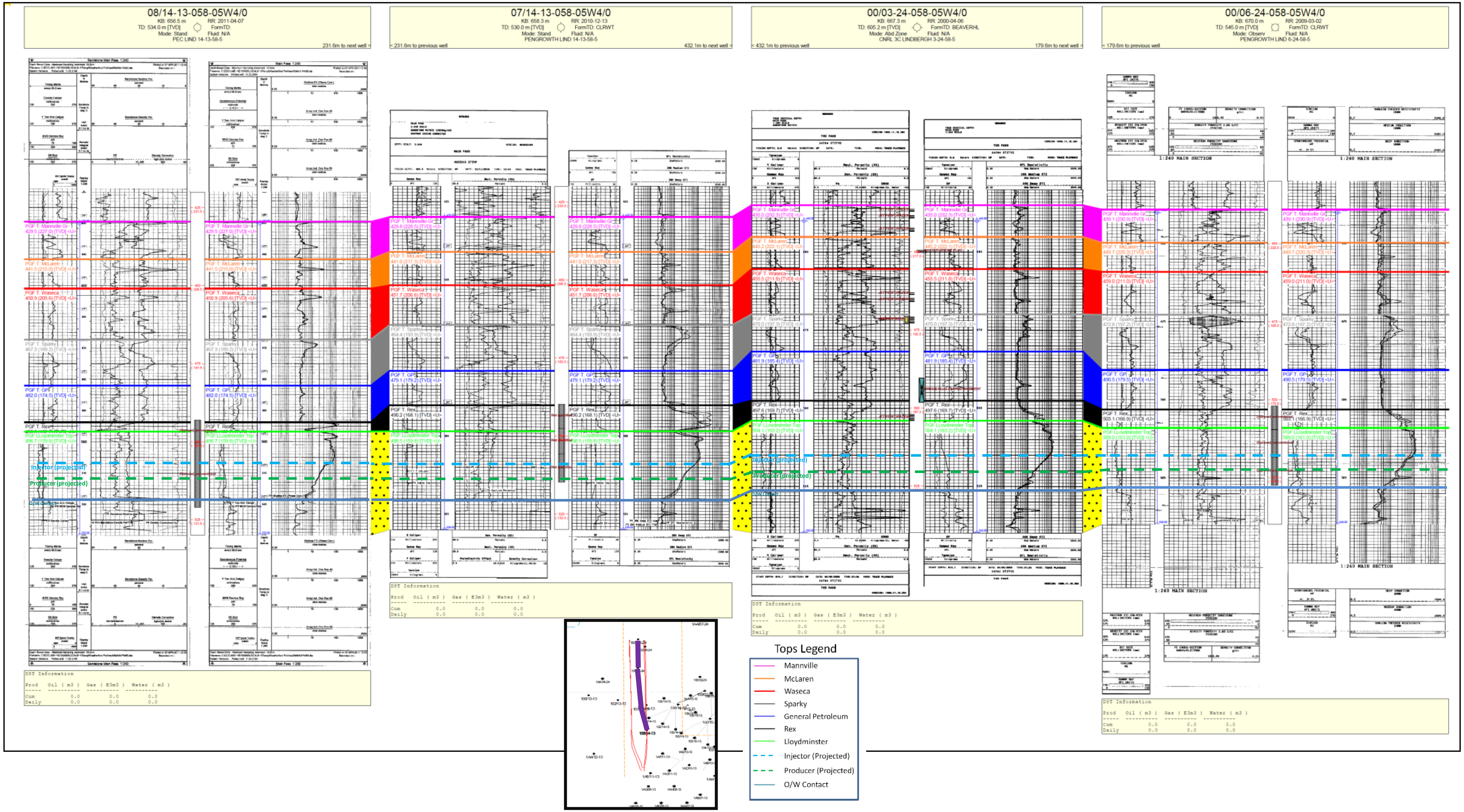
Estimated Top Cummings Fm



Well Location Map



Representative Cross Section Through Project Area



OBIP and Average Reservoir Properties

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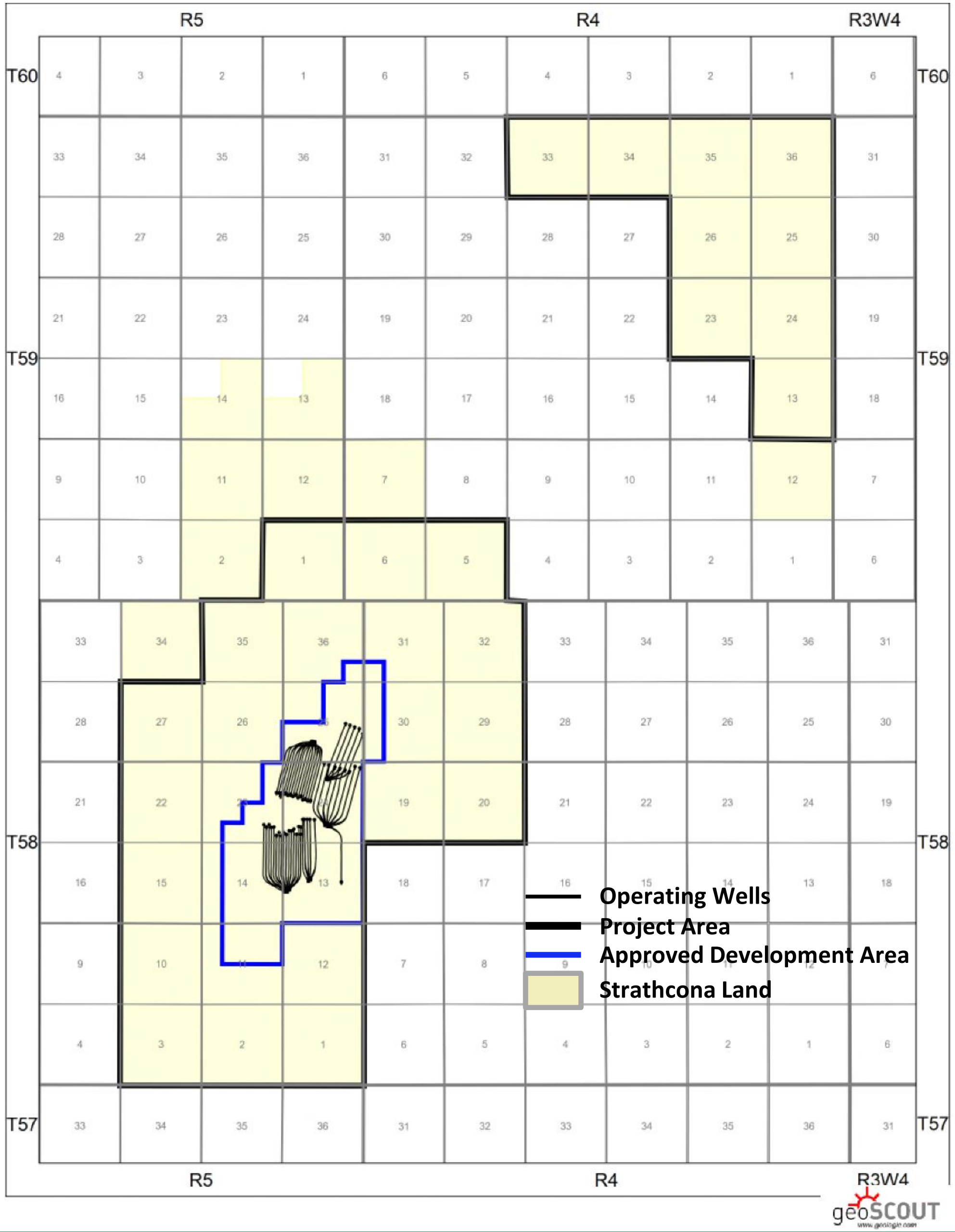

Area	Drainage Size	Operating Wells	Total OBIP[1,2]
	10^3m^2	#	10^6m^3
Approved Development Area	**10855**	**82**	**53.2**
Project Area	**46291**	**82**	**182.4**

SAGD Reservoir Properties		
Depth	metres	500
Pay Thickness	metres	22
Average Porosity	%	35
Average Oil Saturation	%	72
Average Bitumen Weight	%	12
Horizontal Permeability	Darcies	2 to 6
Kv:Kh	X	0.86
Temperature	°C	16
Pressure	MPa	2.9
Oil Gravity	°API	10
Viscosity at 20°C	cP	300,000

(1) As of December, 2020
(2) OBIP = Area x Net Pay Thickness x Porosity x Oil Saturation

Pad Recoveries

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Original Bitumen In Place (OBIP) - Recovery and % recovery by pad

	Active WP	Thickness	Length†	Spacing	Area	Ave ϕ	Ave So	Ave Perm	OBIP	Recovery††	RF%	EURF%
Pad	count	(m)	(m)	(m)	(Ha)			(D)	(e3m3)	(e3m3)		
D01*	3	20.3	828	100	24.8	36%	81%	3.6	1463.1	933.8	63.8%	85%
D02	5	20.0	817	100	40.9	35%	79%	3.2	2247.8	786.7	35.0%	70%
D03*	8	18.1	787	100	63.0	35%	83%	3.3	3294.0	1276.3	38.7%	75%
D04	9	20.8	821	100	73.9	36%	78%	3.4	4294.2	731.3	17.0%	70%
D05*	8	20.2	801	100	64.1	37%	80%	4.0	3812.4	1708.8	44.8%	75%

Developed Bitumen In Place (DBIP) - Recovery and % recovery by pad (above producer level)

	Active WP	Thickness†††	Length†	Spacing	Area	Ave ϕ	Ave So	Ave Perm	DBIP	Recovery††	RF%
Pad	count	(m)	(m)	(m)	(Ha)			(D)	(e3m3)	(e3m3)	
D01*	3	14.8	828	100	24.8	36%	81%	3.6	1066.7	933.8	87.5%
D02	5	16.5	817	100	40.9	35%	79%	3.2	1854.4	786.7	42.4%
D03*	8	14.2	787	100	63.0	35%	83%	3.3	2584.2	1276.3	49.4%
D04	9	14.5	821	100	73.9	36%	78%	3.4	2993.5	731.3	24.4%
D05*	8	16.9	801	100	64.1	37%	80%	4.0	3189.6	1708.8	53.6%

† Length is average slotted length plus 25 meters per end (50 m total)
†† Cumulative production to Dec 31 2020
††† Thickness above the producer level

Definitions:

- OBIP: Area x Ave ϕ x Ave So x Thickness (full net pay)/ 1.005
- DBIP: Area x Ave ϕ x Ave So x Thickness (above producer level) / 1.005
- RF: Recovery Factor to Dec 31, 2020 with respect to OBIP or DBIP
- EURF: Estimated Ultimate Recovery Factor

Co-Injection

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- NCG injection typically initiated with new infill production (infills normally drilled when pad is at ~30 to 35% RF)
- Co-injection only consists of sweet natural gas mixed with steam
- Targets are currently the lesser of 0-10 e3m3/d or 0-3 mol% per well
- Gas concentration target was temporarily exceeded during the turn down in Q2-2020 with no significant adverse impact
- Positive & Negative Impacts:

  + Pad steam reductions of up to 15-20% (deployed to new well pairs)

  + iSOR reduction in the range of 0.5 unit

  + Per barrel operating costs reduced given lower steam requirements

  + Effective pressure maintenance during the ramp down in Q2-2020

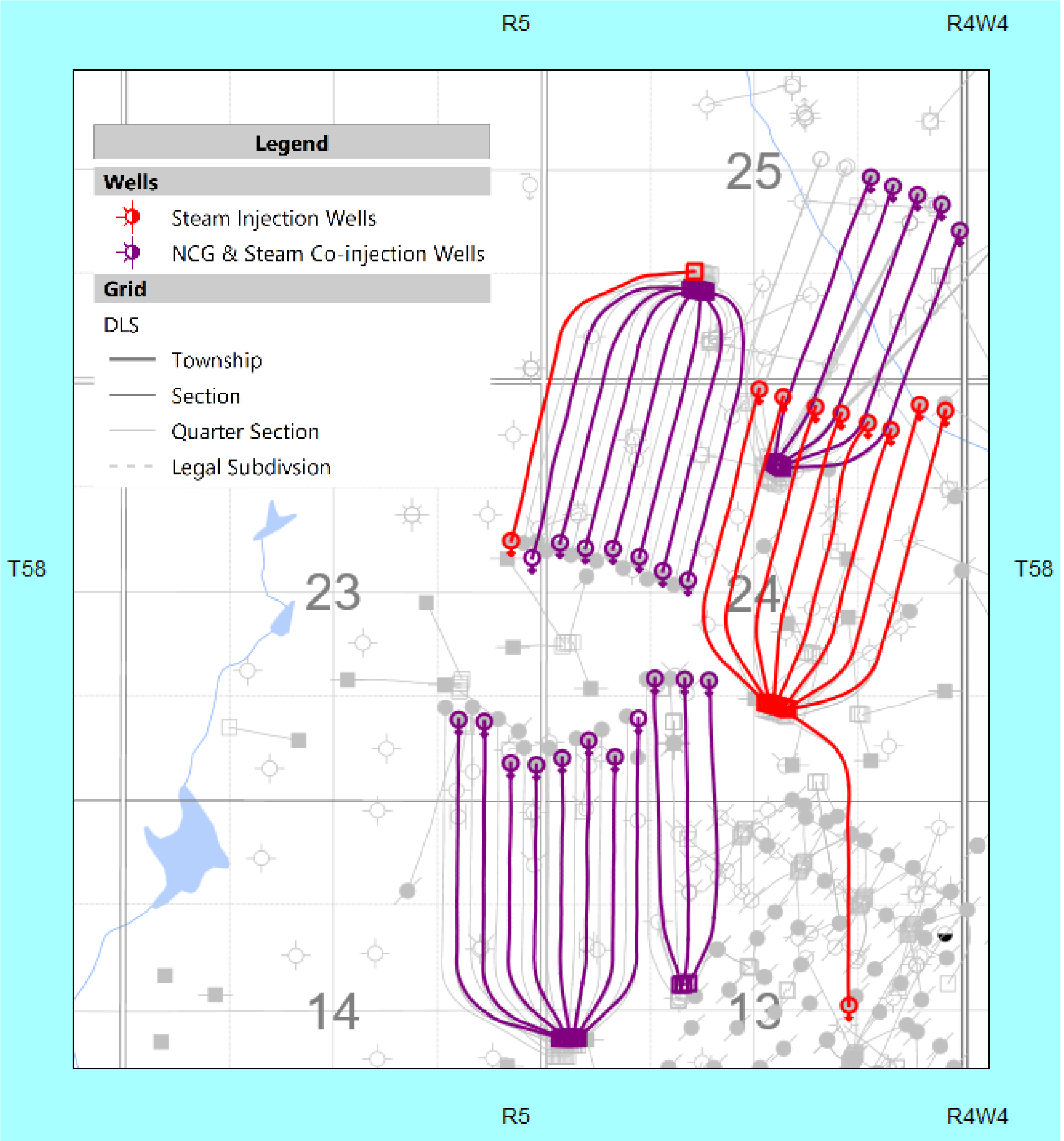
  + No negative impact on recovery factor is observed or expected

  + No wellbore integrity issues has been experienced

  + No interaction with bottom water is detected

  – Significantly increased produced gas volumes

  – Lower heating factor of produced gas decreases boiler efficiency



Surface

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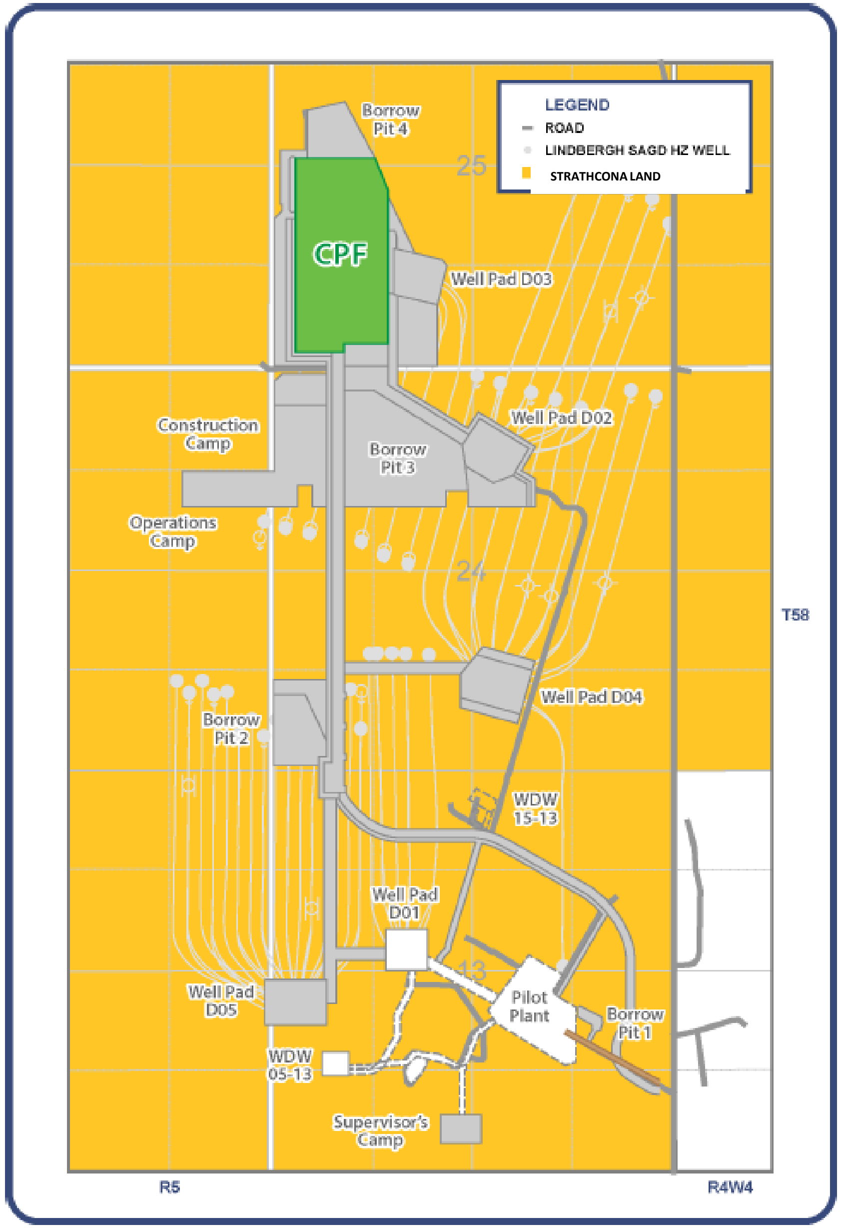
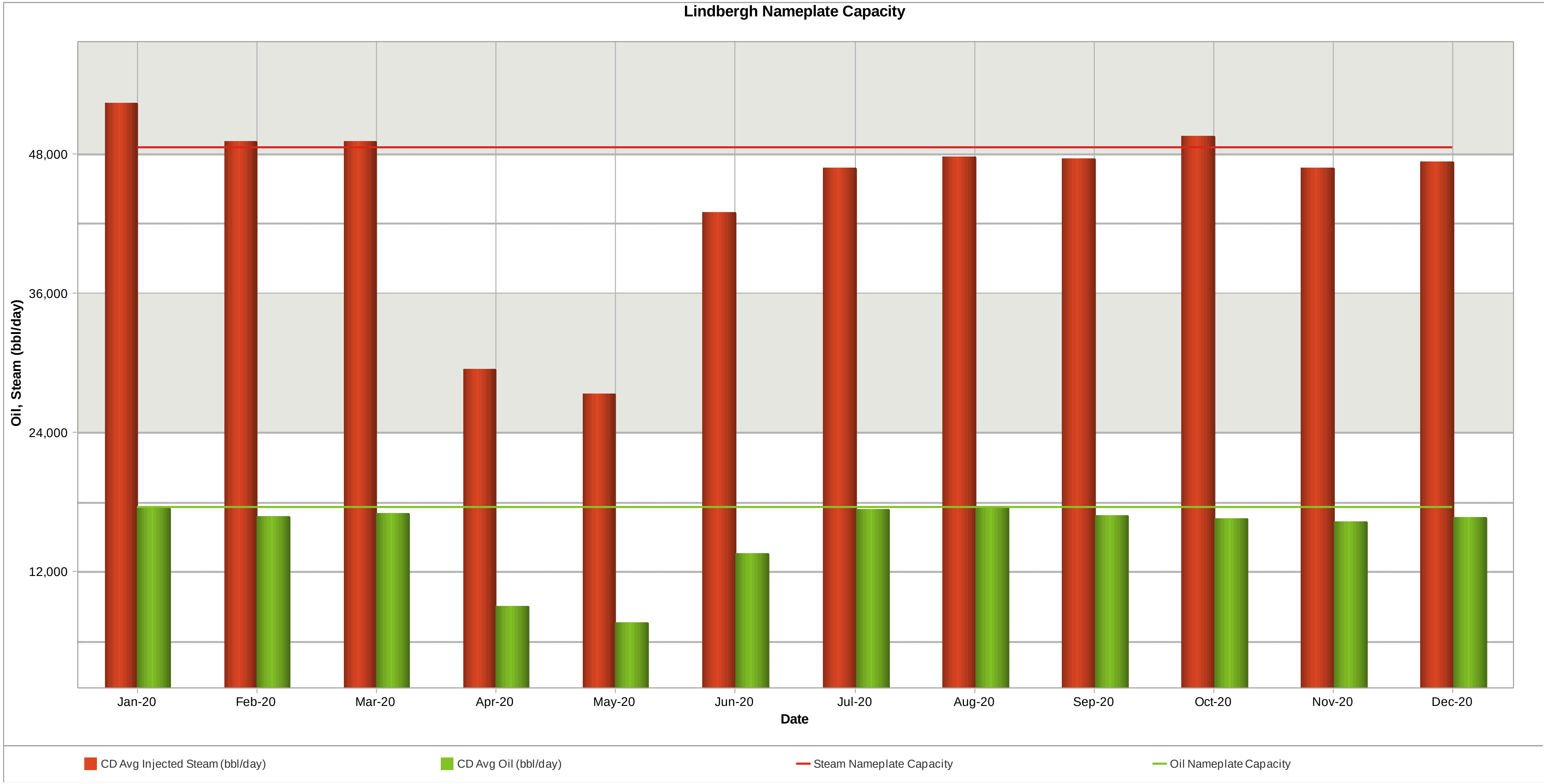
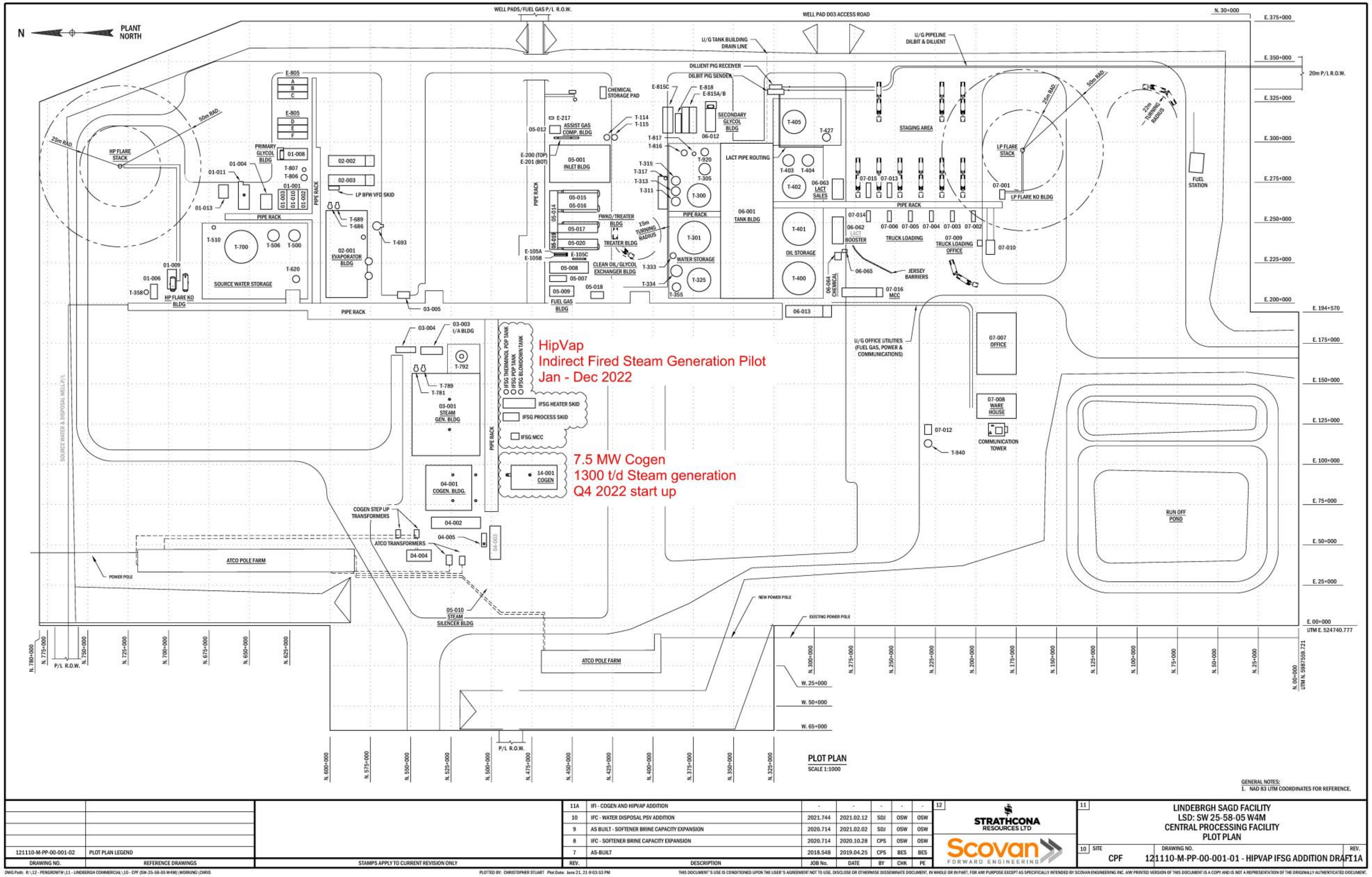
Lindbergh Surface Infrastructure



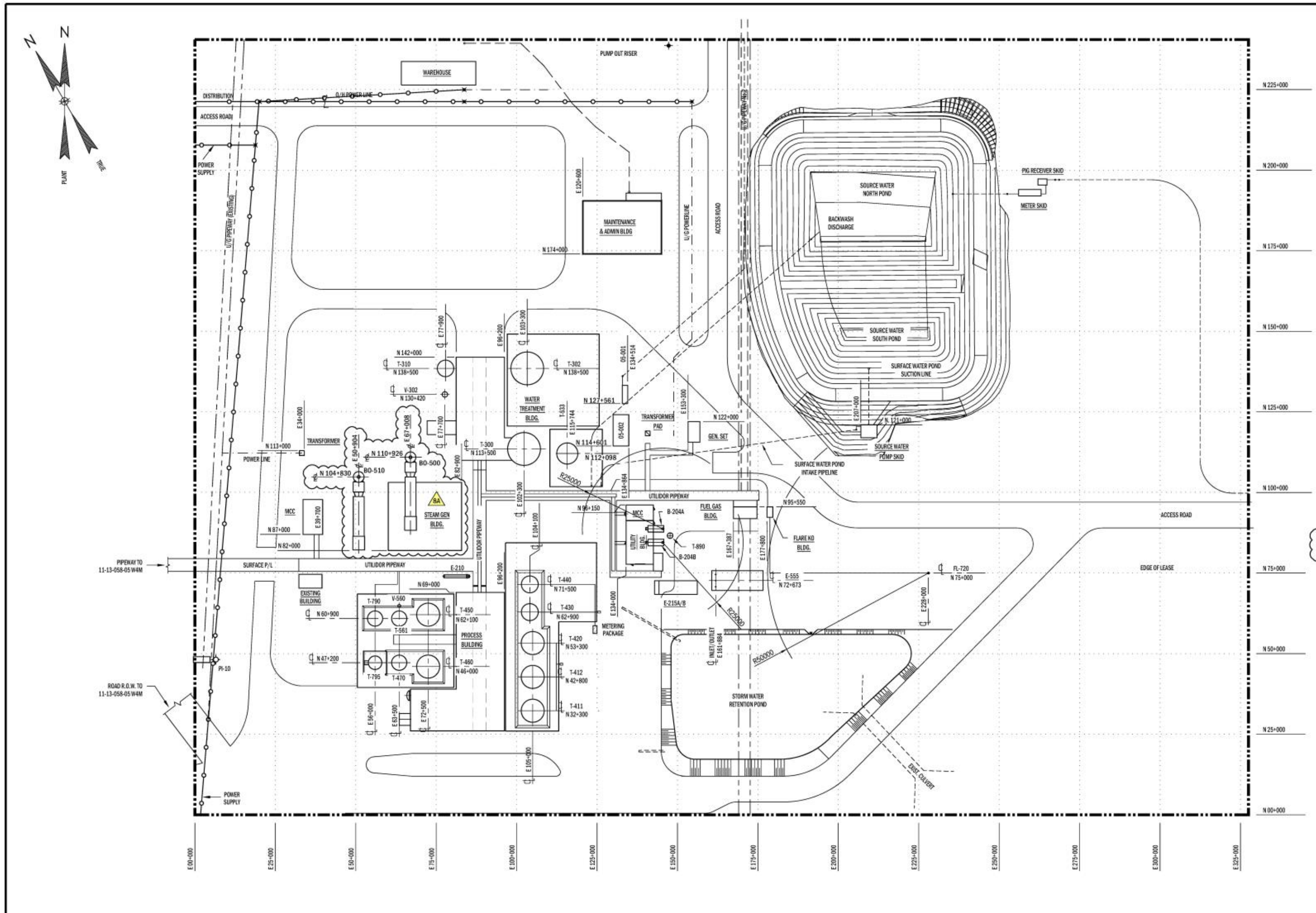
Monthly Average Volumes vs Nameplate



Lindbergh Commercial CPF Plot Plan



Lindbergh Pilot Plot Plan



TAG	BUILDING/EQUIPMENT DESCRIPTION	WIDTH	LENGTH	HEIGHT
	WATER TREATMENT BUILDING	15000	32000	5500
	PROCESS BUILDING	15000	43000	6100
	UTILITY BUILDING	8500	18400	3500
	FUEL GAS BUILDING	3700	7400	3600
	MAINTENANCE & ADMIN BUILDING	16600	24500	4100
	WAREHOUSE BUILDING	7300	23100	7100
	SOURCE WATER PUMP SKID	4000	5000	3900
	TEST SEPARATOR BUILDING	7300	18000	6410
	STEAM GENERATOR BUILDING	22700	28400	6500
	PIG RECEIVER SKID	1850	2820	-
	FLARE KO BUILDING	1829	3251	2261
	MCC BUILDING	6096	10820	3658
	METER SKID	2000	7000	2148
T-300	RAW WATER TANK	10200Ø		9800
T-302	BOILER FEED WATER TANK	10200Ø		9800
T-310	SOFTENER WASTE TANK	5131Ø		3658
T-411	PRODUCTION SALES TANK #1	7163Ø		7925
T-412	PRODUCTION SALES TANK #2	7163Ø		7925
T-420	OFFSPEC OIL TANK	7163Ø		7925
T-430	SLOP TANK	5258Ø		7315
T-440	DILUENT TANK	5258Ø		7315
T-450	PROD. WATER SKIM TANK	7165Ø		9765
T-460	PROD. WATER STORAGE TANK	7165Ø		9765
T-470	DESAND TANK	4725Ø		7315
T-561	BLOWDOWN VENT TANK	4556Ø		7315
T-790	POP TANK	4725Ø		7315
T-795	FLOOR DRAIN TANK	4216Ø		3658
T-890	GLYCOL STORAGE TANK	2390Ø		1830
	METERING PACKAGE FOR T-440	1219	2438	2261
V-302	VACUUM DEAERATOR	1680 I.D.		11280
V-560	STEAM BLOWDOWN SEPARATOR	1680 I.D.		11280
E-215A/B	COOLING GLYCOL AERIAL COOLERS	4268	13260	
FL-720	FLARE STACK	219Ø		18300
E-555	COOLING GLYCOL AERIAL COOLERS	6146	15768	4122
T-533	WATER TRANSFER TANK	6533Ø		9754
05-001	WATER TRANSFER PIG LAUNCHER	1653	5698	1291
05-002	WATER TRANSFER PUMP SKID	4877	9754	4141
BO-500	STEAM GENERATOR	-	24200	-
BO-510	STEAM GENERATOR	-	24200	-

GENERAL NOTES:
1. PLANT COORDINATES E 00+000 & N 00+000 ARE REFERENCED TO UTM COORDINATES E 99+925.000 & N 99+850.000

DRAWING NO.	REFERENCE DRAWINGS

STAMPS APPLY TO CURRENT REVISION ONLY

REV.	DESCRIPTION	JOB No.	DATE	BY	CHK	PE
8A	ISSUED FOR DESIGN - LINDBERGH PILOT RE-START SUPPORT	2021.749	-	SDJ	MH	MH
7	ISSUED FOR REFERENCE	2020.669	2020.03.31	MSJ	ORK	-
6	REVISED WATER TRANSFER PUMP SKID, TANK AND PIG LAUNCHER AREA	2012.060	2014.07.09	MSJ	CWD	-
5	ADDED WATER TRANSFER PUMP SKID, TANK AND PIG LAUNCHER	2013.208	2014.04.23	RCF	WSW	-
4	AERIAL COOLER ADDITION (E-555)	2010.030	2012.03.21	RM	RF	-

CONA RESOURCES

Scovan FORWARD ENGINEERING

LINDBERGH SAGD PILOT FACILITY
LSD: 07-13-058-05 W4M
CENTRAL PROCESSING FACILITY
PLOT PLAN

SITE: CPF | DRAWING NO. 121010-C-PP-00-001-01 | REV. 8A

Plot Date: June 25, 21 @ 01:51 PM

Historical and Upcoming Activity

Suspension/Abandonments

- No suspension/abandonments of SAGD wells or well pads have been completed to date
- No SAGD wells are in the blow down phase or currently suspended

Lindbergh Application History

OPERATOR	DATE	EVENT
Murphy	May 1991	ERCB Scheme Approval 6410 granted
	Aug 1993	ERCB Amended Scheme Approval 6410B granted
	Dec 1996	ERCB Amended Scheme Approval 6410C granted
	Aug 1997	ERCB Amended Scheme Approval 6410D granted
	Jun 1999	ERCB Amended Scheme Approval 6410E granted
Pengrowth	Apr 2004	ERCB Amended Scheme Approval 6410F granted
	July 2011	Scheme Amended - 6410H SAGD Pilot project granted
	Aug 2012	Scheme Amended - 6410I Expansion to 12,500 bopd granted
	Apr 2014	Scheme Amended - 6410J Solvent soak trial granted
	Nov 2014	Scheme Amended – 6410K Facility de-bottlenecking
	Jun 2015	Scheme Amended – 6410L Section 13 addition
	May 2016	Scheme Amended – 6410M EIA approval to 30kbbl/d
	Nov 2016	Scheme Amended – 6410N Infill wells
	May 2017	Scheme Amended – 6410O Legacy well remediation scheduling
	Jun 2017	Scheme Amended – 6410P Phase II treater addition to 40kbbl/d
	May 2018	Scheme Amended – 6410Q Gas co-injection
	Dec 2018	Scheme Amended – 6410R Expansion of project dev area
	May 2019	Scheme Amended – 6410S Additional well pair
	Sep 2019	Scheme Amended – 6410T Cogeneration addition
	Oct 2019	Scheme Amended – 6410U Additional well pairs and infills
Cona	Apr 2020	Scheme Amended – 6410V Increase NCG injection rates
	Apr 2020	Scheme Amended – 6410W Additional well pair and infills

Key Learnings

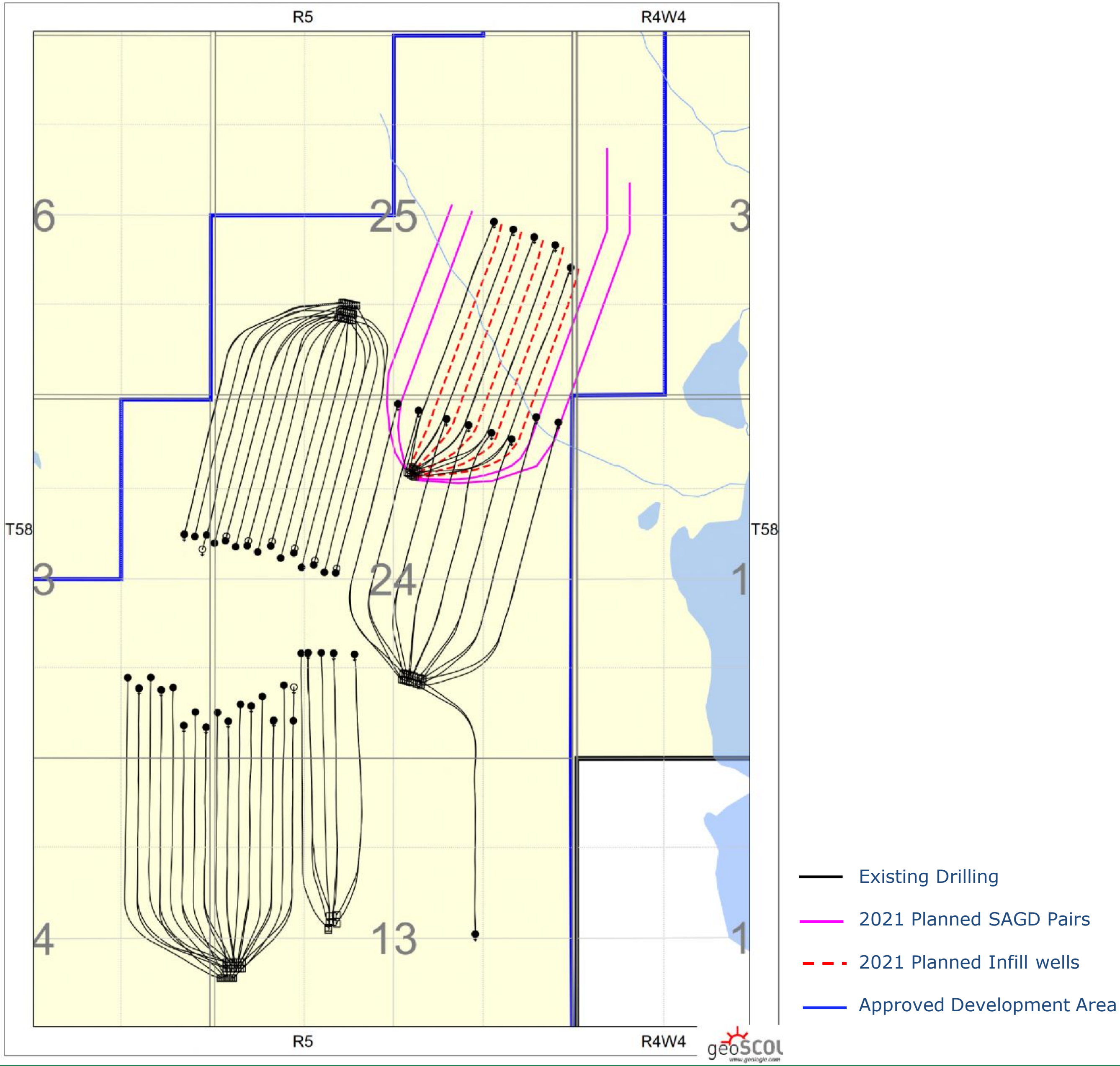
- Ramp down strategy due to low commodity price environment was executed in Q2-2020
  - Maintained as many SAGD well pairs operating as possible and shut-in infill wells to manage production
  - Managed steam chamber pressure with NCG injection prior to and during shutdown of well pairs
  - Successful ramp-up from a production volume, water balance and restart of downhole pumps perspective
  - Main issues experienced during ramp down:
    - Water balance in the reservoir was of a concern with condensing steam chambers and dropping pressure; this was successfully mitigated through strategic NCG injection and post ramp down water production was less than expected (achieved through a gradual ramp-up to manage facility constraints and throughput)
    - As a result of NCG pressure maintenance; bottom water breakthrough was not experienced
    - Upon restart, fewer ESP’s failed than anticipated (strategically shut-down rod pumps vs. ESP’s to mitigate failures where possible)
    - Ramp-down was conducted in a way that balanced field production with minimum facility throughput
- Infill wells have met or exceeded expectations
  - Learnings from D05 infill program were incorporated on D03 which resulted in faster ramp-up
- NCG co-injection meeting expectations
  - Current target of 2.5 mol% of gas injection has resulted in ~15% steam savings
- Continued successful operation of 2 SAGD well pairs (D01-03 and D04-06) in previously depleted cyclic steam stimulation area
  - Significant de-risking of reservoirs with previous CSS operation
  - D04-06 is operated with a more conservative ΔP between injector and producer to control vapour production compared to other well pairs
- Reduced steam chamber operating pressure
  - Fine tuned the steam chamber operating pressure to manage bottom water production while optimizing SOR
- Wellbore hydraulics optimization
  - Production ports in the scab liner and shift-able ports in the steam injection string improve well conformance
  - Tubing deployed flow control devices showing encouraging results
  - Single string injection with distributed steam ports trialed with success
- Continuous improvement in ESP run life
  - Advanced gas handling stages improving performance in wells with high vapour production
- No pilot or major technical innovation during the calendar year other than the items under ramp down and ramp up in Q2-2020

Compliance

There were no non-compliances or self disclosures in 2020

2021 Activity

- 4 well pairs and 5 infill wells planned for 2021 at Lindbergh
- 2 existing OTSG replacements located at the Pilot Facility
- Installation of the HIPVAP Indirect Fired Steam Generation



5 Year Development Plan

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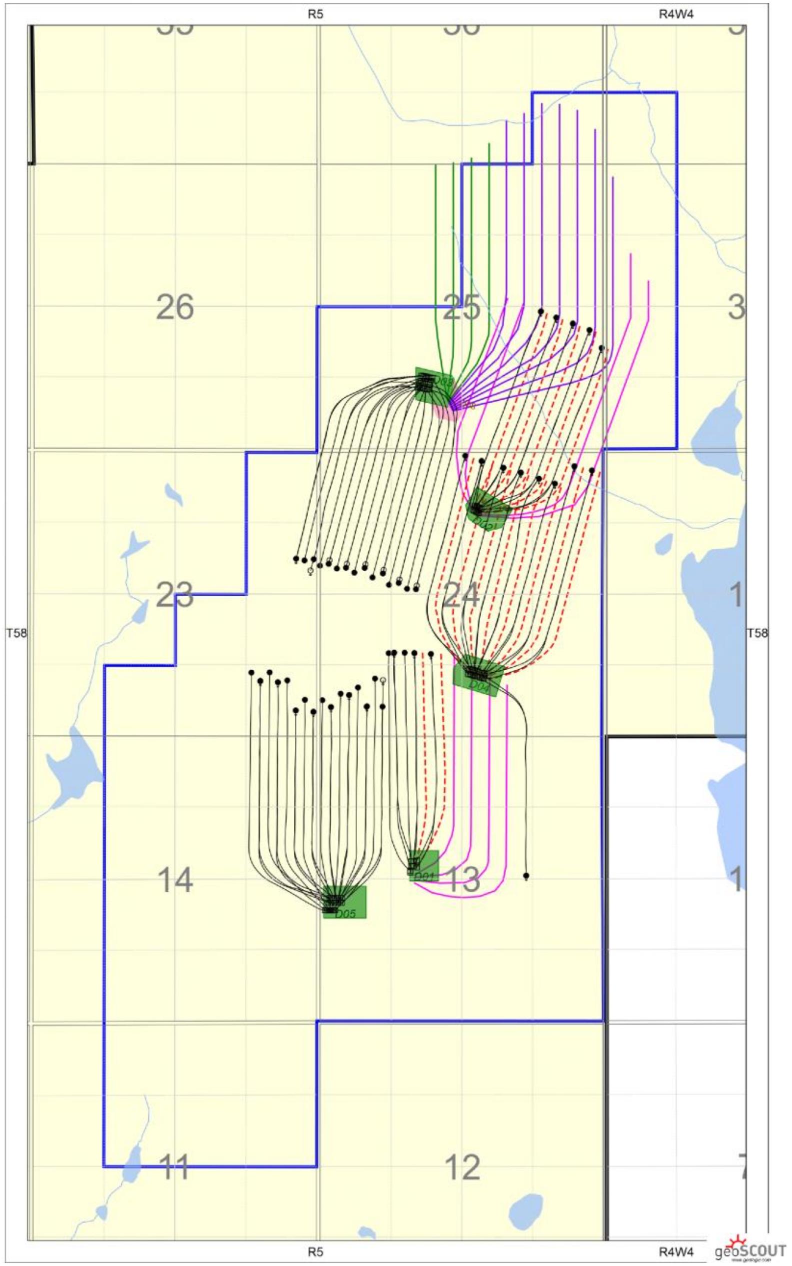
New drilling subject to market conditions, internal approval and regulatory approval where applicable.

- Drilling 4 well pairs and 5 infill wells on Pad D02 in 2021
- Future considerations pending internal approval
  - Apply for development of Pad D08 for a 4 well pair Solvent SAGD pilot (2022)
  - Infill well drilling program for Pad D04 (2023)
  - Additional well pairs and infill wells in Pad D01 and D08 (2024+)



Future Plans

- Continuous incremental expansion of the CPF to 40,000 bbl/d pending economic environment
- Implementation of solvent assisted SAGD to improve efficiency (lower SOR) and recovery
- Continue implementation of NCG injection with steam to improve efficiency and recovery
- Increased cogeneration of steam and electricity where applicable

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