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SPE workshop

# Integrated Artificial Lift Excellence: Technologies, Operations, and the Digital Future

12 – 13 May 2026 | KUALA LUMPUR, MALAYSIA

# Well A Gas Lift Deepening

Abdul Rahim Abas, Zulkifli M Zain, Muhammad Khusairie Ismail **PETRONAS**

Low Yoke Peng, Mohd Fakhrurazi Ishak, Aminul Fahmi **Weatherford**

Srinivasan Sivaram **Schlumberger**

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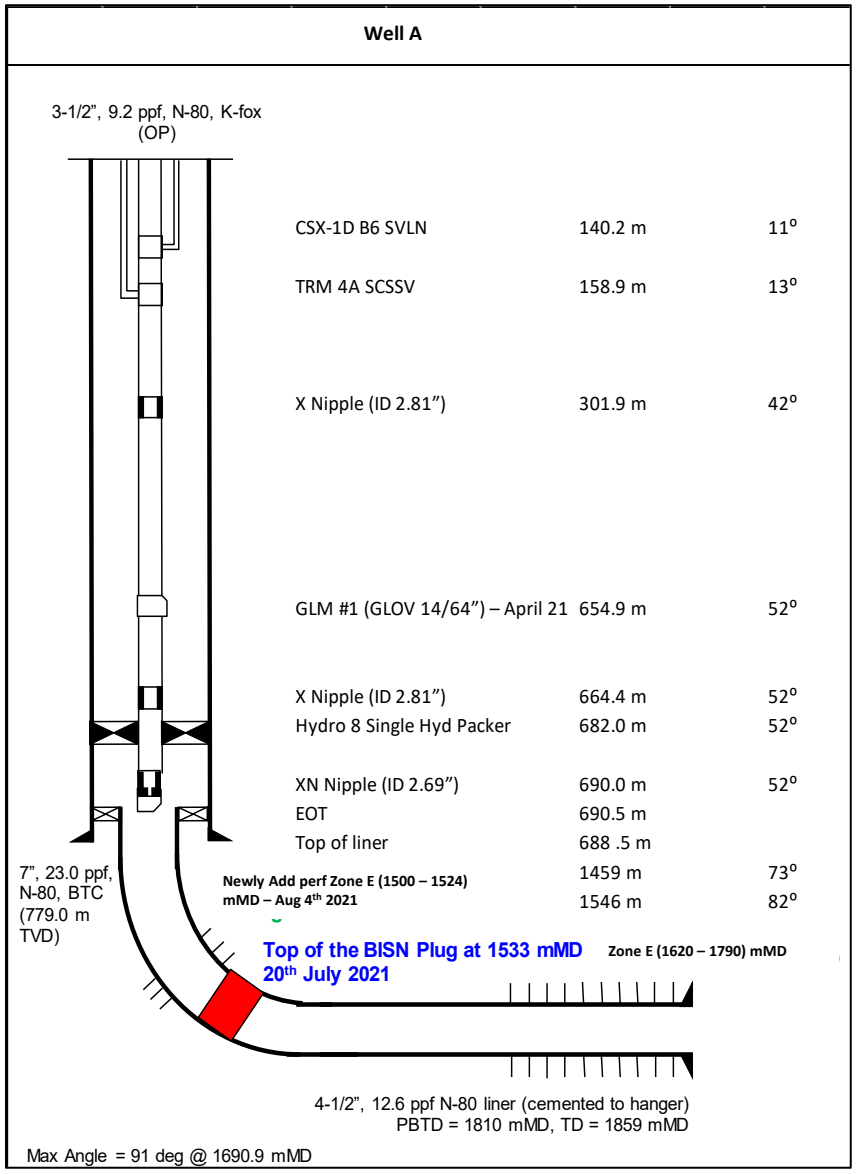
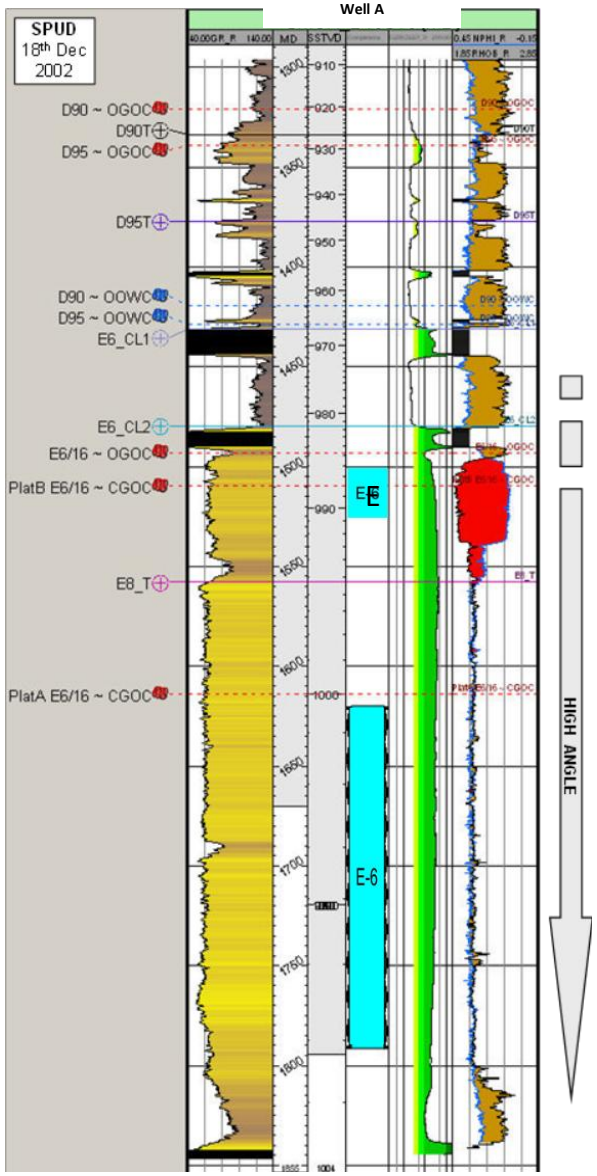
# Well Background




## Well A Background:

- Completed as a single horizontal well to access Zone E reservoir.
- Set Plug to isolate lower zone perforation and add perf to upper zone in July 2021.
- Well was producing from 'newly added' upper zone 'intermittently'.
- Well was idle effective since September 2023.
- Reservoir pressure is 1055 psig at mid perf (Oct-2025).
- Minimal depletion from neighbouring wells
- Well equipped with only 1 GLM set at 654.9 mMD

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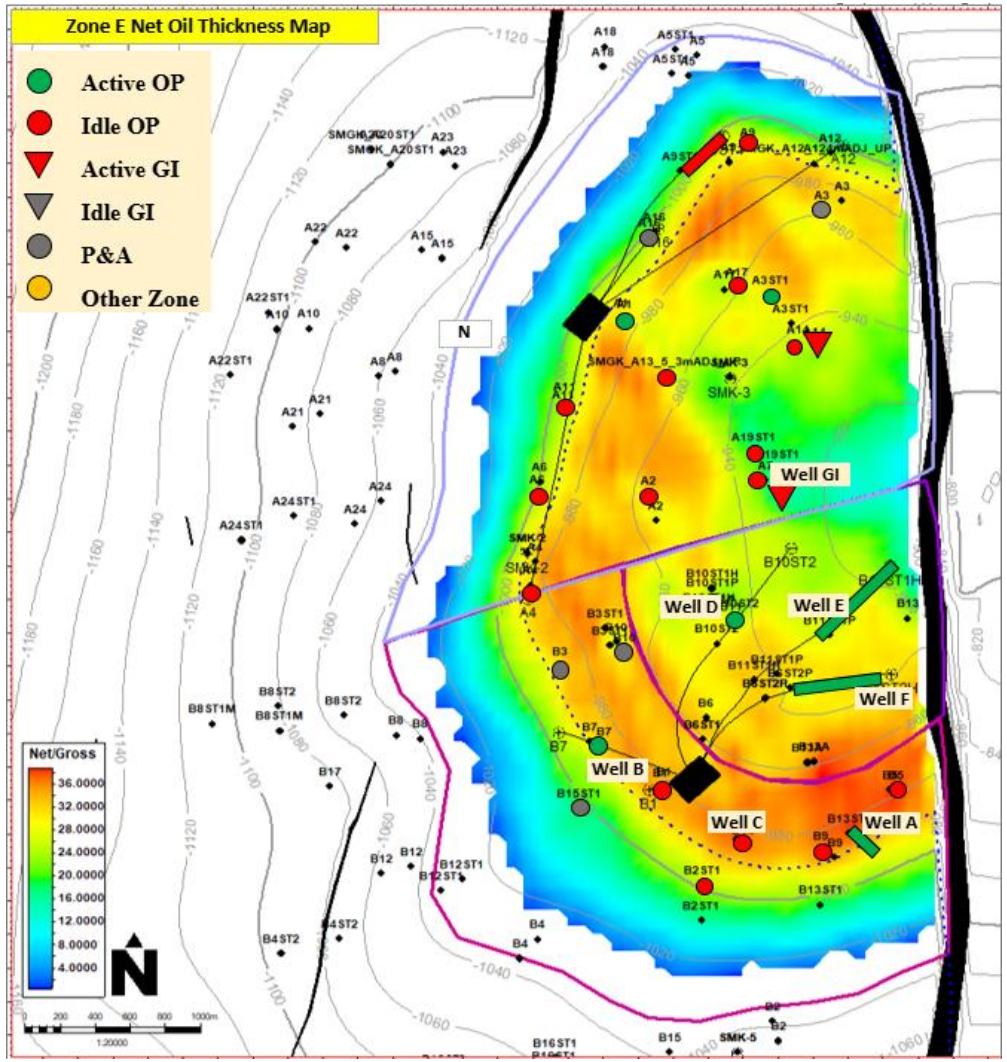
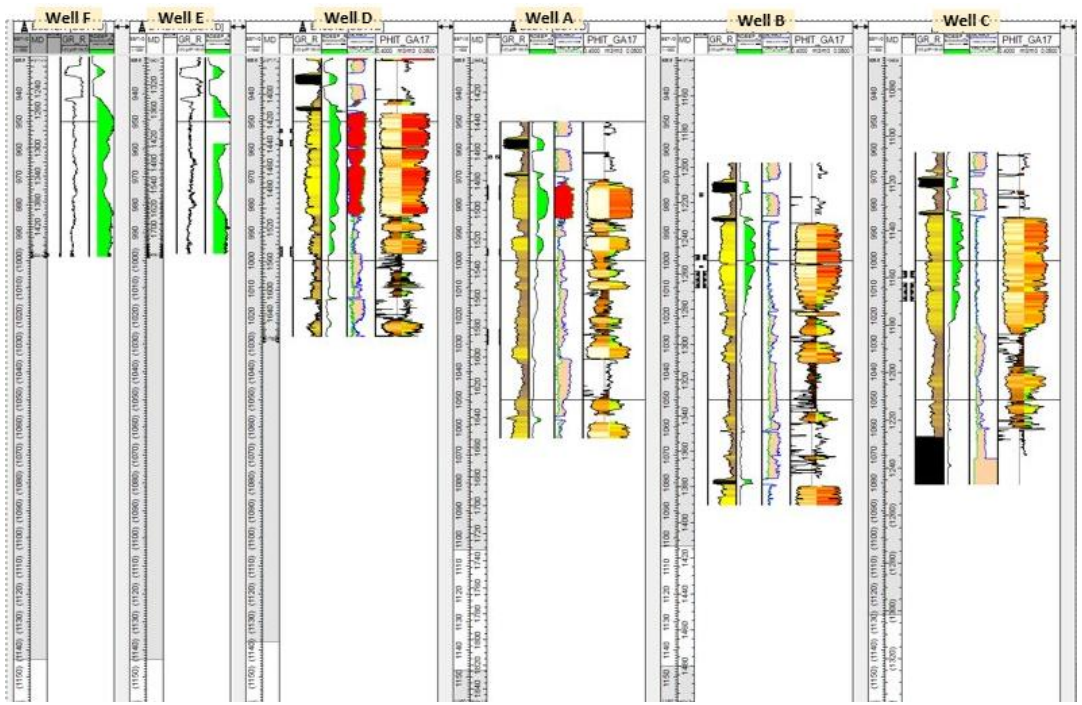
# Reservoir Background




## Zone E Reservoir Overview:

- Gas cap expansion supplemented by gas injection (Moderate aquifer strength)
- Only 1 active OP-Well B since Nov 2024.
- Contact logging showed with 8m remaining oil column from Well C (2018) and Well B (2021).
- Reservoir pressure at 1055 psig (Oct-2025)

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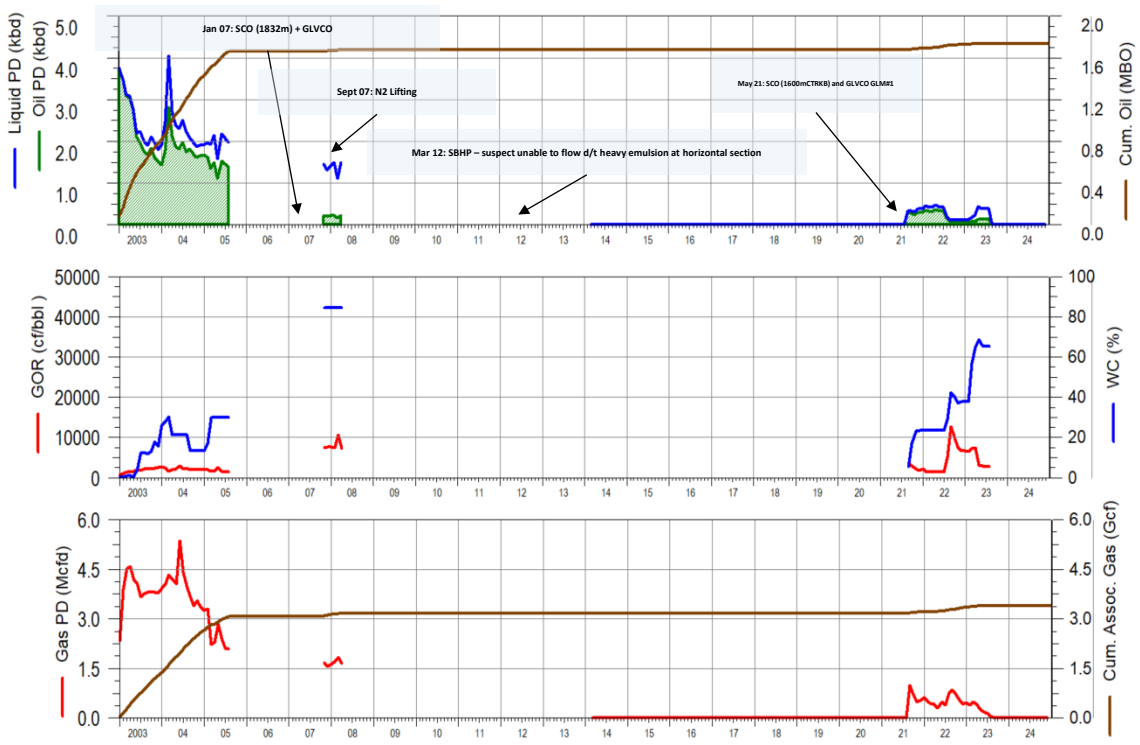
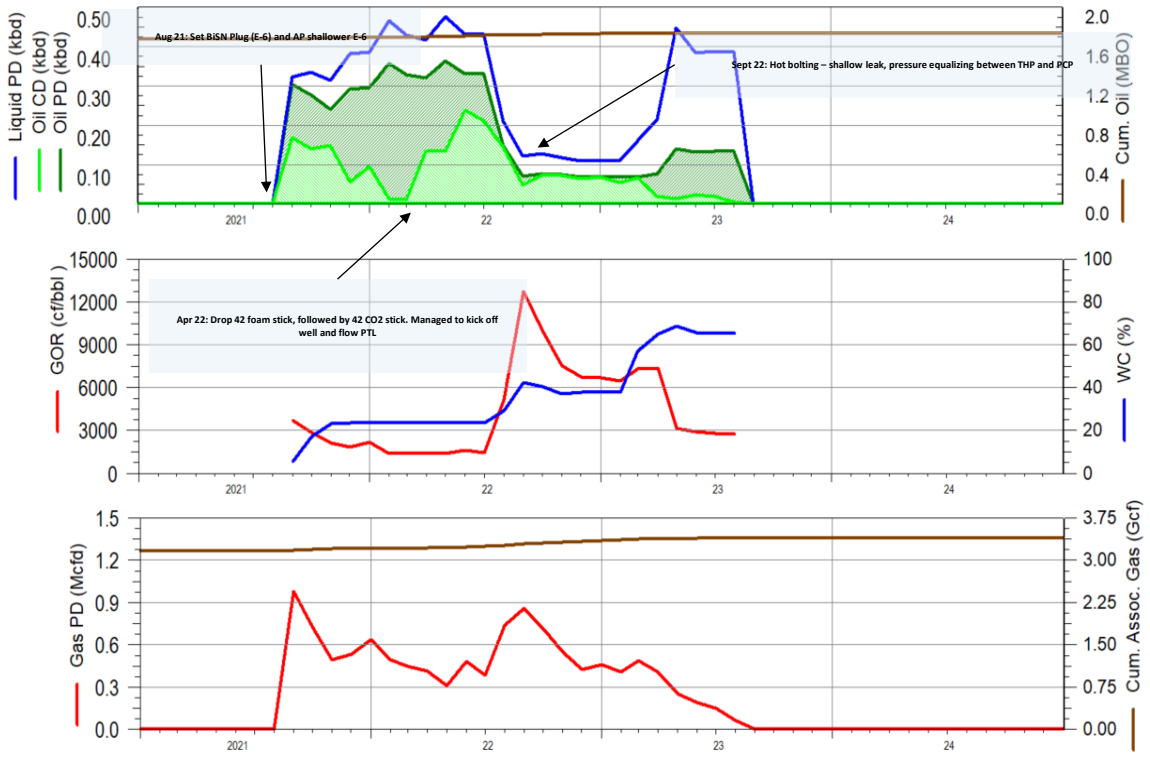
# Production Rate (Historical)

**Well A Production Performance (Zone E)**




**Well A Production Performance (Zone E) since 2021**



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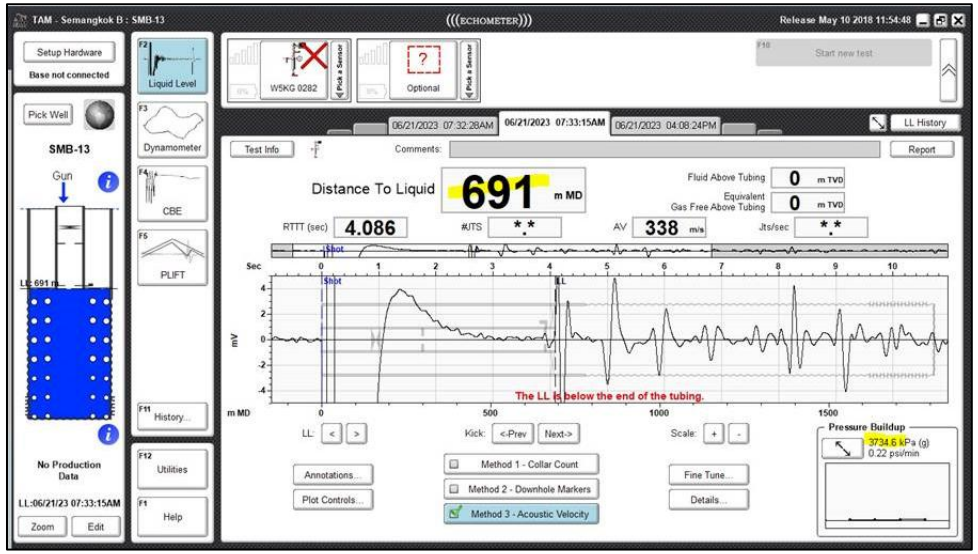
# Observation & Troubleshooting

SITHP

PCP before gas lift injection

| Time | SITHP (Kpa) | PCP (Kpa) | FWS (Kpa) | Note |
|---|---|---|---|---|
| 1000 | 1200 | 2800 | 1880 | Start monitor after Flow PTN |
| 1200 | 1200 | 2800 | 1885 | |
| 1400 | 1200 | 2800 | 1883 | |
| 1600 | 1200 | 2800 | 1887 | |
| 1800 | 1200 | 2800 | 1883 | |
| 1000 | 1200 | 8000 | 1920 | Monitor after flow with gas lift |

**Echometer shot (June 2023)**




| SITHP (kpa) | 3737 |
|---|---|
| PCP (kpa) | 3669 |


| SITHP (kpa) | 2050 |
|---|---|
| PCP (kpa) | 2650 |

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# Observation & Troubleshooting

## Known Parameters:

- Liquid level ✓
- Reservoir Pressure ✓

## Unknown Parameter:

- Skin? Or perf damage? – disrupted permeability. X

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# Observation & Troubleshooting

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**21st March 2025 - Pumping**

| Time (min) | Pump Rate, (bpm) | Volume, (bbl) | Pressure, psi (THP) | Pressure, psi (PCP) |
|---|---|---|---|---|
| 0 | 0.4 | 0 | 400 | 363 |
| 5 | 1.0 | 5.0 | 200 | 363 |
| 10 | 1.3 | 8.0 | 100 | 363 |
| 15 | 1.5 | 14.0 | 70 | 363 |
| 20 | 1.5 | 16.0 | 0 | 363 |
| 25 | 2.0 | 23.0 | 0 | 363 |
| 30 | 2.0 | 33.0 | 0 | 363 |
| 35 | 2.0 | 43.0 | 0 | 363 |
| 40 | 2.0 | 53.0 | 0 | 363 |
| 45 | 2.0 | 63.0 | 0 | 363 |

**21st March 2025 - Injectivity**

| Pump Rate, (bpm) | Volume, (bbl) | Pressure, psi (THP) | Pressure, psi (PCP) |
|---|---|---|---|
| 0.3 | 1.5 | 0 | 363 |
| 0.5 | 4.0 | 0 | 363 |
| 0.7 | 7.5 | 0 | 363 |
| 1.0 | 12.5 | 0 | 363 |
| 1.5 | 20.0 | 0 | 363 |
| 2.0 | 30.0 | 0 | 363 |

**22nd March 2025 - Pumping**

| Time (min) | Pump Rate, (bpm) | Volume, (bbl) | Pressure, psi (THP) | Pressure, psi (PCP) |
|---|---|---|---|---|
| 0 | 0.3 | 0.0 | 1034 | 363 |
| 5 | 0.5 | 2.0 | 896 | 363 |
| 10 | 0.7 | 5.0 | 689 | 363 |
| 15 | 0.7 | 5.5 | 0 (vacum) | 363 |
| 20 | 1.2 | 10.0 | 0 (vacum) | 363 |
| 25 | 1.6 | 18.0 | 0 (vacum) | 363 |
| 30 | 2.0 | 28.0 | 0 (vacum) | 363 |
| 35 | 2.0 | 38.0 | 0 (vacum) | 363 |
| 40 | 2.0 | 48.0 | 0 (vacum) | 363 |
| 45 | 2.0 | 58.0 | 0 (vacum) | 363 |
| 50 | 2.0 | 68.0 | 0 (vacum) | 363 |
| 55 | 2.0 | 78.0 | 0 (vacum) | 363 |
| 60 | 2.0 | 88.0 | 0 (vacum) | 363 |
| 65 | 2.0 | 98.0 | 0 (vacum) | 363 |
| 70 | 2.0 | 100.0 | 0 (vacum) | 363 |

**22nd March 2025 - Monitoring**

| Time (hrs) | Pressure, psi (THP) | Pressure, psi (PCP) |
|---|---|---|
| 07:00 | 0 | 363 |
| 08:00 | 0 | 363 |
| 09:00 | 0 | 363 |
| 10:00 | 0 | 363 |
| 11:00 | 0 | 363 |
| 12:00 | 0 | 363 |
| 13:00 | 20 | 363 |
| 14:00 | 50 | 363 |
| 15:00 | 50 | 363 |
| 16:00 | 50 | 363 |
| 17:00 | 50 | 363 |
| 20:00 | 50 | 363 |
| 22:00 | 60 | 363 |
| 24:00 | 60 | 363 |

**23rd March 2025 - Monitoring**

| Time (hrs) | Pressure, psi (THP) | Pressure, psi (PCP) |
|---|---|---|
| 02:00 | 60 | 363 |
| 04:00 | 80 | 363 |
| 06:00 | 100 | 363 |
| 07:00 | 100 | 363 |
| 09:00 | 100 | 363 |
| 11:00 | 100 | 363 |
| 13:00 | 100 | 363 |
| 15:00 | 100 | 363 |
| 17:00 | 100 | 363 |

**27th March-2025**
**Echometer shot 565mMD**
**THP pressure 1200kPa**


| | MD (m) | TVD (m) |
|---|---|---|
| Fluid Level | 565 | 470 |
| Top Perf | 1500 | 1018 |

Hydrostatic Pressure of sea water = 795 psi

Surface pressure is 1,200 kPa = 174 psi

Reservoir Bottom Hole Pressure @ 1500m-MD (1018m-TVD) = surface pressure + hydrostatic pressure of sea water

= 174 psi + 795 psi

= 969 psi

# Nodal Analysis

## Deep Gas Lift System Design

For analysis and comparison purposes two cases were considered;

1. **Case 1:** Current Conditions Well Model with gas lift mandrel depth at 654.9 mMD.

2. **Case 2:** DGL System; WidePak packer with 1.5" X 0.109" WT Tubing at extended depth 1280mMD

# Case 1

[Open]

# Case 1 : Well Test (Current Condition)

- Well Test data unavailable due to well unable to flow.
- The model was fine tune with the solution GOR – 471scf/bbl.

| Reservoir Data | Flowing Parameters | | | | | | |
|---|---|---|---|---|---|---|---|
| Reservoir Pressure (psig) | Operating Pressure (psig) | Oil Rate (Stb/d) | Form Gas Rate (MMScf/d) | Water Rate (Stb/d) | Injection Gas Rate (MMScf/d) | WHP (psig) | Injection Depth (mMD) |
| 1048 | 1013.69 | 16.5 | 0.008 | 38.6 | 1.2 | 334 | 654.9 |

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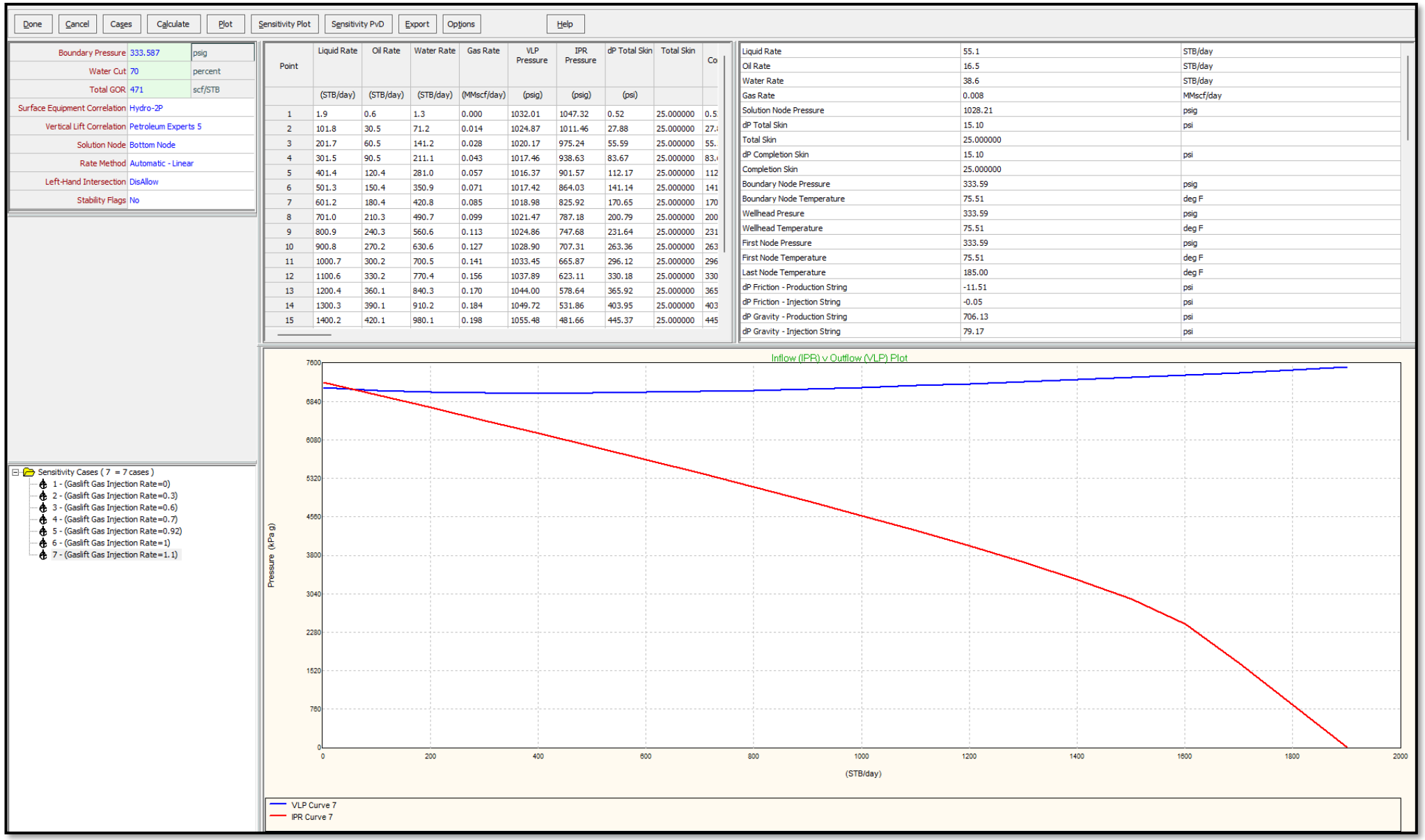
# Case 1 : IPR/VLP curve (Current Condition)



Done | Cancel | Cases | Calculate | Plot | Sensitivity Plot | Sensitivity PvD | Export | Options | Help

| | | |
|---|---|---|
| Boundary Pressure | 333.587 | psig |
| Water Cut | 70 | percent |
| Total GOR | 471 | scf/STB |
| Surface Equipment Correlation | Hydro-2P | |
| Vertical Lift Correlation | Petroleum Experts 5 | |
| Solution Node | Bottom Node | |
| Rate Method | Automatic - Linear | |
| Left-Hand Intersection | DisAllow | |
| Stability Flags | No | |

| Point | Liquid Rate | Oil Rate | Water Rate | Gas Rate | VLP Pressure | IPR Pressure | dP Total Skin | Total Skin | Co |
|---|---|---|---|---|---|---|---|---|---|
| | (STB/day) | (STB/day) | (STB/day) | (MMscf/day) | (psig) | (psig) | (psi) | | |
| 1 | 1.9 | 0.6 | 1.3 | 0.000 | 1032.01 | 1047.32 | 0.52 | 25.000000 | 0.5 |
| 2 | 101.8 | 30.5 | 71.2 | 0.014 | 1024.87 | 1011.46 | 27.88 | 25.000000 | 27. |
| 3 | 201.7 | 60.5 | 141.2 | 0.028 | 1020.17 | 975.24 | 55.59 | 25.000000 | 55. |
| 4 | 301.5 | 90.5 | 211.1 | 0.043 | 1017.46 | 938.63 | 83.67 | 25.000000 | 83. |
| 5 | 401.4 | 120.4 | 281.0 | 0.057 | 1016.37 | 901.57 | 112.17 | 25.000000 | 112 |
| 6 | 501.3 | 150.4 | 350.9 | 0.071 | 1017.42 | 864.03 | 141.14 | 25.000000 | 141 |
| 7 | 601.2 | 180.4 | 420.8 | 0.085 | 1018.98 | 825.92 | 170.65 | 25.000000 | 170 |
| 8 | 701.0 | 210.3 | 490.7 | 0.099 | 1021.47 | 787.18 | 200.79 | 25.000000 | 200 |
| 9 | 800.9 | 240.3 | 560.6 | 0.113 | 1024.86 | 747.68 | 231.64 | 25.000000 | 231 |
| 10 | 900.8 | 270.2 | 630.6 | 0.127 | 1028.90 | 707.31 | 263.36 | 25.000000 | 263 |
| 11 | 1000.7 | 300.2 | 700.5 | 0.141 | 1033.45 | 665.87 | 296.12 | 25.000000 | 296 |
| 12 | 1100.6 | 330.2 | 770.4 | 0.156 | 1037.89 | 623.11 | 330.18 | 25.000000 | 330 |
| 13 | 1200.4 | 360.1 | 840.3 | 0.170 | 1044.00 | 578.64 | 365.92 | 25.000000 | 365 |
| 14 | 1300.3 | 390.1 | 910.2 | 0.184 | 1049.72 | 531.86 | 403.95 | 25.000000 | 403 |
| 15 | 1400.2 | 420.1 | 980.1 | 0.198 | 1055.48 | 481.66 | 445.37 | 25.000000 | 445 |

| | | |
|---|---|---|
| Liquid Rate | 55.1 | STB/day |
| Oil Rate | 16.5 | STB/day |
| Water Rate | 38.6 | STB/day |
| Gas Rate | 0.008 | MMscf/day |
| Solution Node Pressure | 1028.21 | psig |
| dP Total Skin | 15.10 | psi |
| Total Skin | 25.000000 | |
| dP Completion Skin | 15.10 | psi |
| Completion Skin | 25.000000 | |
| Boundary Node Pressure | 333.59 | psig |
| Boundary Node Temperature | 75.51 | deg F |
| Wellhead Presure | 333.59 | psig |
| Wellhead Temperature | 75.51 | deg F |
| First Node Pressure | 333.59 | psig |
| First Node Temperature | 75.51 | deg F |
| Last Node Temperature | 185.00 | deg F |
| dP Friction - Production String | -11.51 | psi |
| dP Friction - Injection String | -0.05 | psi |
| dP Gravity - Production String | 706.13 | psi |
| dP Gravity - Injection String | 79.17 | psi |

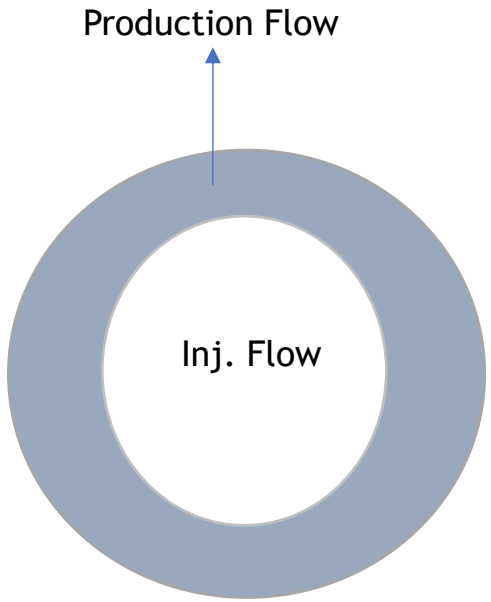
Sensitivity Cases ( 7 = 7 cases )
- 1 - (Gaslift Gas Injection Rate=0)
- 2 - (Gaslift Gas Injection Rate=0.3)
- 3 - (Gaslift Gas Injection Rate=0.6)
- 4 - (Gaslift Gas Injection Rate=0.7)
- 5 - (Gaslift Gas Injection Rate=0.92)
- 6 - (Gaslift Gas Injection Rate=1)
- 7 - (Gaslift Gas Injection Rate=1.1)

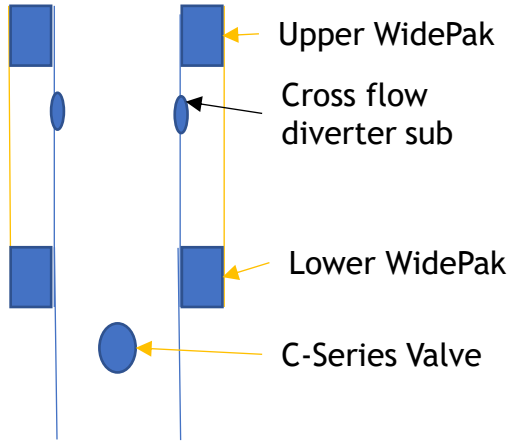
# Case 2

[Open]

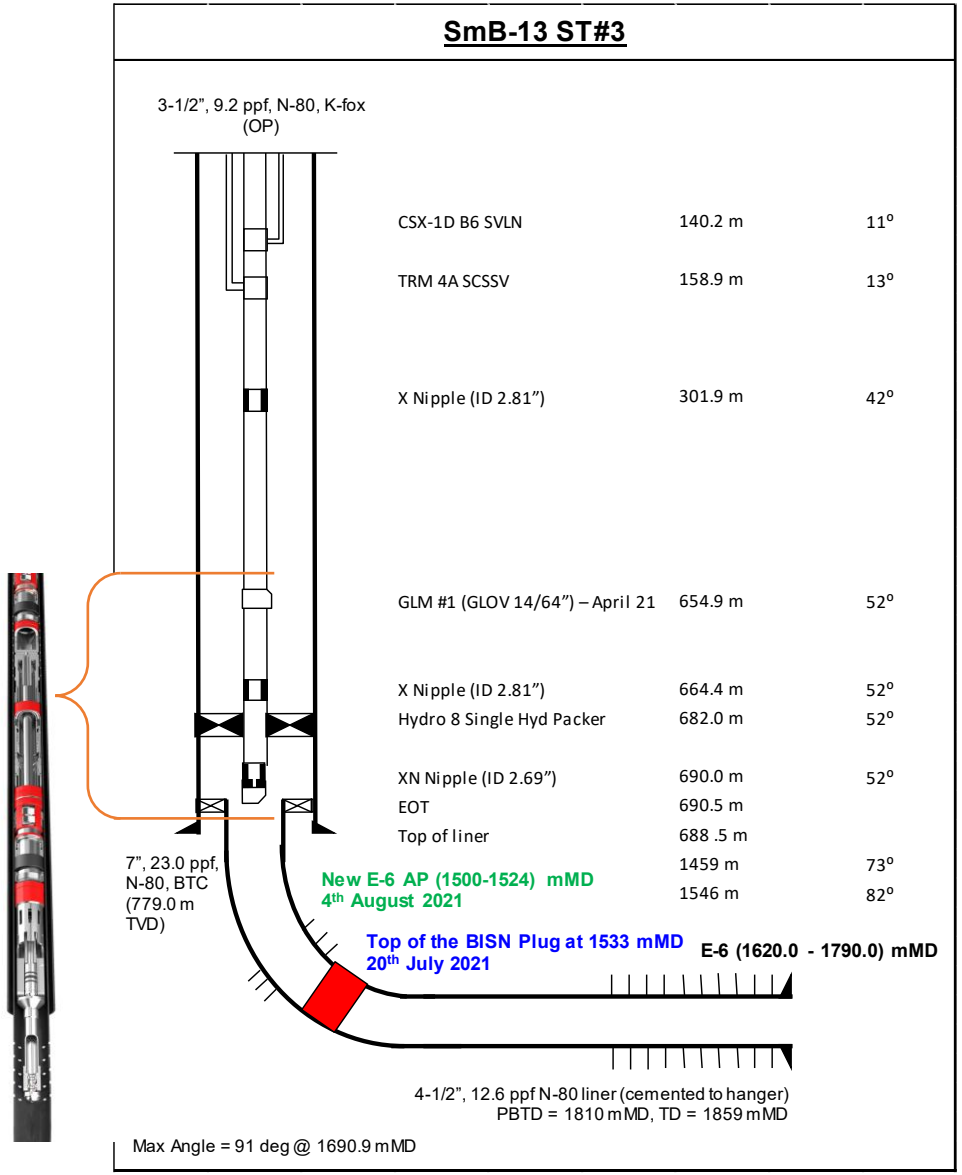
# Case 2 : Well Model w/ DGL System

## WidePak DGL System

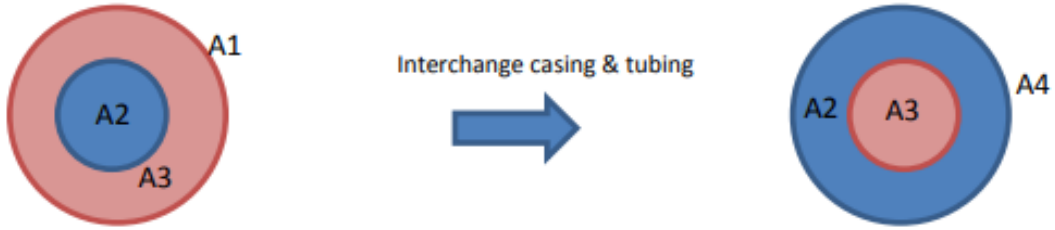



- 3 1/2" WidePak packer installed at 654.9m MD depth and a
- 1.5"OD /1.282"ID Coil Tubing is installed at the bottom end of DGL system
- Gas injection valve (c/w Check valves) installed at the other end of coil tubing.



# Case 2 : Well Model w/ DGL System



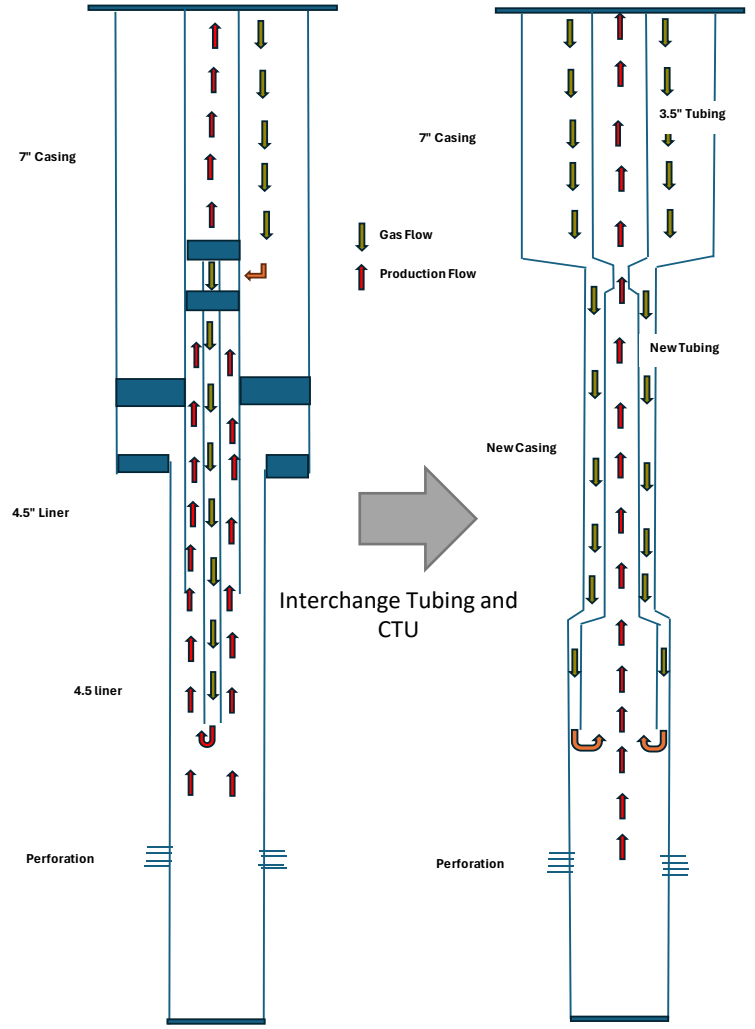

| Tubing | |
|---|---|
| **OD** | 3.500 in |
| **ID** | 2.992 in |
| **A1 area (using ID)** | 7.032 in2 |
| **Outer Area** | 9.622in2 |

| CTU | |
|---|---|
| OD | 1.50 in |
| ID | 1.282 in |
| A2 gas injection flow area (using ID) | 1.291 in2 |
| Outer area (using OD) | 1.767 in2 |

Interchange Tubing and CTU

| New Tubing | |
|---|---|
| **A3 production fluid flow area (A1 – CTU outer)** | 5.264 in2 |
| **New equivalent ID** | 2.589 in |

| New Casing | |
|---|---|
| **A2 gas injection flow area** | 1.291 in2 |
| **A4 area of new casing (OD + A2)** | 10.913 in2 |
| **New equivalent ID** | 3.727 in |

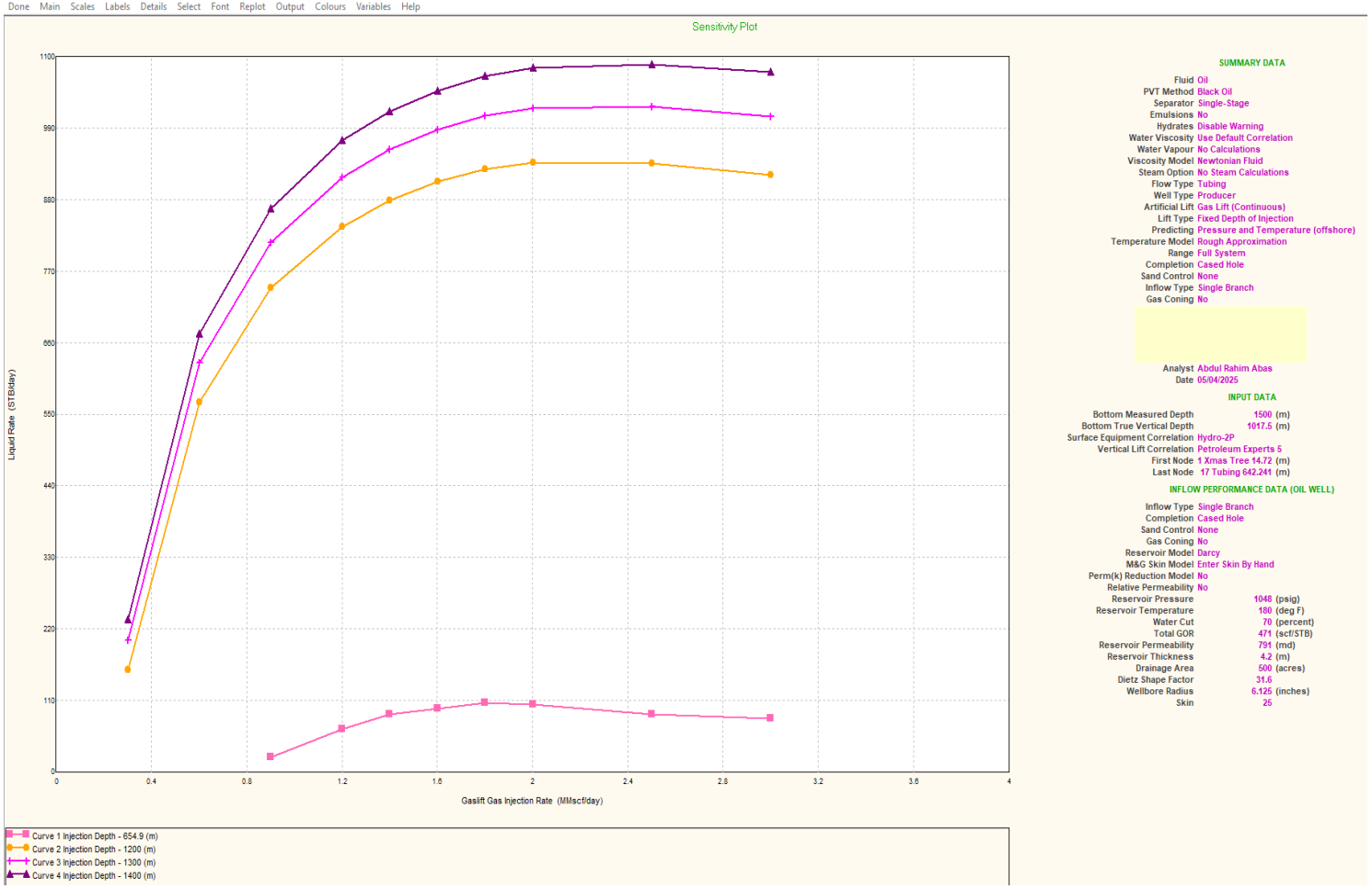



**Well configuration before interchange between tubing and CTU.**

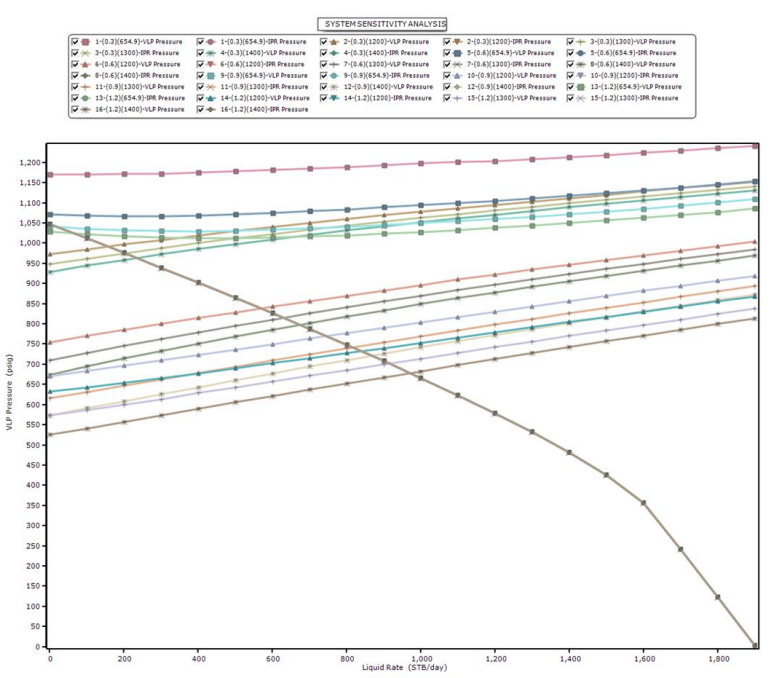
**Well configuration after interchange of tubing and CTU.**

[Open]

# Case 2 : DGL Depth Selection




- Sensitivity analysis was run to select the maximum depth.
- Maximum depth determined via limitation of;
  - Max CHP – 1421 psig
  - System pressure – 290 psig
  - Optimum IGLR – 1.2 Mmscfd
  - Without Unloading valve



# Case 2 : DGL Depth Selection

- With the current DGL system setup along with gas lift injection rate available, a sensitivity analysis was run to select the maximum depth of end of DGL valve can be achieved.
- The maximum available gas injection pressure for this well is 1421 psig, with a corresponding optimum gas injection rate of 1.2 Mmscfd.
- For the gas injection rate sensitivity analysis, injection depth of up to 1400 mMD was considered.

| Reservoir Data | Flowing Parameters | | | | | | |
|---|---|---|---|---|---|---|---|
| Reservoir Pressure (psig) | IPR-VLP Pressure (psig) | Oil Rate (Stb/d) | Form Gas Rate (MMScf/d) | Water Rate (Stb/d) | Injection Gas Rate (MMScf/d) | WHP (psig) | Injection Depth (mMD) |
| 1048 | 1024 | 19.9 | 0.01 | 46.4 | 1.2 | 334 | 654.9 |
| 1048 | 733 | 251.8 | 0.12 | 587.5 | 1.2 | 334 | 1200 |
| 1048 | 702 | 274.5 | 0.13 | 640.6 | 1.2 | 334 | 1300 |
| 1048 | 679 | 291.5 | 0.14 | 680.2 | 1.2 | 334 | 1400 |

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# Case 2 : DGL Depth Selection

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Design | Results | Done | Cancel | IPR | Sensitivity | Export | Report | Help | Design Plot

**Design Options**

| | |
|---|---|
| Design Rate Method | Entered By User |
| Design Rate Type | Liquid |
| System Calculation Rate Method | Automatic - Geometric |
| Valve Type | Casing Sensitive |
| Valve Setting | All Valves PVo = Gas Pressure |
| Injection Point | Injection Point is ORIFICE |
| Valve Spacing Method | Normal |
| Dome Pressure Correction >1200psig | Yes |
| Check Rate Conformance With IPR | Yes |
| Use IPR For Unloading | Yes |
| Orifice Sizing Method | Calculated dP @ Orifice |
| Pipe Correlation | Hydro-2P |
| Tubing Correlation | Petroleum Experts 5 |

**Design Input**

| | | |
|---|---|---|
| Design Rate | 879.943 | STB/day |
| Maximum Gas Available | 1.4 | MMscf/day |
| Maximum Gas During Unloading | 1.4 | MMscf/day |
| Flowing Wellhead Pressure | 334 | psig |
| Unloading Wellhead Pressure | 334 | psig |
| Operating Injection Pressure | 1421 | psig |
| Kickoff Injection Pressure | 1421 | psig |
| Desired dP Across Valve | 250 | psi |
| Maximum Depth Of Injection | 1400 | m |
| Minimum Spacing | 76.2 | m |
| Static Gradient Of Load Fluid | 0.38 | psi/ft |
| Safety to Close Last Unloading Valve | 0 | psi |
| Water Cut | 85 | percent |
| Total GOR | 471 | scf/STB |
| Min CHP Decrease Per Valve | 50 | psi |
| Thornhill-Craver DeRating % - Valves | 100 | percent |
| Thornhill-Craver DeRating % - Orifice | 100 | percent |

**Current Valve Type**

| | |
|---|---|
| Manufacturer | Mcmurry-Macco |
| Type | R-1D |
| Specification | Normal |
| Maximum Port Size | 20 64ths inch |

- BK-1
  - Carbide
  - Normal
- BKLK-2
  - Carbide
  - Normal
- BKT
  - Carbide
- BKT-1
  - Carbide
- PK-1
  - Carbide
  - Normal
- R-20
  - Carbide
  - Normal
- RCB
  - Carbide
  - Normal
- RP-6
  - Carbide
  - Normal
- Mcmurry-Macco
  - R-1
    - Normal
  - R-1D
    - Normal
  - R-2
    - Normal
  - R-2D
    - Normal
  - R-F1
    - Normal
- Otis-Merla
  - NM16R
    - Normal
- PTC
  - 1.0inch(11.2mm_bellows)
    - Normal
  - 1.5inch(16.2mm_bellows)
    - Normal
  - 1.5inch(23mm_bellows)
    - Normal
- Weatherford
  - 1
    - R-1D
  - R-1
    - Monel
  - R-1D
    - Monel

| Port Size | R Value |
|---|---|
| 8 | 0.042 |
| 10 | 0.066 |
| 12 | 0.094 |
| 16 | 0.165 |
| 20 | 0.255 |

GLM Depth proposed 1275 mMD

**Design Results**

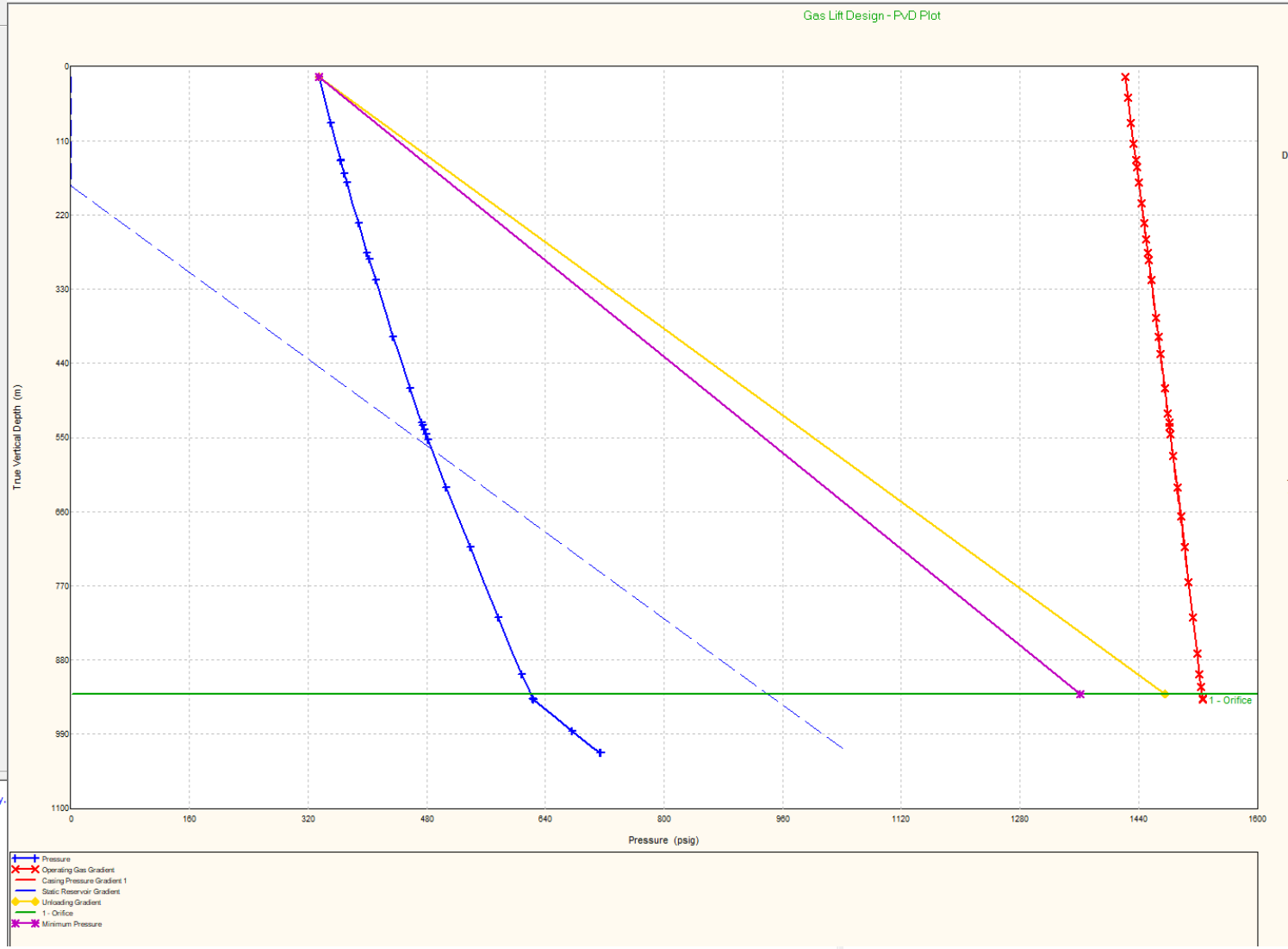
| | | |
|---|---|---|
| Actual Liquid Rate | 879.943 | STB/day |
| Actual Oil Rate | 131.991 | STB/day |
| Injected Gas Rate | 1.18902 | MMscf/day |
| Injection Pressure | 1421 | psig |

**Design Narrative**

The OIL RATE is being checked for conformance with the IPR.
The GAS INJECTION RATE may be changed to ensure consistency.
This option is slower so please be patient...
Operating Valve Number 1 @ 1275.2 (md) 929.535 (tvd) (m)
Operating Valve Number 1 @ 1274.81 (md) 929.472 (tvd) (m)
Operating Valve Number 1 @ 1274.13 (md) 929.431 (tvd) (m)
Operating Valve Number 1 @ 1273.59 (md) 929.407 (tvd) (m)

GasLift Design - NEW WELL

Done Main Scales Labels Details Select Font Replot Output Colours Variables Test Data Help



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# Well Objective & Scope Of Work

## Objective

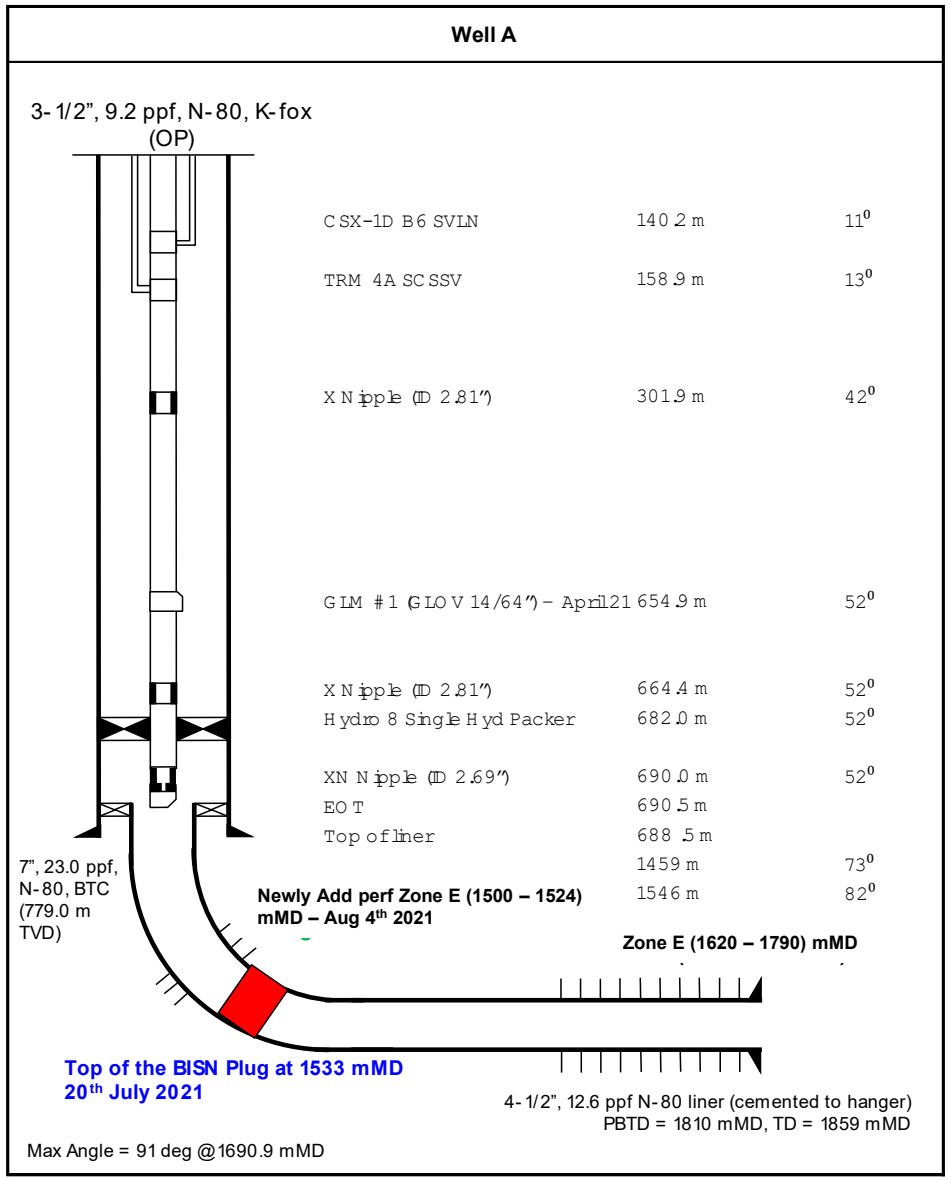
To install deepening gas lift system via CTU to extend gas lift injection point.

## Scope of Work

1. SLK: TCC, Tag TD,
2. SLK: SBHP
3. SLK: 2.80” wire scratcher, set PXN plug at XN-Nipple @ 690.0 m-MDRKB
4. PMP: Tubing Integrity Test
5. N2 Kickoff to flow test at 1280 mMD
6. SLK: Retrieve GLOV at GLM #1 @ 654.9 m-MDRKB
7. PMP: Full system integrity test (annulus-packer-tubing-plug)
8. SLK: Retrieve catcher sub and plug @ 690.0 m-MDRKB
9. CTU: Drift with 2.50’’ Drift Ring JetBLASTER until 1300m and perform N2 Kickoff
10. CTU: Deploy ~625m of 1.5” CT with DGL Assembly into the well across GLM #1
    - i. Run #2a: DGL tail pipe assembly
    - ii. Run #2b: Set lower widepak
    - iii. Run #3: RIH anchor seal assembly to test lower Widepak
    - iv. Run #4: Set gas injection tube
    - v. Run #5: Set upper widepak
    - vi. Run #6: RIH anchor seal assembly to test upper Widepak

## Justification

- Well unable to flow due to liquid level below GLM #1. Potentially due to low GOR (observed from SITHP vs FWS) and high water cut at the perf zone.
- Only 1 active OP producing from Zone E area - recently perf-ed Well B (280 bopd)
- SBHP is to derisk RCOS for 2027 redrill in Zone E, last SBHP in 2022



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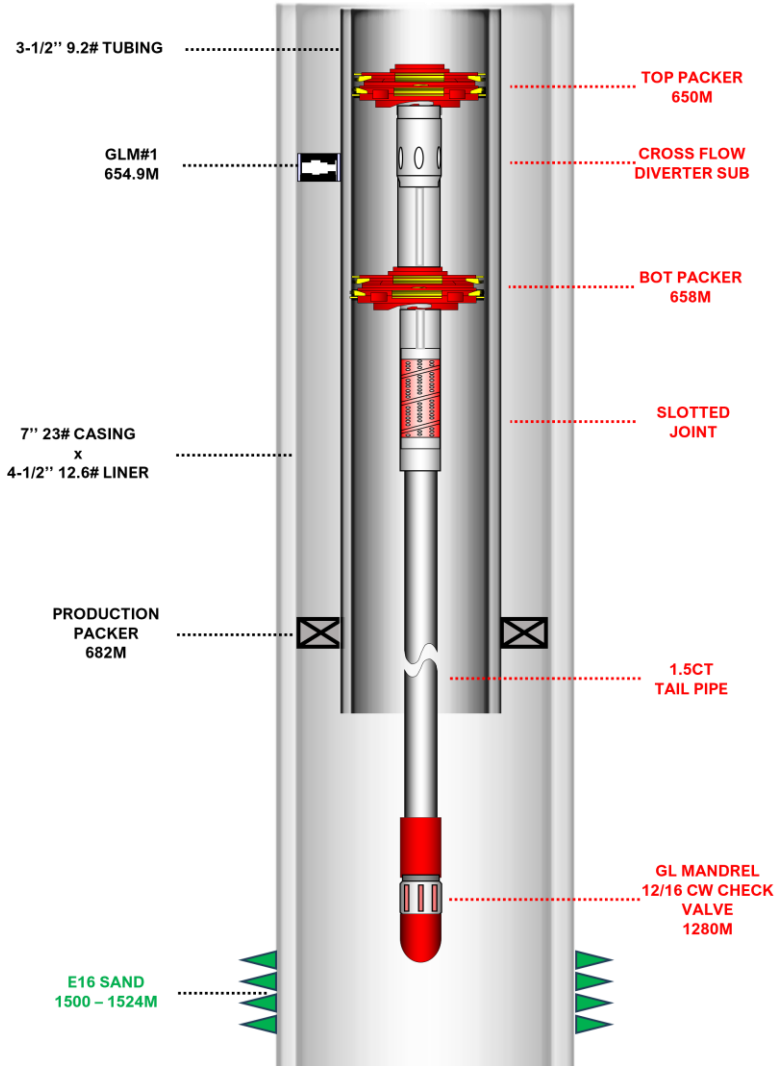
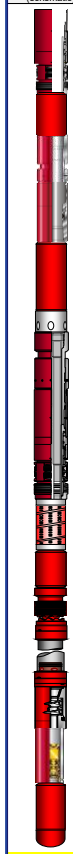
# Well Objective & Scope Of Work




## Post Deepening Gas Lift Installation

1. The existing GLOV is retrieved prior to DGL installation
2. The bottom and top packers will isolate the GLM, enabling gas lift to be diverted downhole and exit at the GL Mandrel (1280 mMD)
3. A total of 630 m tailpipe will be installed, extending from 654.9 mMD to 1280 mMD
4. The deepening extends beyond the production packer and EOT, entering the 4-1/2" liner

| TITLE | COMPLETE 3-1/2" DEEP GAS LIFT SYSTEM | | | | |
|---|---|---|---|---|---|
| Customer | Exxon | Weatherford Location | Malaysia | Job Number | |
| Contact | | Operation | | Prepared by | LAI |
| Field/Well Number | SmB-13 | Rig/Platform | | Date | 8/31/2025 |

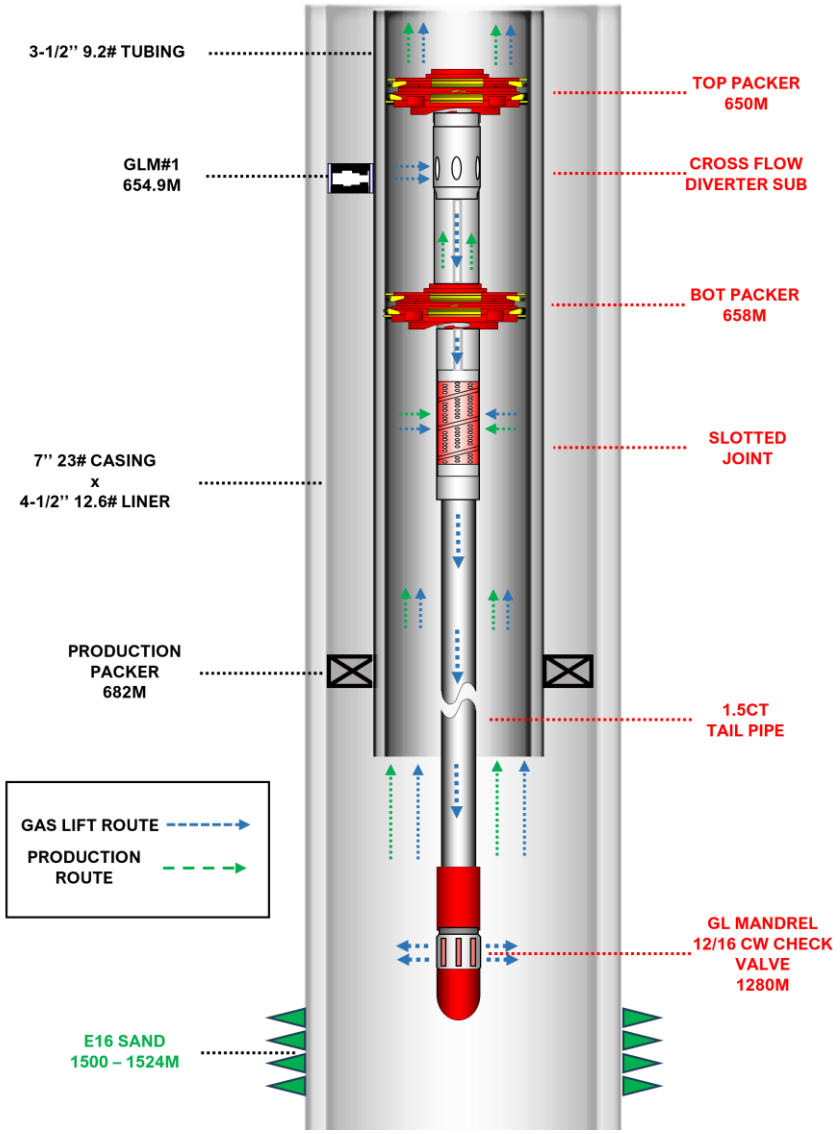
| BHA (schematic) | Item | Description | OD (in.) | ID (in.) | Length (ft.) | Fish Neck | Top Depth (FT) | Bottom (FT) | Remark |
|---|---|---|---|---|---|---|---|---|---|
|  | 1 | **Widepak SLE Packer + Extension Sub**<br>5,000 psi - Optional V3<br>Set Force: 22,225 lbf /Release Force: 3,700 lbf<br>2.344-10 STUB ACME-3G Box<br>Top - COE = 2.825 ft | 2.72 | 1.81 | 3.583 | 2.500-8 SPEC. BUTTRESS L.H. | 2,129.90 | 2,133.49 | Upper COE @650.02 m |
| | 2 | **Spacer Pipe**<br>2.344-10 STUB ACME-3G Pin x Pin | 2.375 | 1.995 | 9.000 | | 2,133.49 | 2,142.49 | Top of PJT @ 651.18 m |
| | 3 | **SO Tie-Back Stinger (Male)**<br>4 shear screws installed (1,238 lbf/screw)<br>4,952 lbf overpull required to sting out of receptacle<br>2.344-10 STUB ACME-3G Box | 2.72 | 1.75 | 1.083 | 2.72 | 2,142.49 | 2,143.57 | Top of SPM @ 654.86 m |
| | 4 | **SO Tie-Back Receptacle (Female)**<br>2.344-10 STUB ACME-3G Box<br>3" GS Profile | 2.72 | 2.32 | 1.292 | 3" GS | 2,143.57 | 2,144.86 | |
| | 5 | **Spacer Pipe**<br>2.344 - 10 STUB ACME-2G Pin X Pin | 2.375 | 1.995 | 9.000 | | 2,144.86 | 2,153.86 | |
| | 6 | **Crossflow Diverter Sub**<br>Flow area 1.34 sq in Injection area 0.301 sq in<br>2.344 - 10 STUB ACME-3G Box x Pin | 2.7 | ported | 0.833 | | 2,153.86 | 2,154.70 | |
| | 7 | **272 WidePak Anchor Seal Assembly**<br>2.344-10 STUB ACME-3G Box x 2.275 STUB ACME Pin<br>Release force: 6,475 lbf | 2.72 | 1.74 | 1.375 | | 2,154.70 | 2,156.07 | Bottom of SPM @ 656.86 m |
| | 8 | **Widepak SLE Packer + Extension Sub**<br>5,000 psi - V3<br>Set Force: 22,225 lbf/Release Force: 3,700 lbf<br>2.344-10 STUB ACME-3G Box<br>Top - COE = 2.825 ft | 2.72 | 1.81 | 5.440 | 2.500-8 SPEC. BUTTRESS L.H. | 2,156.07 | 2,161.51 | LOWER COE @658 m |
| | 9 | **Slotted Joint**<br>2.344 - 10 STUB ACME-3G Pin x 2.063 - 10 STUB ACME Box | 2.375 | 2 | 1.567 | | 2,161.51 | 2,163.08 | |
| | 10 | **Gas Injection Tube PBR**<br>2.063 - 10 STUB ACME Pin x 2.063 WTS-8 Pin | 2.39 | 1.47 | 0.750 | | 2,163.08 | 2,163.83 | |
| | 11 | **CT Connector x Quick Connect**<br>2.063" WTS-8 Box X Pin | 2.625 | 1 | 2.073 | | 2,163.83 | 2,165.90 | |
| | 12 | **1.5" Coiled Tubing** | 1.5 | 1.282 | 2029.000 | | 2,165.90 | 4,194.90 | |
| | 13 | **CT Connector**<br>1.9" NU Pin | 2.2 | 1 | 1.038 | | 4,194.90 | 4,195.94 | |
| | 14 | **Dual Flapper Check Valve**<br>1.9" NU Box x Pin | 2.2 | 0.91 | 1.131 | | 4,195.94 | 4,197.07 | |
| | 15 | **PM-1 Mandrel**<br>C/W Check valve , orifice (CV-SO) : port size 12/64<br>1.9" NU Box X Box | 2.25 | NA | 2.500 | | 4,197.07 | 4,199.57 | Injection Point 1280.03 m |
| | 16 | **Pup Joint**<br>1.9" NU Pin X Pin | 2.2 | 1.38 | 3.000 | | 4,199.57 | 4,202.57 | |
| | 17 | **Bull Plug**<br>1.9" NU Box | 2.2 | N/A | 0.500 | | 4,202.57 | 4,203.07 | |
| Distance Between Elements:26.17 ft | | | | | | | | | |

Overall BHA Length (ft.) 44.16

| Verified by | |
|---|---|
| Date | 23/2/2024 |

**Note:** All dimensions are approximate until verified by Weatherford supervisor in the field prior to run in hole.

# Well Objective & Scope Of Work

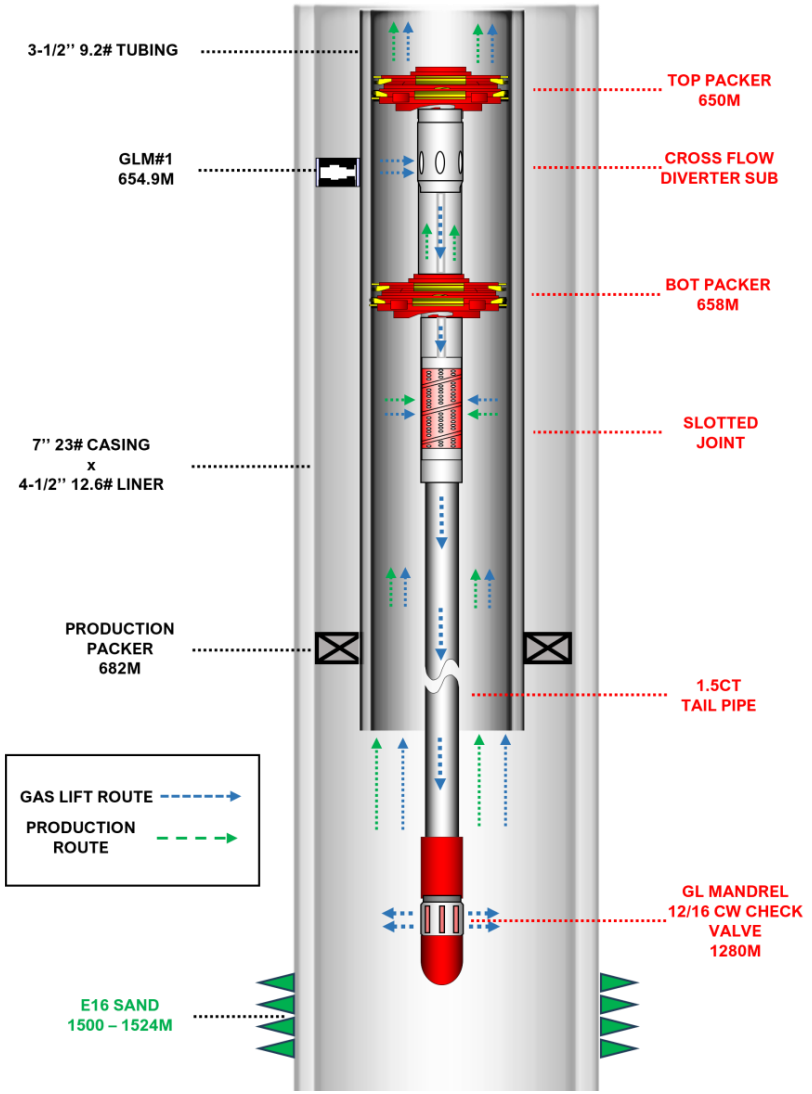



## Injection Gas and Production Direction

1. Gas lift injection initiated through GLM#1 at 1420 psi with an injection rate of 0.92 MMSCF/D
2. Injection gas flows downhole via the 1.5" CT tail pipe and exits through the GL Mandrel at 1280 m
3. The injected gas mixes with production fluids and flows upward along the tail pipe annulus
4. The gas–liquid mixture enters the slotted liner and continues its flow toward surface

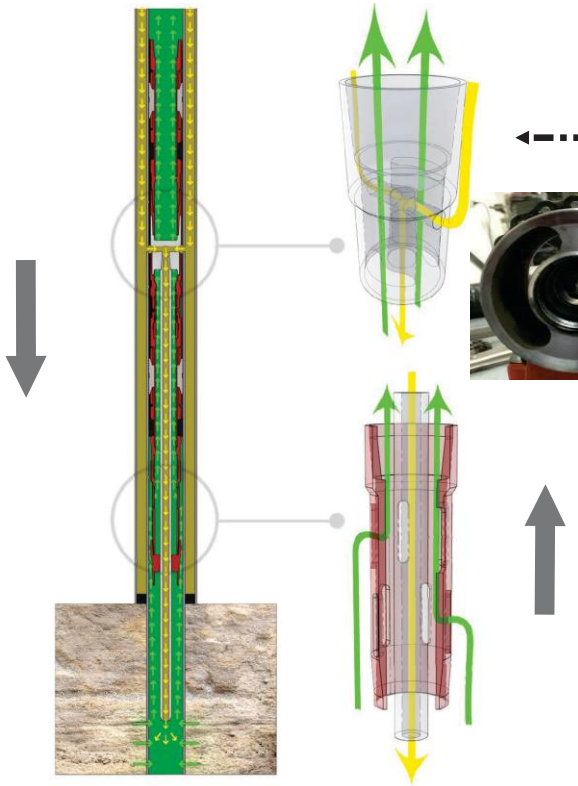
[Open]

# Well Objective & Scope Of Work




## Injection Flow Regime

1. Injection gas down casing annulus
2. Enters WIDEPAK Straddle via punched tubing ,SPM or SSD
3. Into annular ports on cross flow sub & down stinger tube & injection string – CT or small pipe



## Crossflow sub

Allows simultaneous injection & production

Flow area for 3.5 system

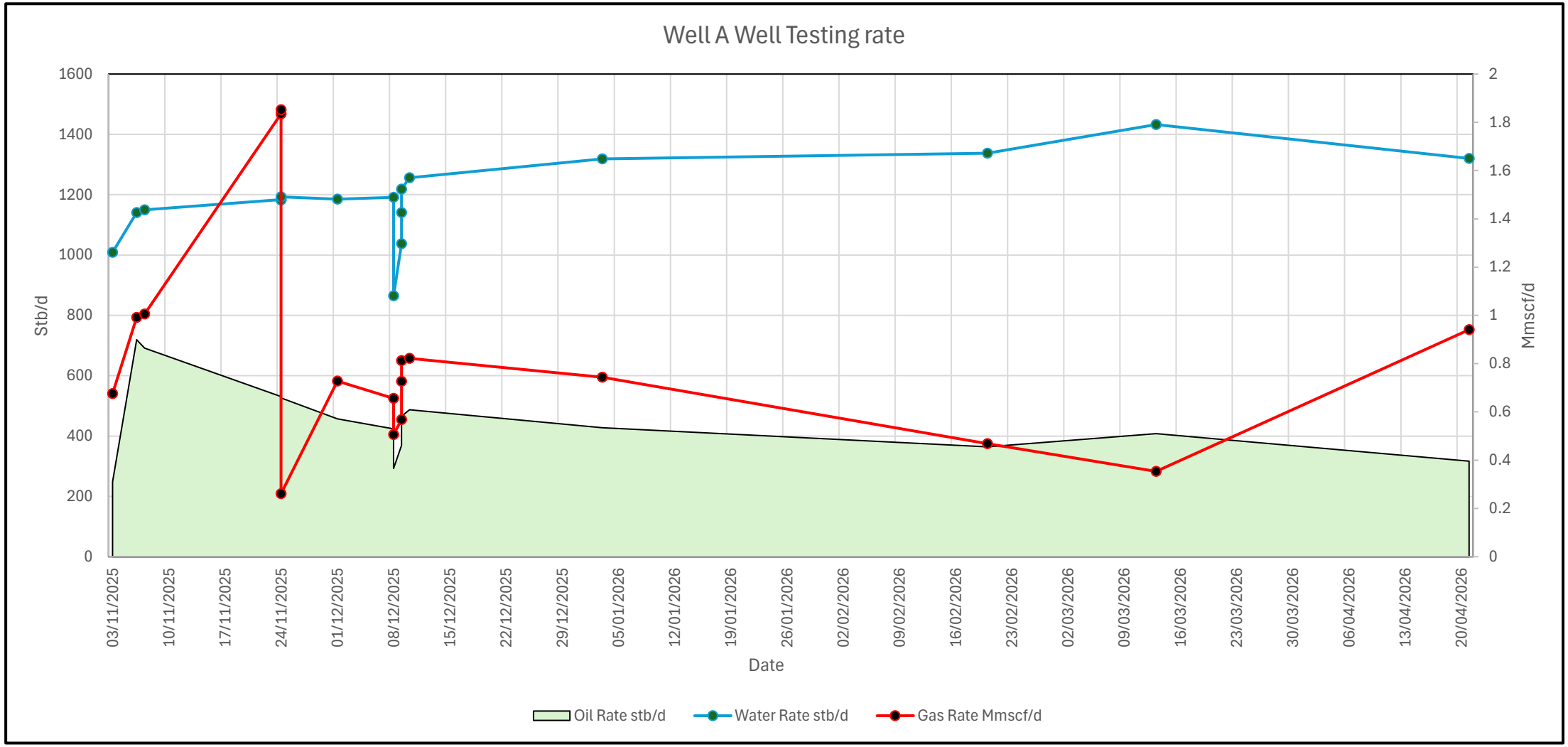
- Production: 1.16 $in^2$
- Injection: 0.78 $in^2$

## Production Flow Regime

1. Production via injection string annulus
2. Into straddle via slotted pup joints
3. Up to cross flow sub via stinger tube / straddle annulus
4. Through cross flow sub to surface via upper packer and existing completion

[Open]

# RESULT POST INSTALLATION



# Conclusion



- The intervention successfully enabled stable deep gas lift injection and restored well deliverability.
- Selection criteria are crucial in selecting the right candidates via well diagnostic and well modelling.
- Plan for further assessment and replication of the technology on other wells with similar issue.

# Thank you

The Authors would like to thank PETRONAS Carigali Sdn. Bhd. for allowing the publication of this work.