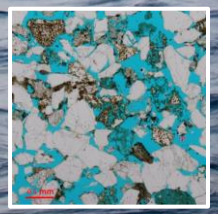
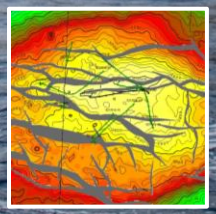
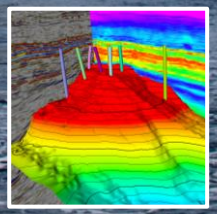
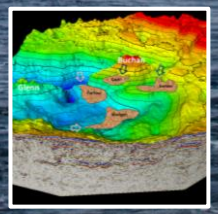
The Buchan Oil Field – The New Beginning

JERSEY OIL&GAS

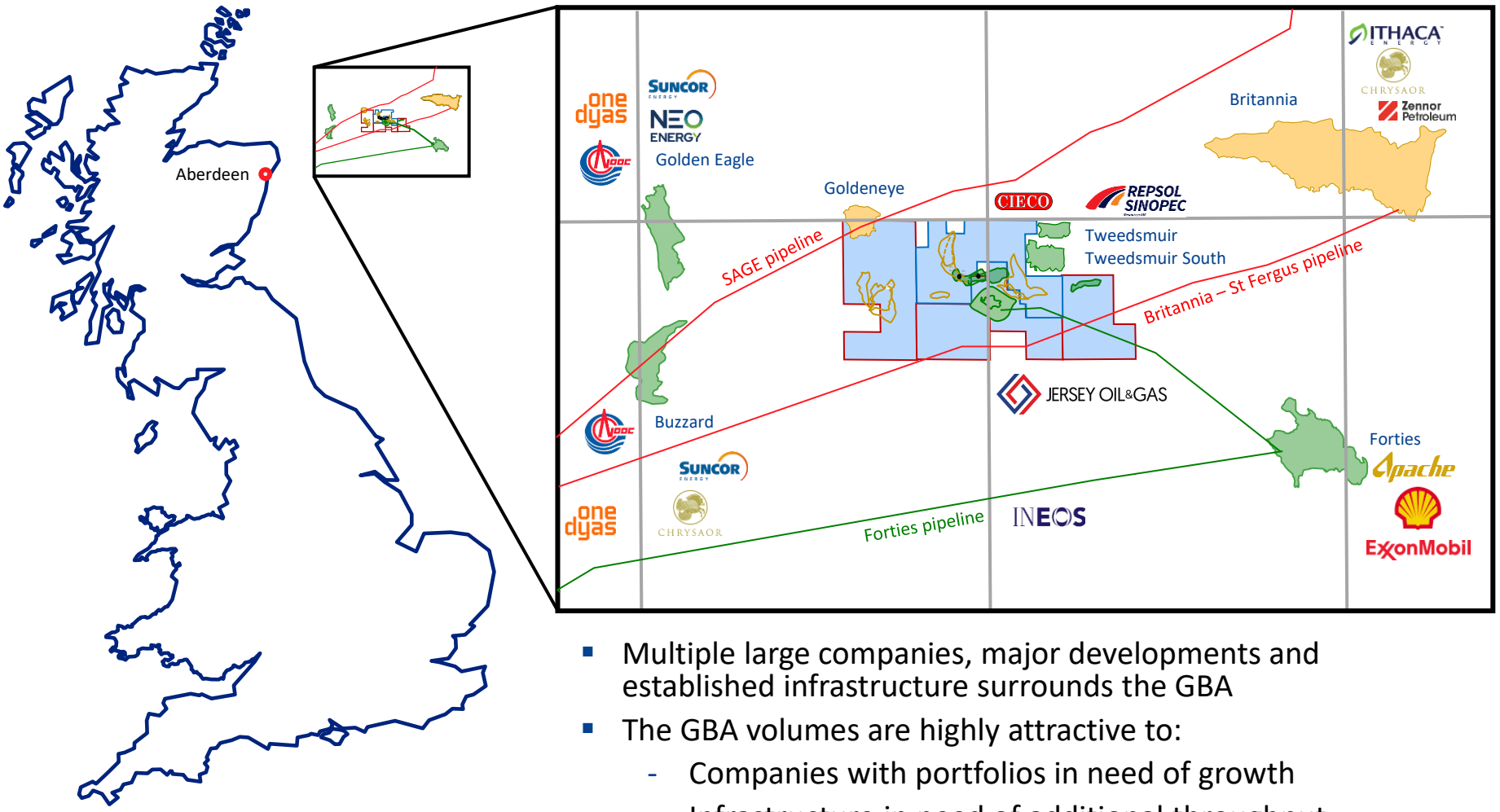
Technical Presentation



15th October 2020

The GBA sits in the heart of the Central North Sea



- Multiple large companies, major developments and established infrastructure surrounds the GBA
- The GBA volumes are highly attractive to:
  - Companies with portfolios in need of growth
  - Infrastructure in need of additional throughput

JOG's acreage in the Greater Buchan Area

Verbier

- P2170 Blocks Block 20/5b & 21/1d
- 88% operated working interest
  - CIECO 12%

Buchan & J2

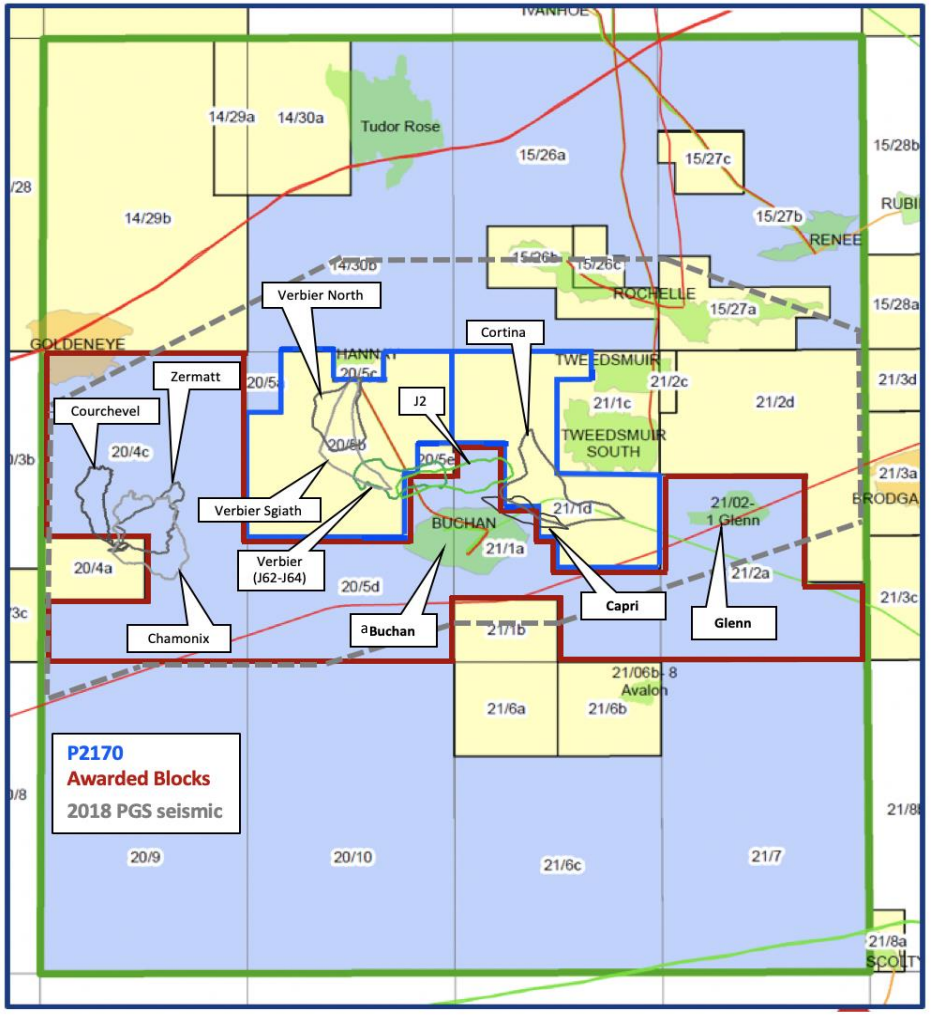
- P2498 Blocks 20/5a & 21/1a
- 100% working interest and operatorship
- Straight to Second Term (4 years)

Glenn

- P2499 Block 21/2a
- 100% working interest and operatorship
- Initial Term (Phase A - 2 yrs, Drill or drop)

Zermatt

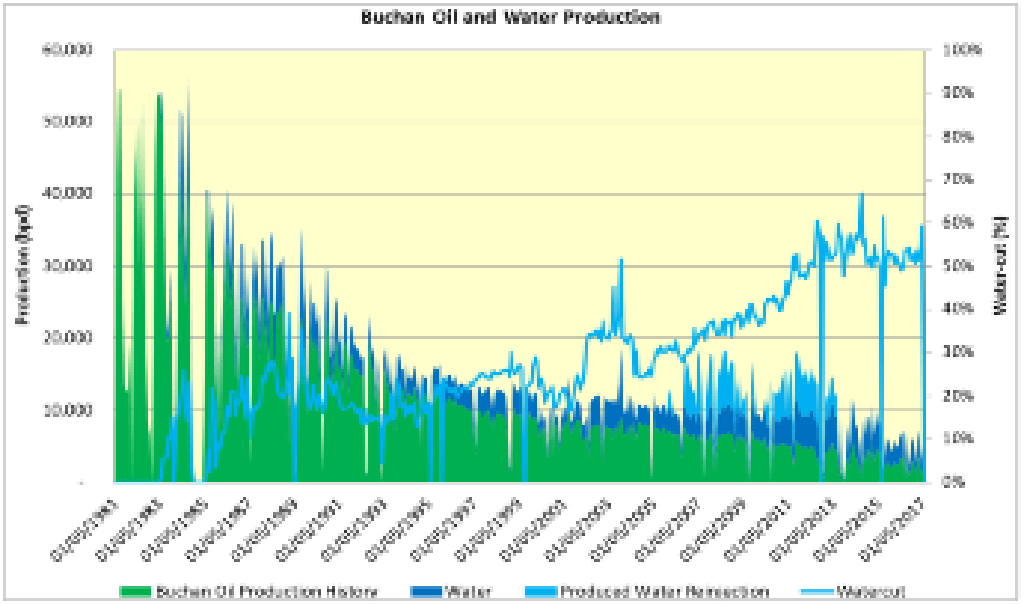
- P2497 Block 20/4c
- 100% working interest and operatorship
- Initial Term (Phase A - 2 yrs, Drill or drop)



Substantial potential hub asset with opportunity for multiple tie-backs

Buchan history

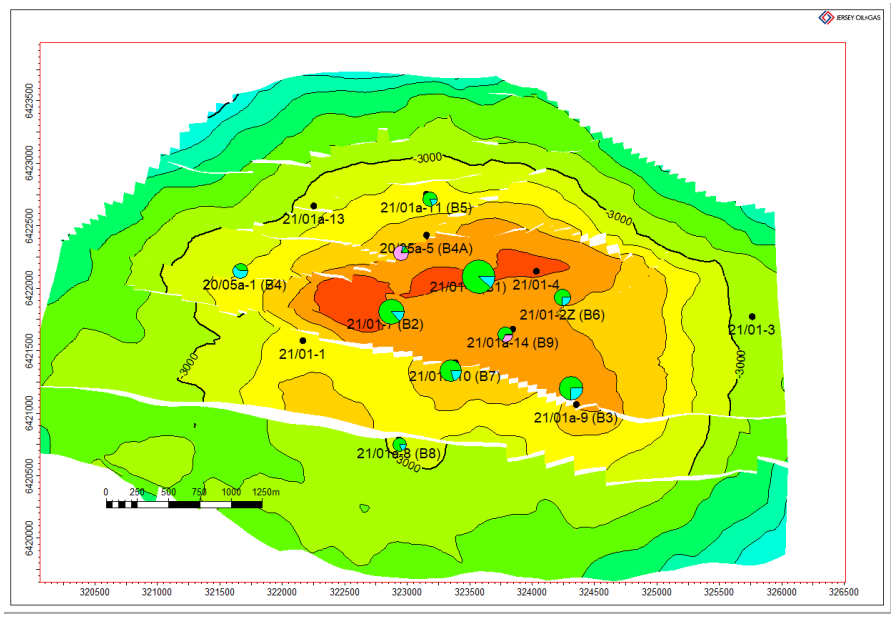
- Field production 1981-2017, 147Mmbbls produced
- Reservoir: Devonian age Buchan Group sandstones. Dual porosity system
- Seal: Lower Cretaceous mudstones
- Production via FPV Buchan Alpha, taken off station 2017 due to failed safety case
- Producing 3500 BOPD at COP with 50% WC
- Solid production history allows DCA for remaining resource estimation, independent of STOIIP and recovery factor based estimates
- Open fracture system provides flow to well bores but volumetrically insufficient for recovered volumes implying substantial matrix contribution
- New seismic data has resulted in a revision to the view of the field structure and origin with positive implications for more accurate dynamic modelling

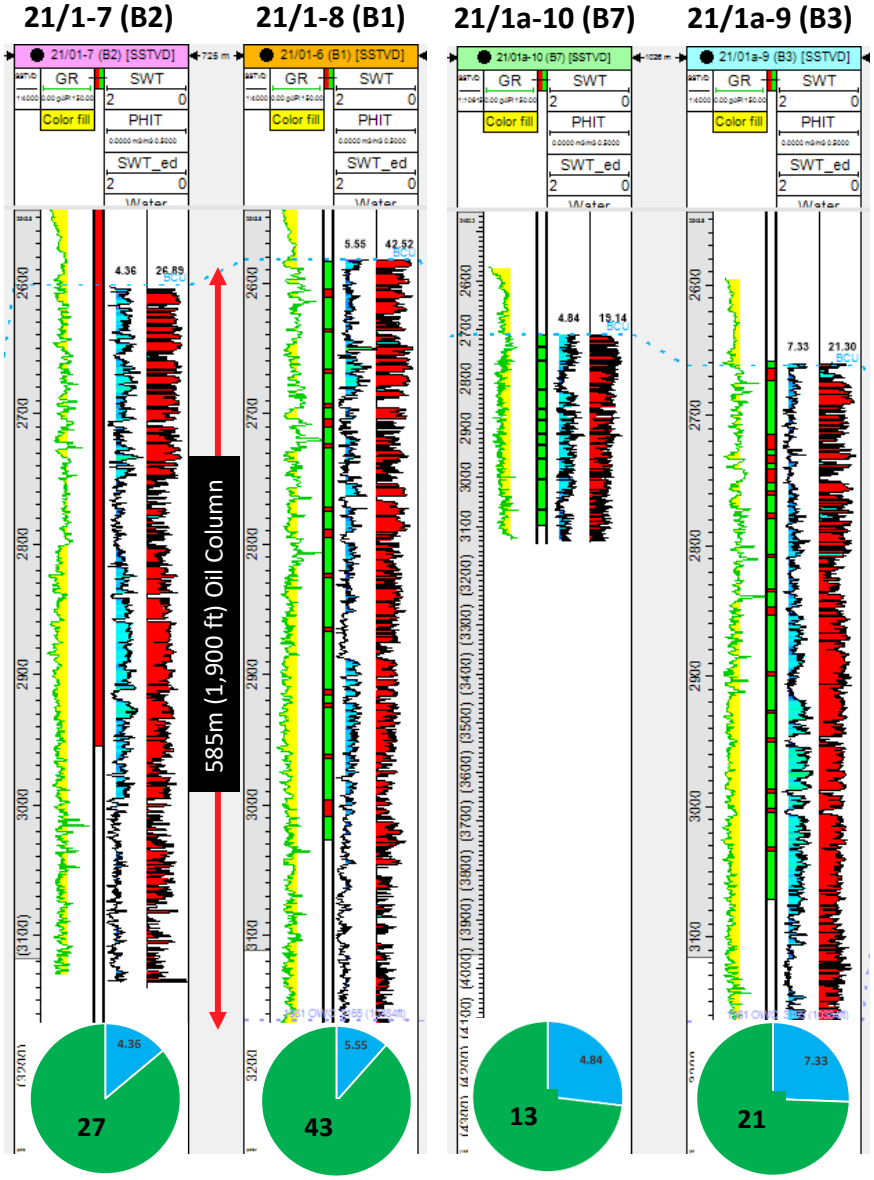


Property	Units	Value	Comments
Oil gravity	°API	33.5	
Formation Volume Factor	rb/stb	1.205	At 222°F, 7506 psig
Initial GOR	scf/stb	285	
Bubble point pressure	psig	1271	At 222°F
Oil viscosity	cP	1.025	At 222°F, 7506 psig

36 years of production history

Buchan producers



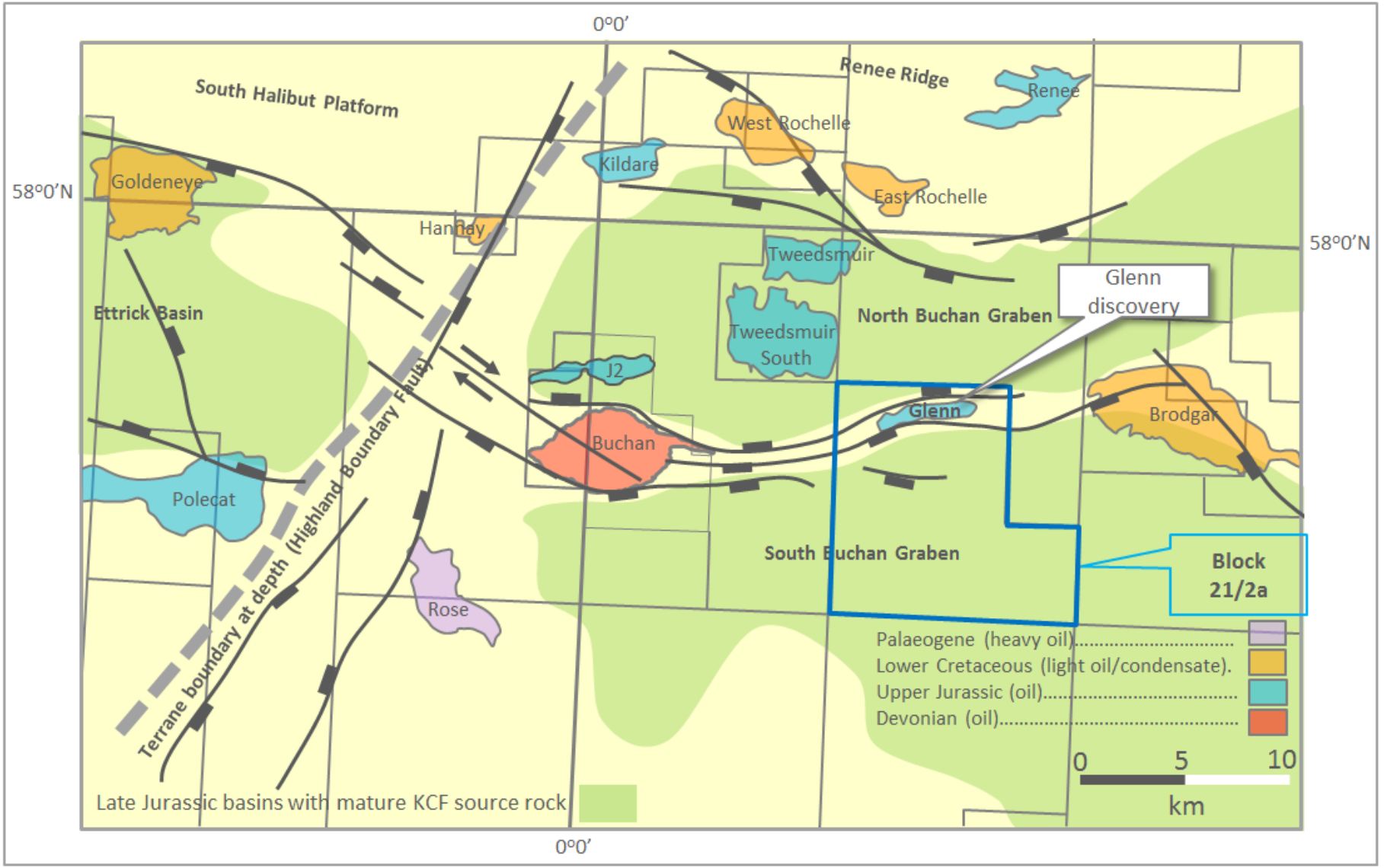


Key Reservoir Parameters

Oil Column: 585m (1900ft)
NTG: >70%
Porosity: <15% (up to 28%)
Perm: <20mD (0.02-200 mD)
Sw: 50-70%
Fm Water Salinity: 180000 ppm NaCl
OODT: 3155m
OWUT: 3173m
OOWC: 3164m

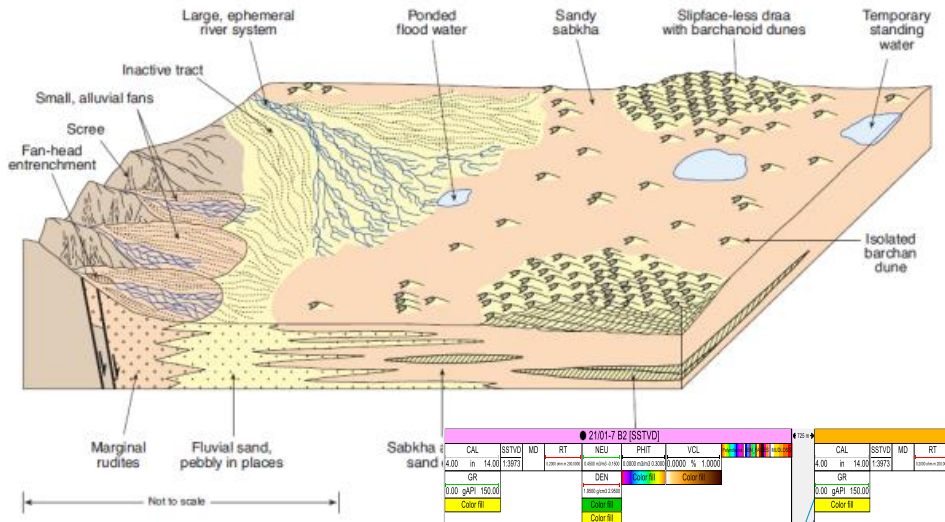
Significant oil production from core area

Tectonic elements of GBA



Tectonically active domain

Old Red Sandstone Depositional setting



Depositional Environments

- Arid fluvial
- Mostly braided and low sinuosity channels from Caledonian uplifts
- Axial or an alluvial fan system
- Predominantly subarkosic sandstones and siltstones with occasional thin shales and calcrete conglomerates.

High sinuosity fluvial and floodplain

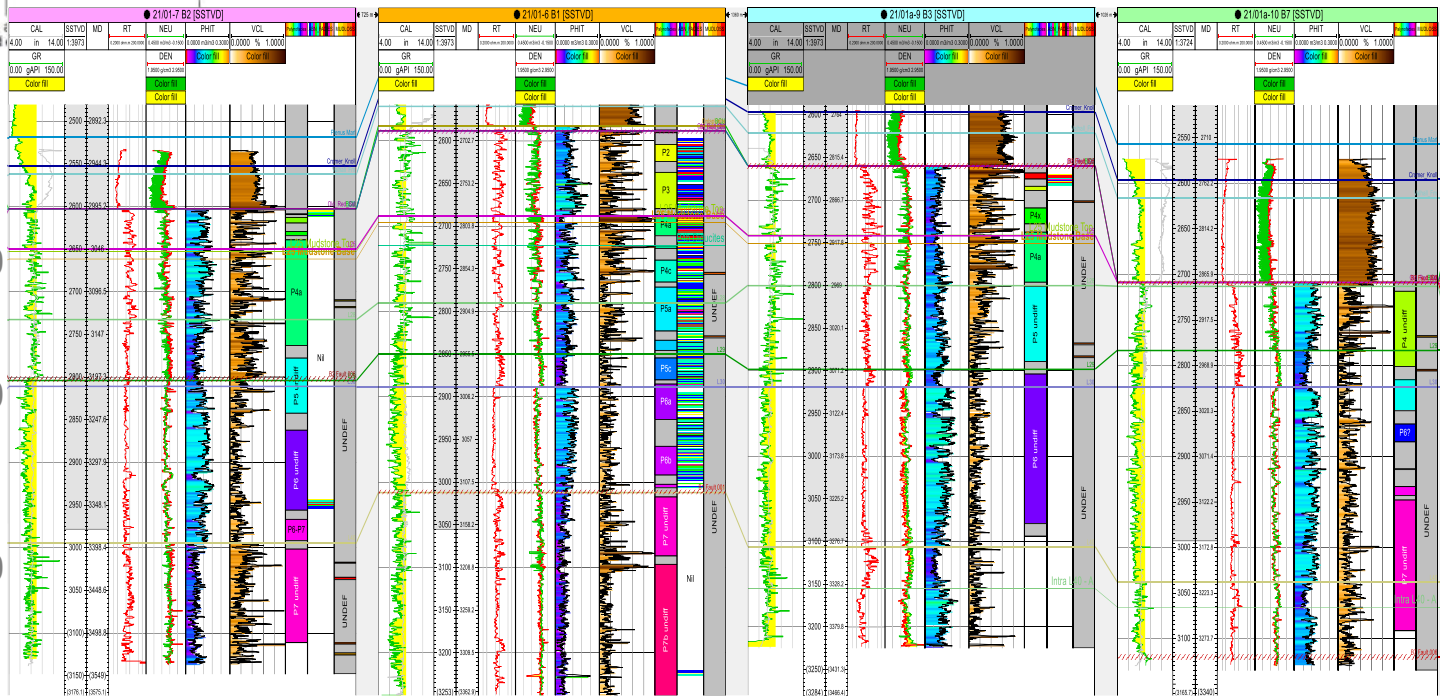
L20

L30

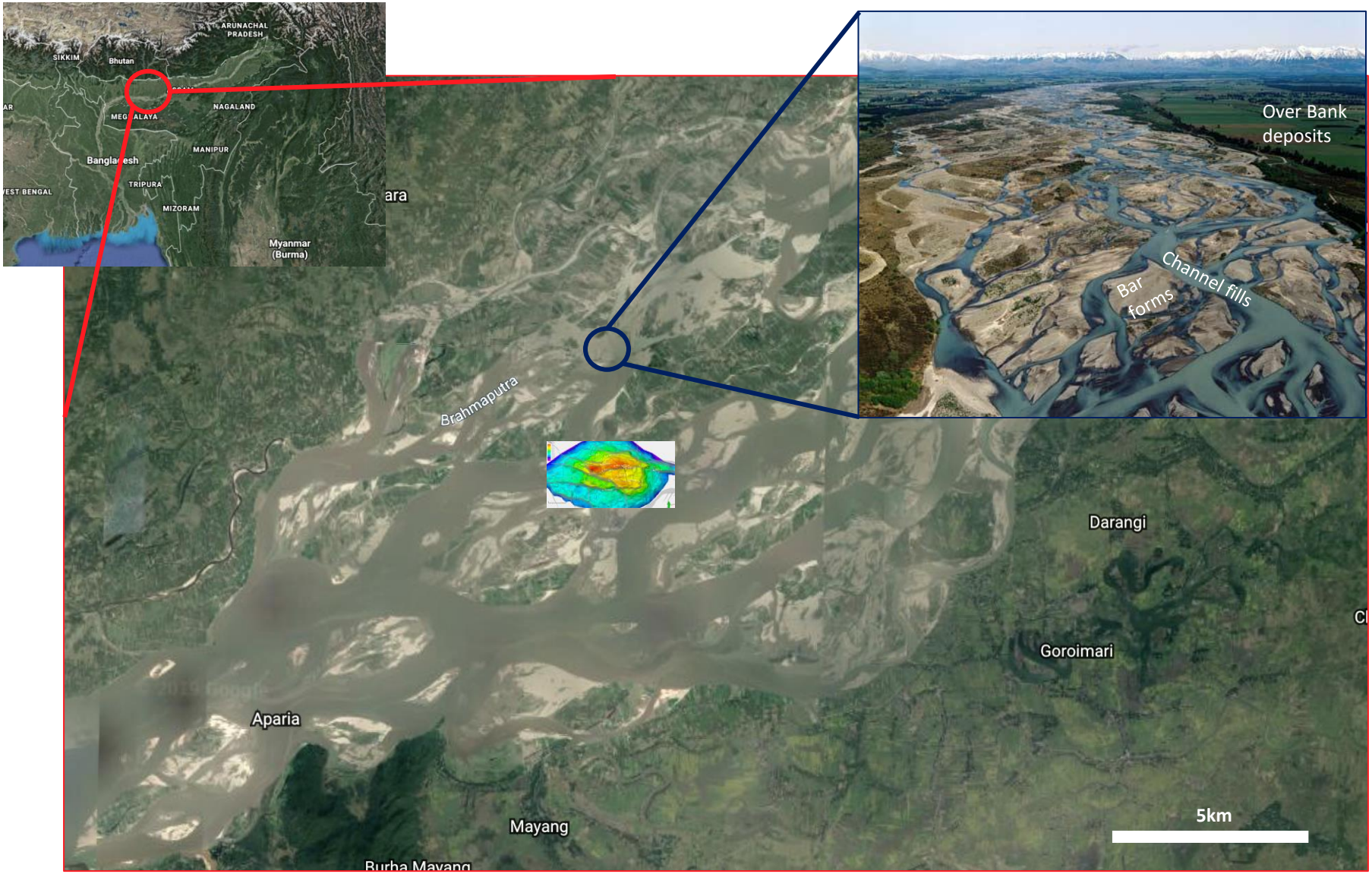
Braided fluvial

L40

Braided fluvial

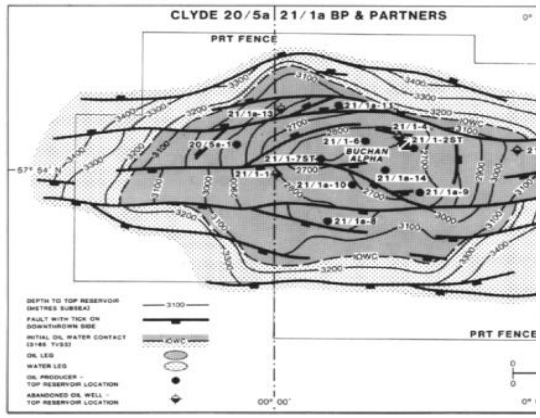


Old Red Sandstone Depositional setting

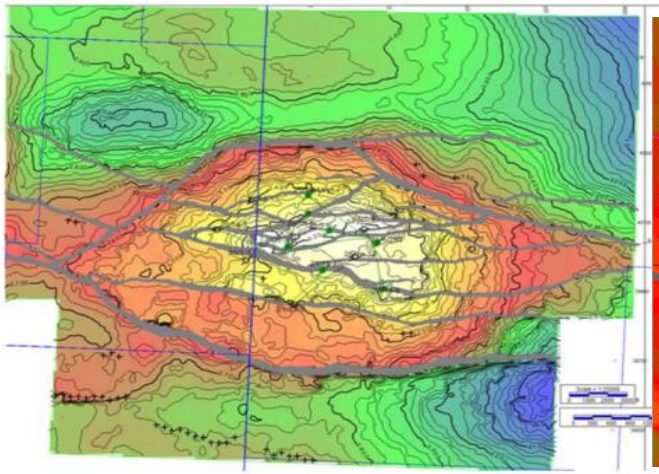


Sand rich system

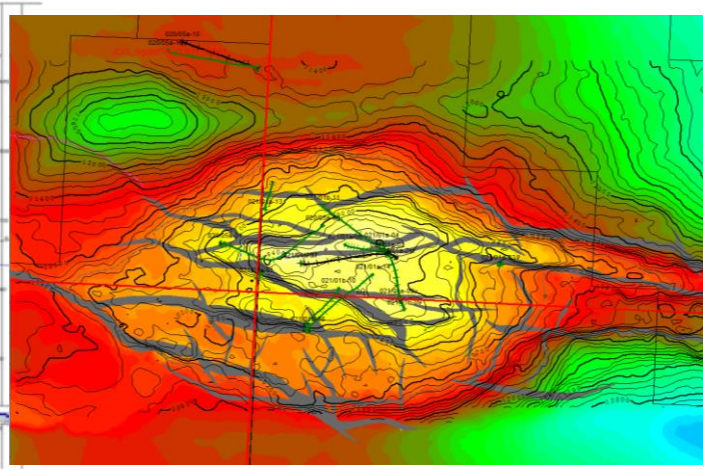
Evolution of Buchan field definition



1991

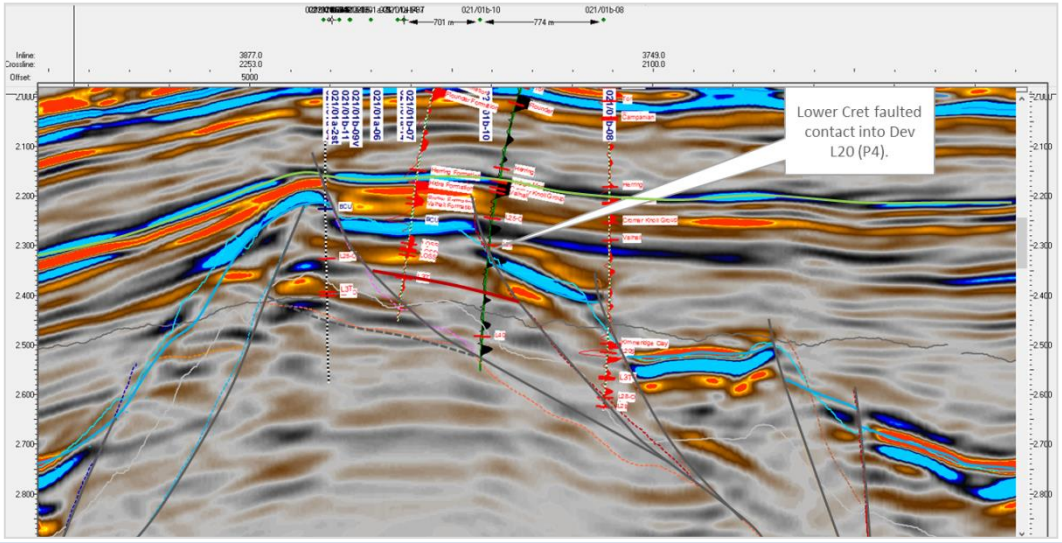


2014



2020

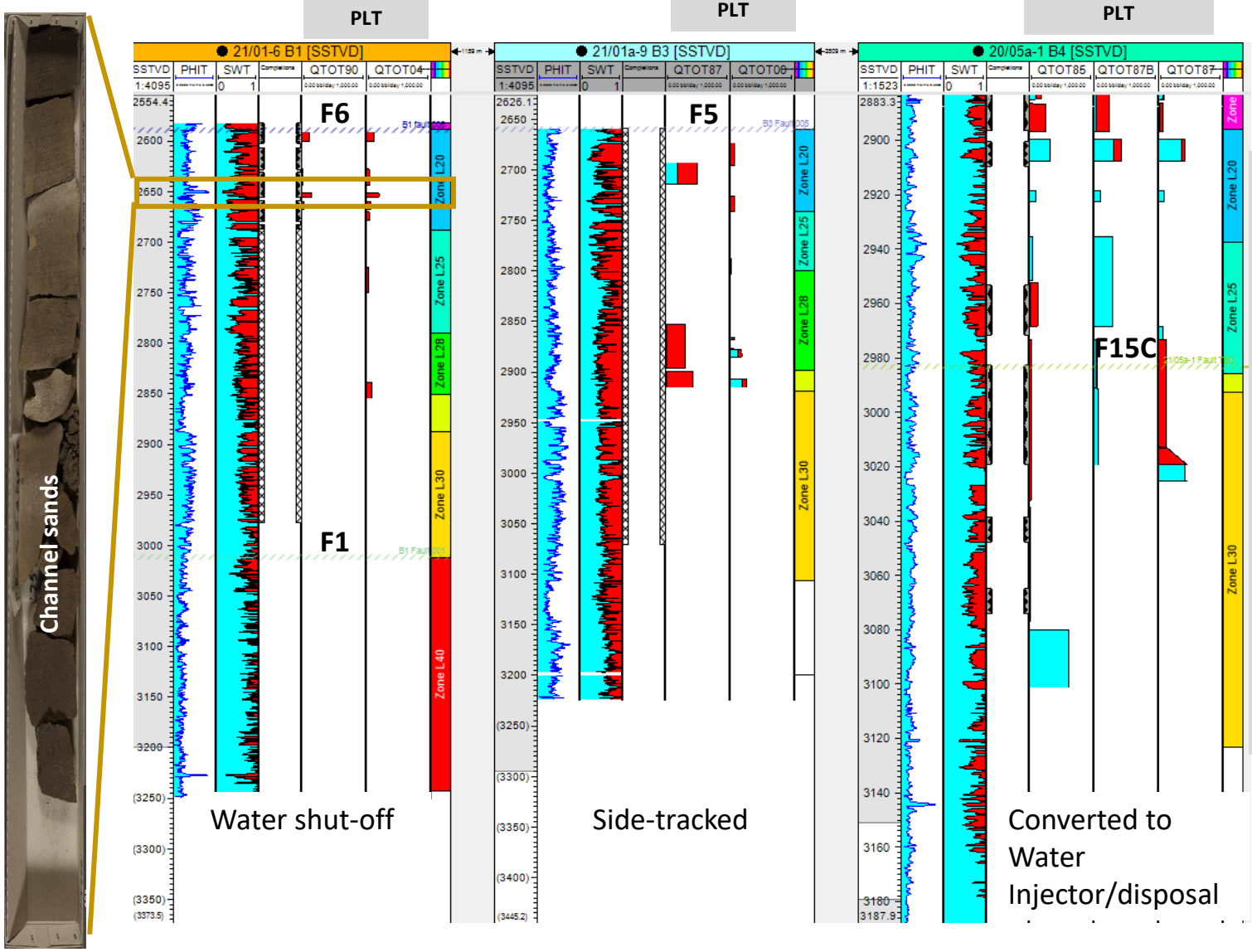
- Earlier mapping only recognised E-W faulting
- New seismic data has identified a secondary suite of N-S faults



Benefits of 2018 seismic data

- Fault framework revision
- Fault position uncertainty
- Lost section estimation
- Field –wide correlation and zonation
- Well-bore/fault correlation
- Fault intersection and flow indicators (PLT)
- Effective fracture network

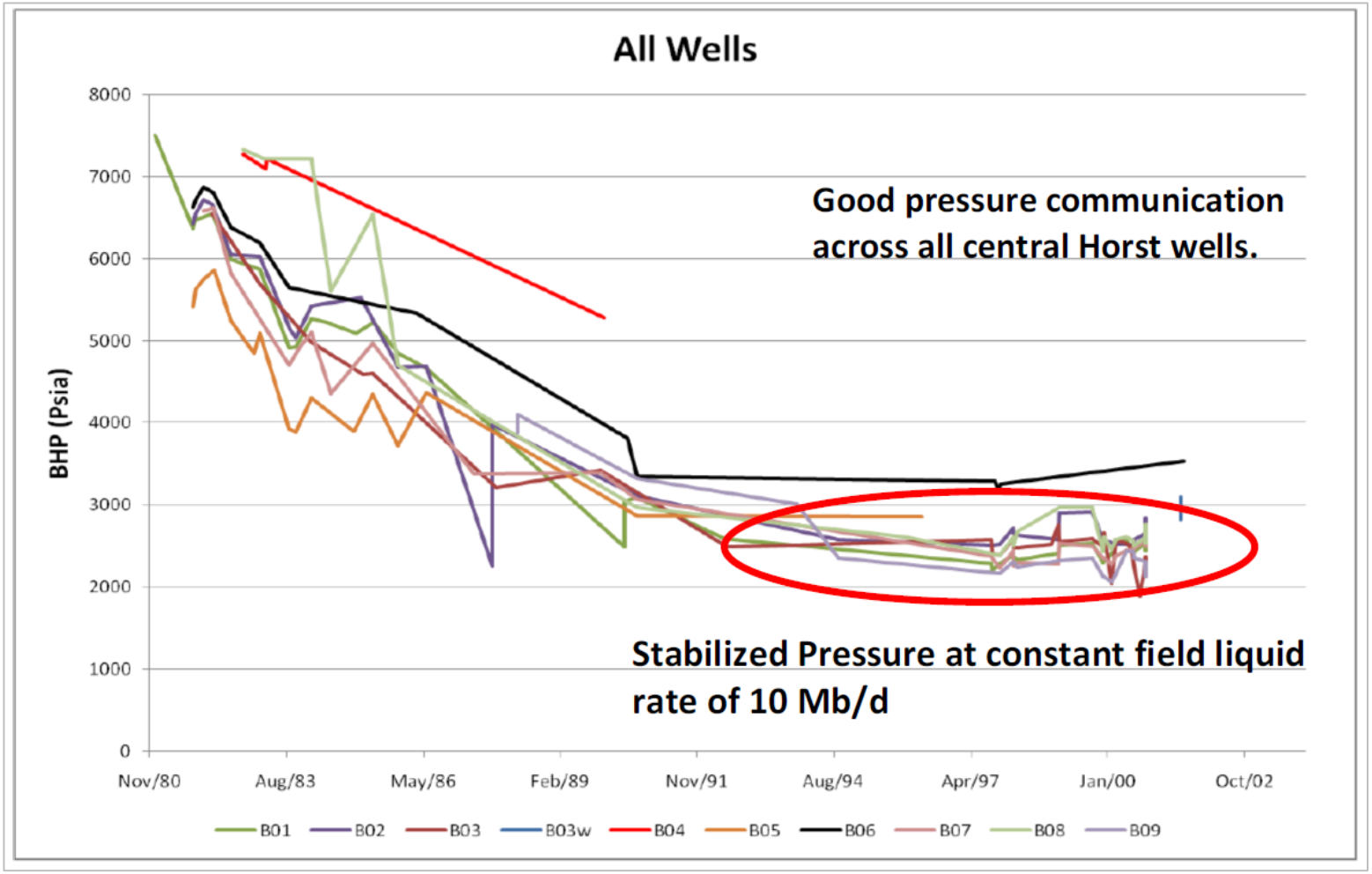
Success lies in structural mapping



- PLT was used for surveillance, WSO and sidetrack
- Integration of PLT with interpretation shows almost all producers have been drilled through faults, which have aided production as there are fracture corridors around these faults
- Significant production has also been attributed to channel sands

Integration of PLT with geological interpretation

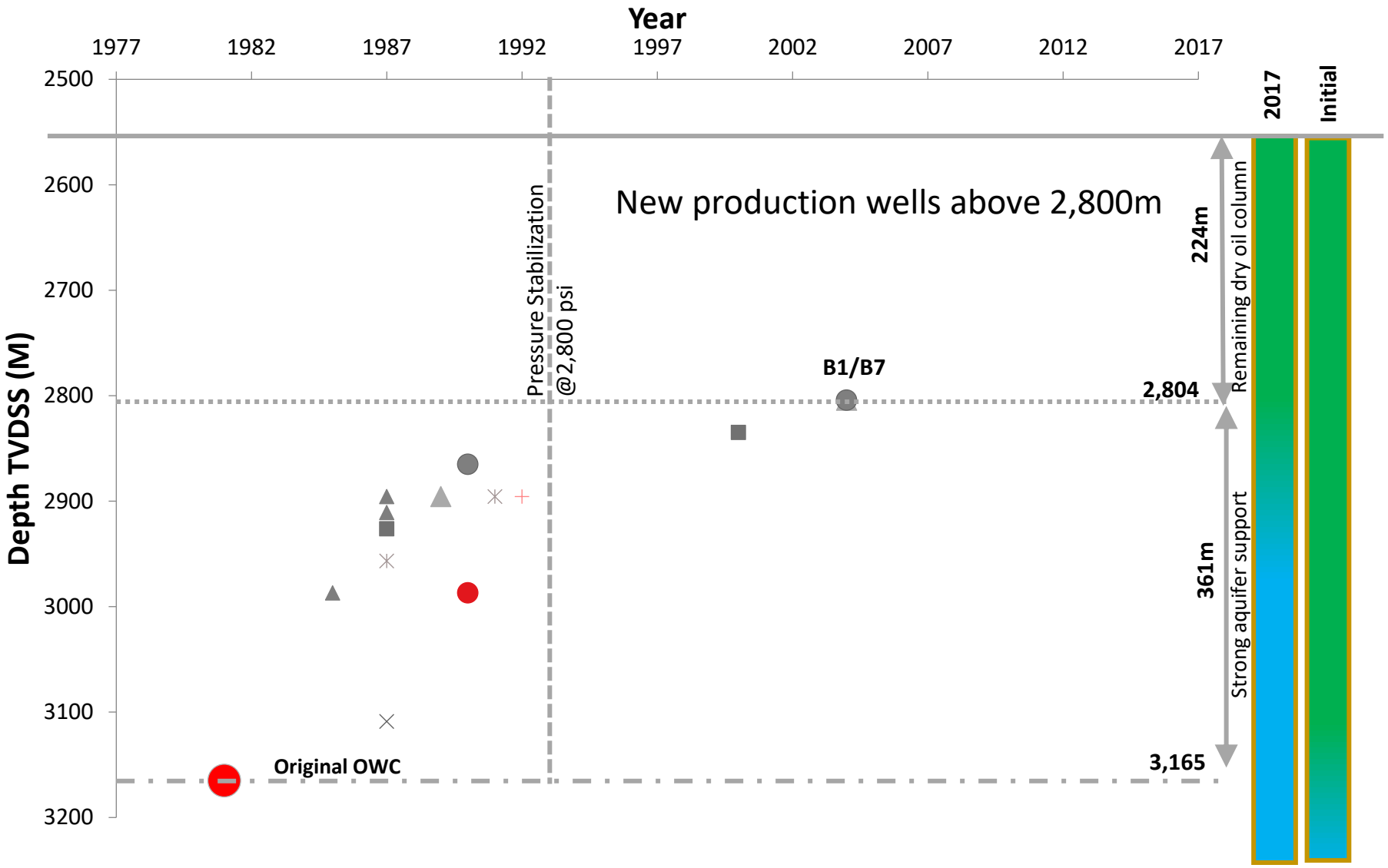
Buchan pressure data



Pressure Data

- All central horst wells on common trend (except B4 & B8)
- Pressure stabilized after ~1992

OWC movement through Time

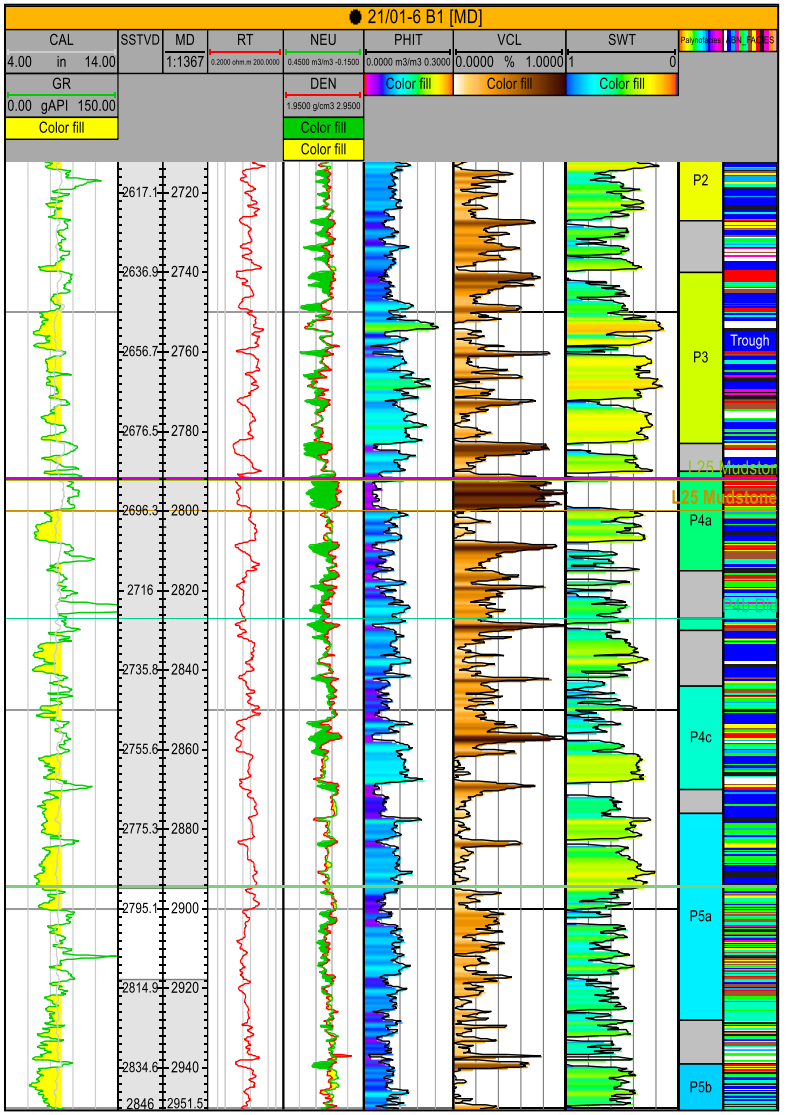


The Bubble point is 1,286 psi, while current reservoir press is above @2,500 psi; no Secondary Gas Cap

Significant column height

Facies associations

- Facies associations organised into a series of fining upward packages
- Floodplain
  - Mudstones
  - Finely laminated/ wave rippled siltstones
- Bar-top
  - Very fine to fine sandstones
  - Parallel laminated/wavy bedded
  - Current rippled sandstones
  - Parallel laminated sandstones
- Barform
  - Low angle plane bed stratified sandstones
  - Planar tabular cross-bedded sandstones
- Channel fill facies
  - Trough cross stratified sandstones
  - Massive sandstone
  - Intra-clast channel lag deposit / intra-formational conglomerate
  - Erosion surface



Buchan Facies Characterisation 21/1-6 (B1)

Trough cross stratified, poorly sorted, micaceous, medium to coarse grained sandstones

Often associated with conglomerates and massive sandstones

Multi-storey channel fill complexes or isolated channel units

Normally overlays channel fill

Planar tabular cross-bedded sandstones and to a lesser extent Low angle plane bed stratified sandstones

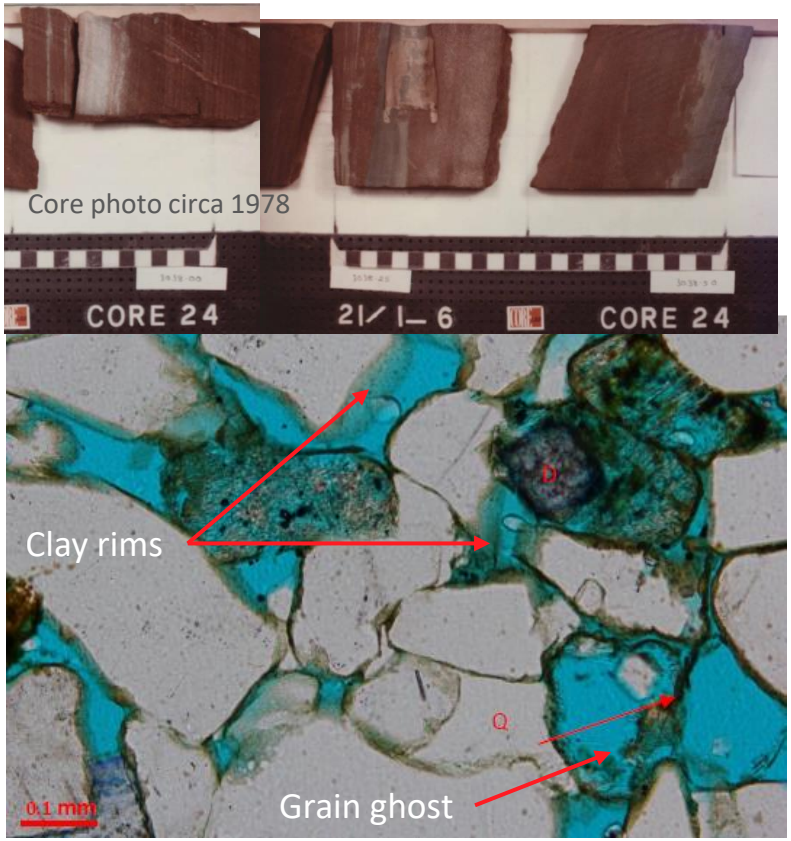
Moderately sorted fine sandstone

Overlay the bar form facies and maybe overlain by the floodplain facies

Finely laminated siltstones and mudstones
Very fine to fine sandstones Parallel laminated/wavy bedded very fine sandstone; Current rippled sandstones fine sandstone

Modification of exposed bar tops during the low stage of the fluvial system , calcretes and occasional bioturbation

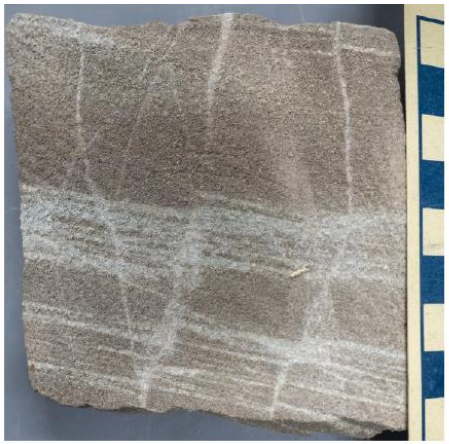
Cross-bedded sandstone
Sub-rounded grains; clay rims inhibit quartz cementation. Some pore filling calcite and feldspar replacing dolomite rhombi.
Cross-cutting cemented fracture



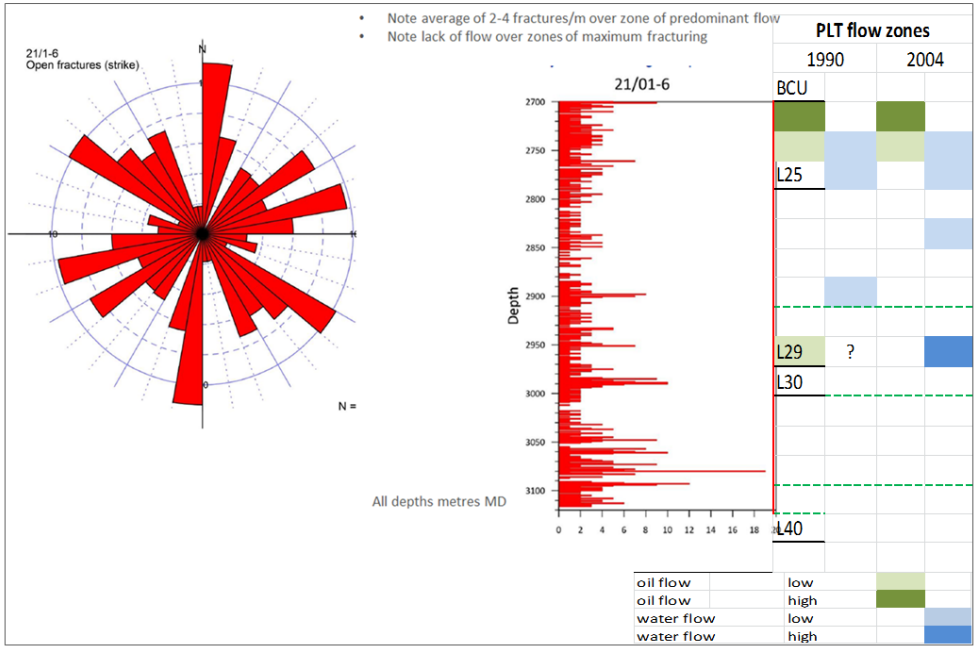
Cross-bedded, channel fill sandstone
Thick authigenic clay rims surround detrital grains, occlude pores and restricts quartz overgrowth. Plagioclase dissolution leaves grain ghosting clay rims; note lack of subsequent compaction.
Porosity – 16%

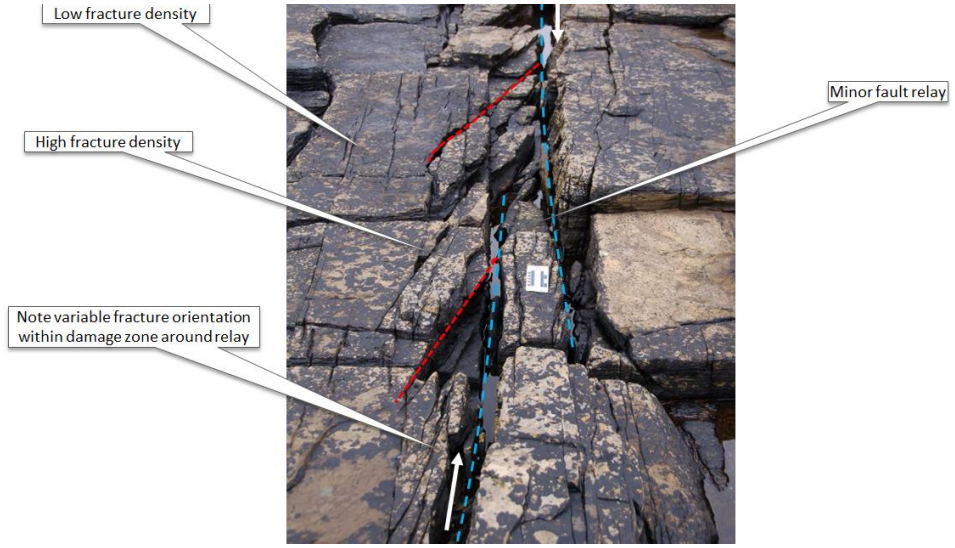
Buchan fractures

21/01-6 oil-stained fracture in channel fill sandstone with mud rip-up clasts - 2984m MD

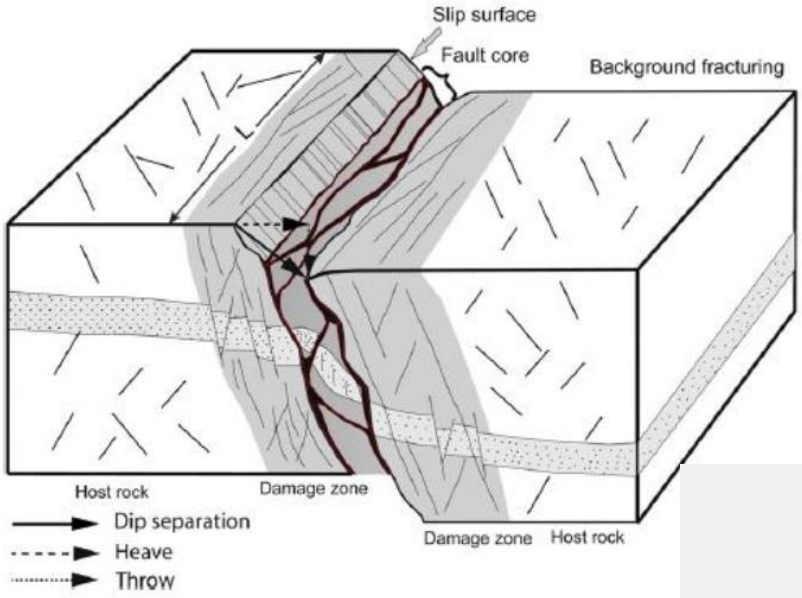


21/01-6 Deformation bands in planar bedded bar-form sandstone - 3080m MD

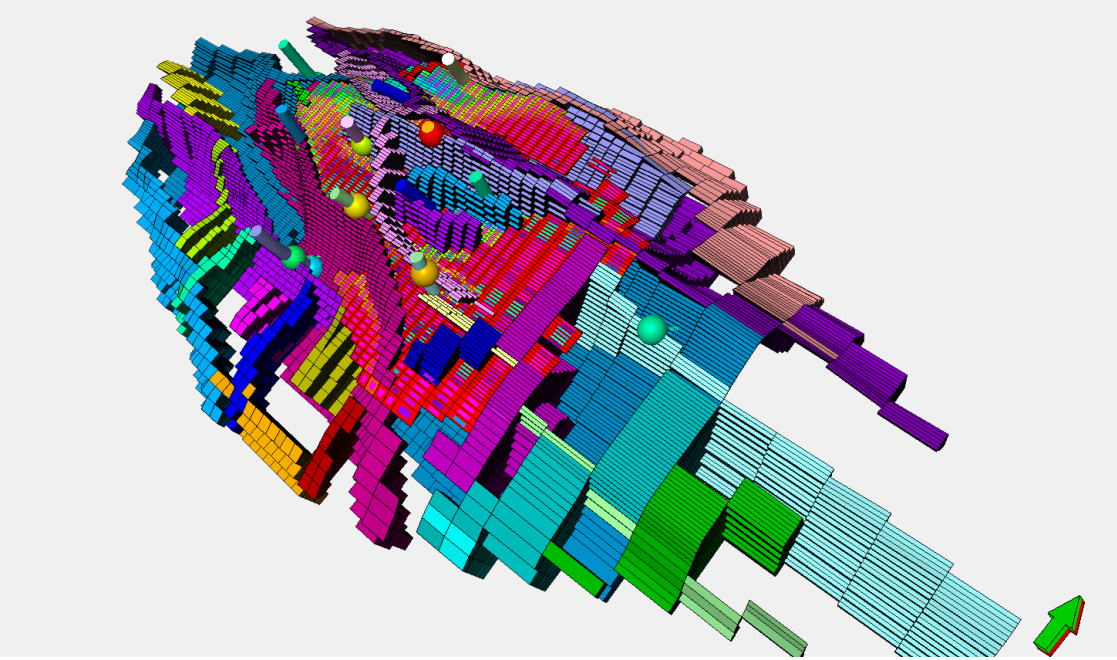




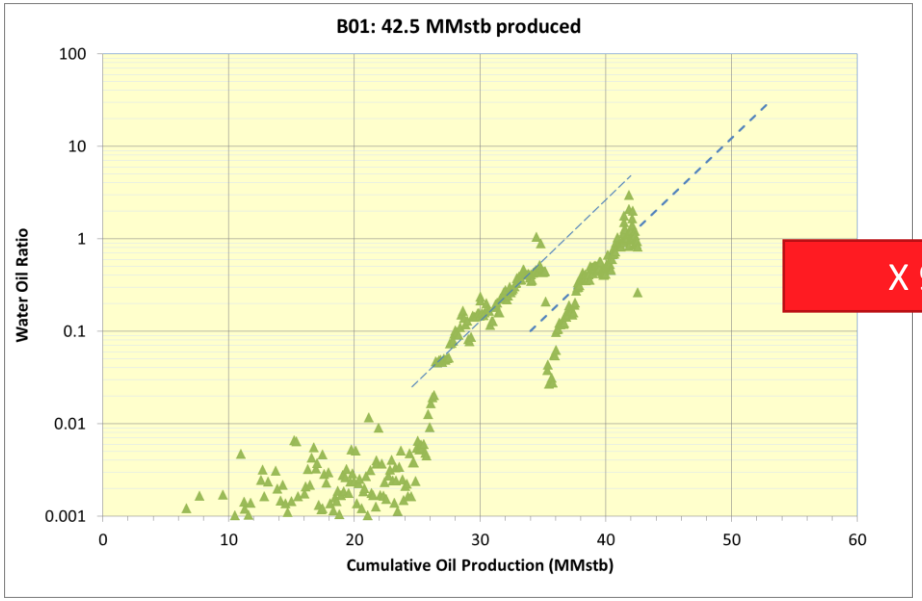
Fractures aid fluid flow



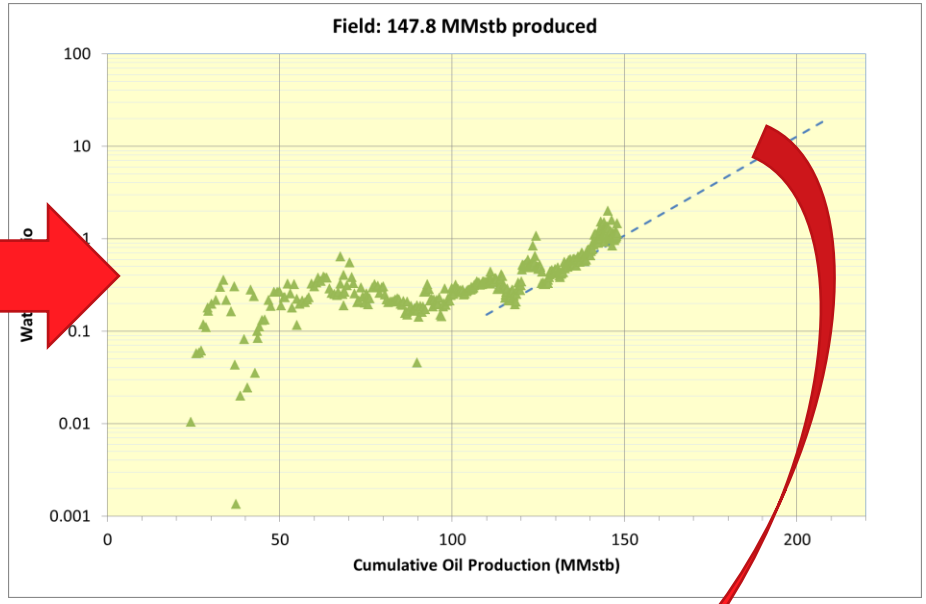
Fault framework model with fractures distribution



Buchan decline curve analysis vs simulation

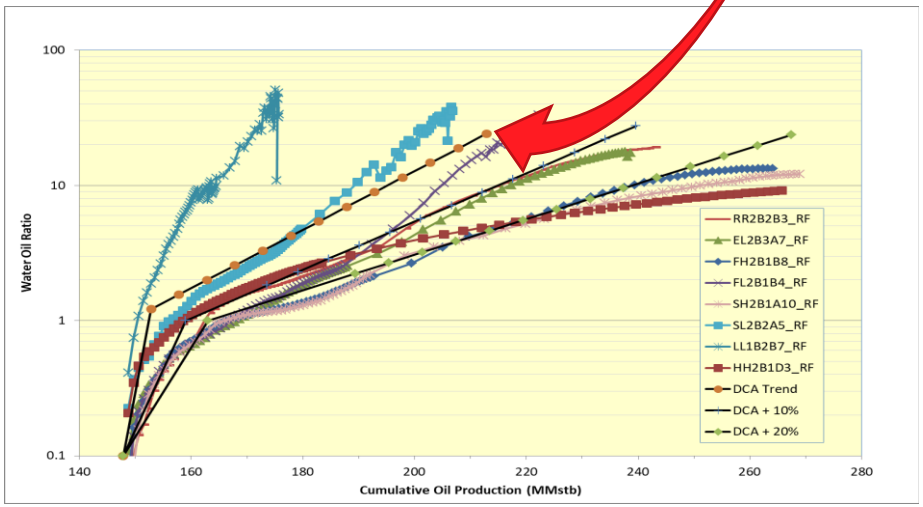


X 9



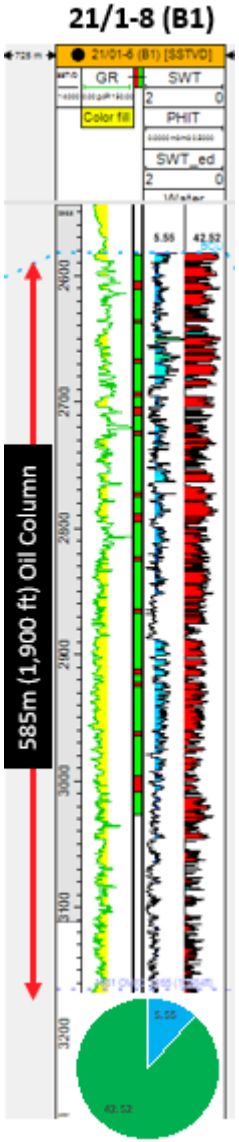
DCA

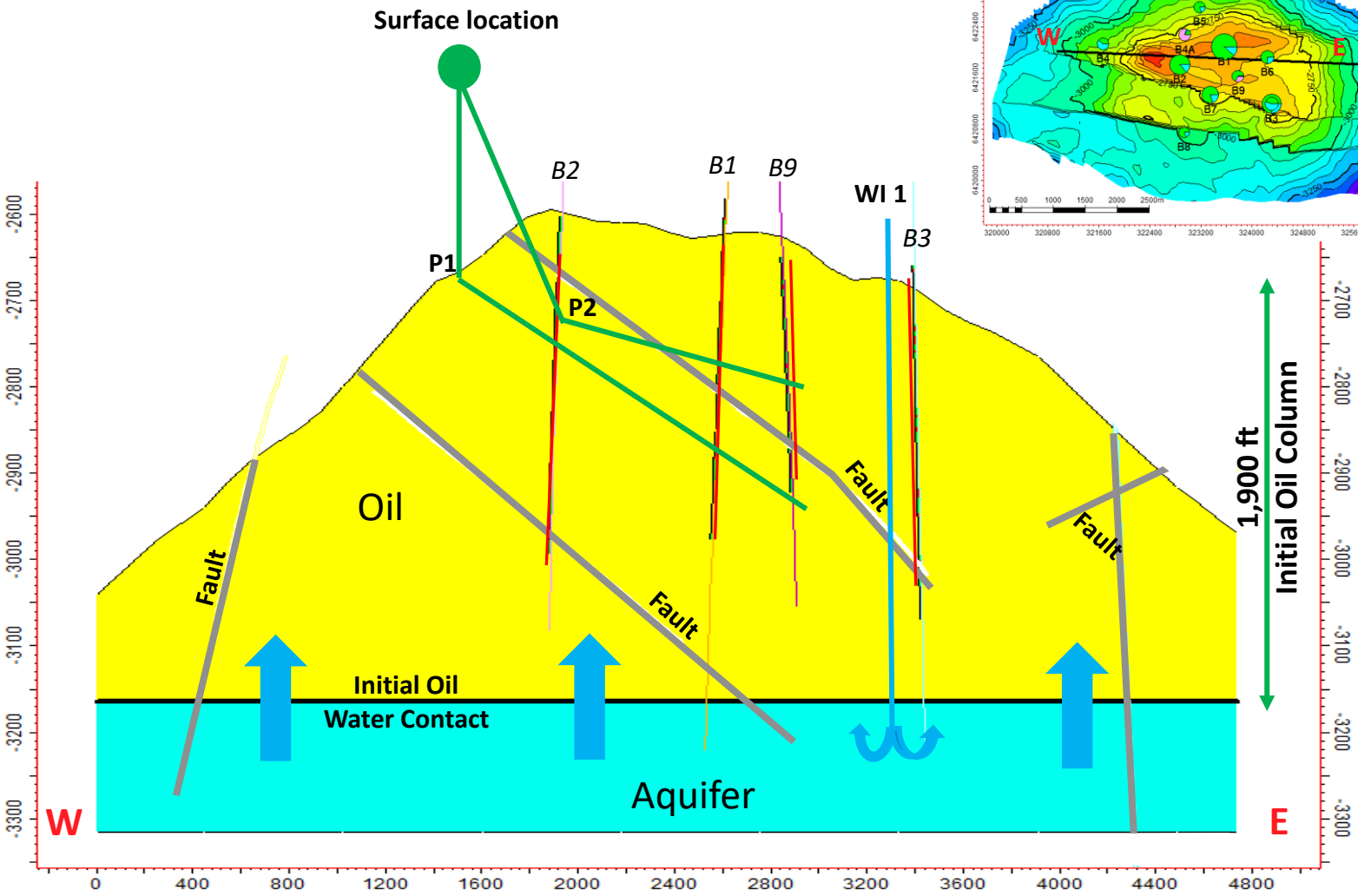
- DCA performed for each well
- Summed for the field
- Gives data based forecast for water cut
- Simulation
- Earlier work in alignment with DCA
- Future development with new highly deviated wells could exceed vertical well DCA trend

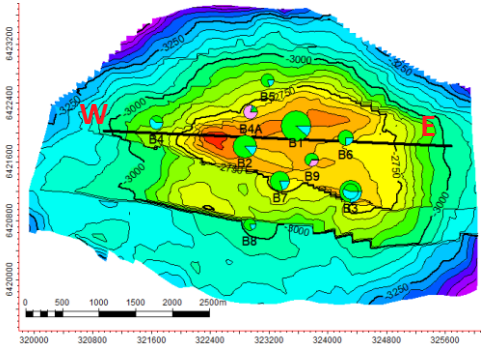


Significant resources available

Cross-section across Buchan Field







Buchan fluid contact

Buchan subsurface development scenario

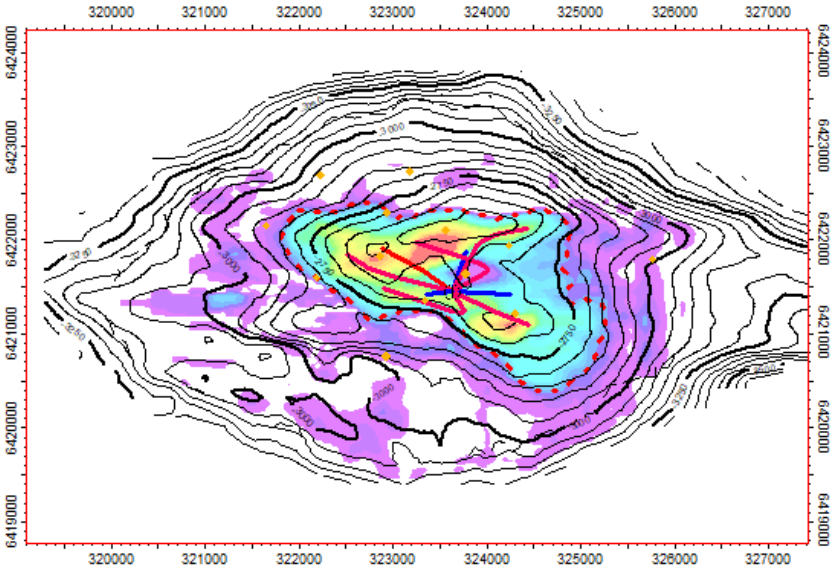
Initial development ('80s)

Wells
- 9 vertical producers
- 2 water disposal

Artificial Lift
- Gas Lift

Water shut off (WSO)

Challenges
- Overpressure
- Unknown reservoir performance
- Unoptimized development
- Vertical wells
- No Pressure support
- Retrofit artificial lift system



Redevelopment (Today)

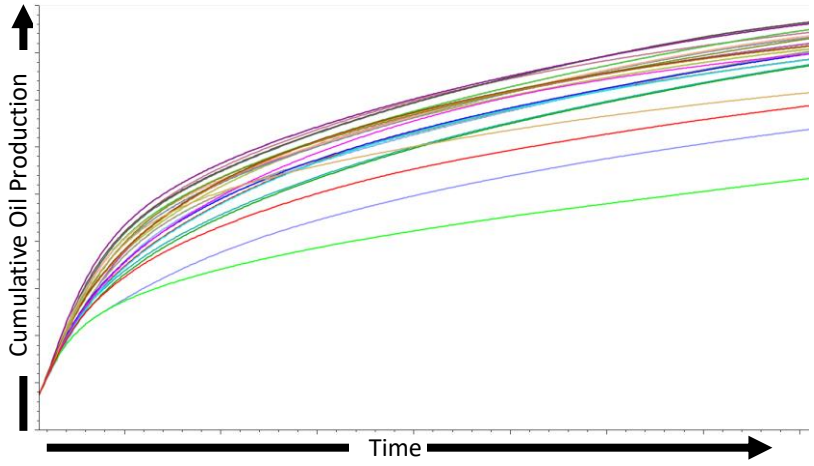
Producer Wells
- 3-6 highly deviated producers

Injector wells
- 2-3 water injectors for pressure maintenance

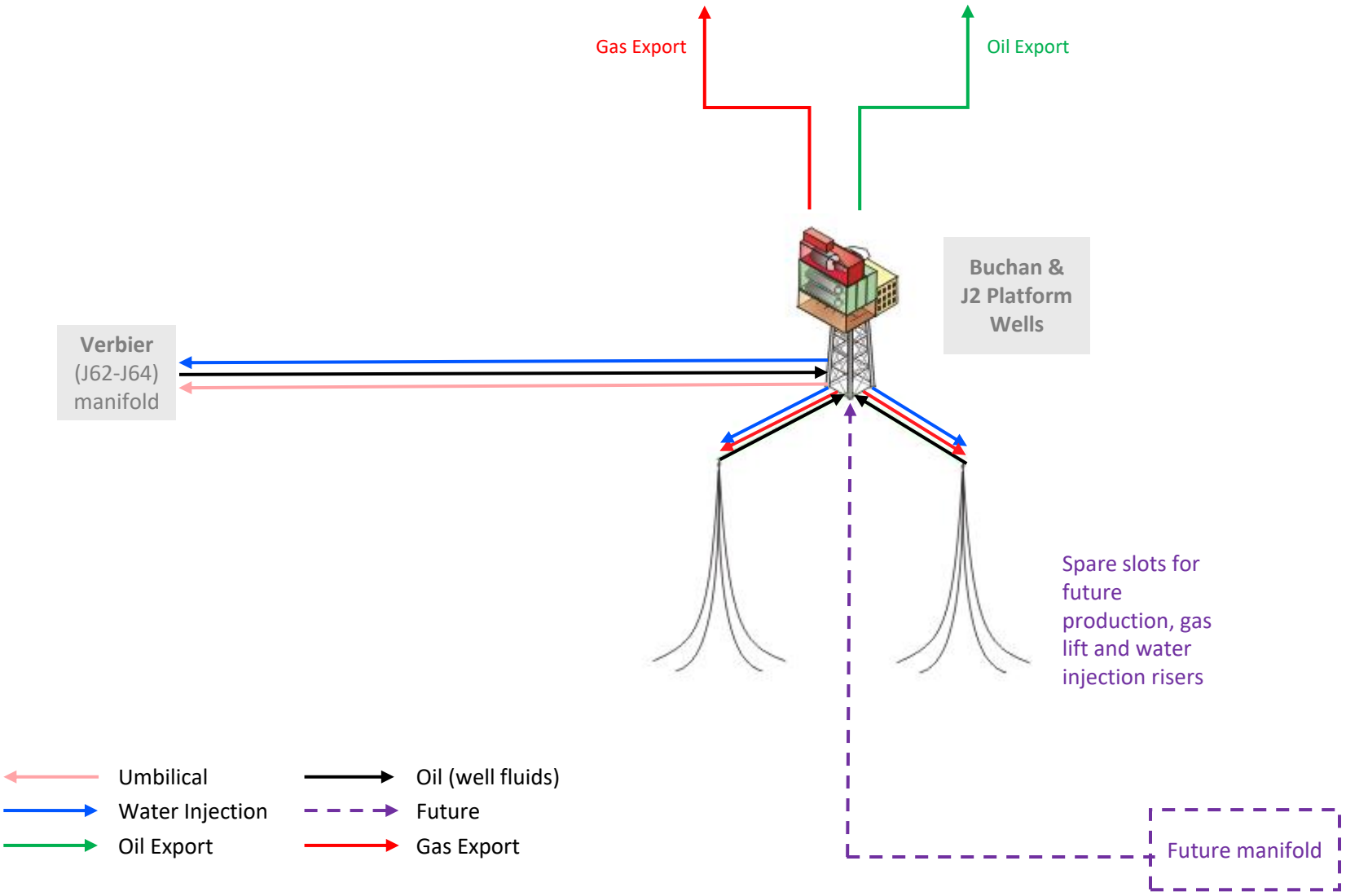
Artificial Lift
- Gas Lift
- ESP

Smart completions for WSO

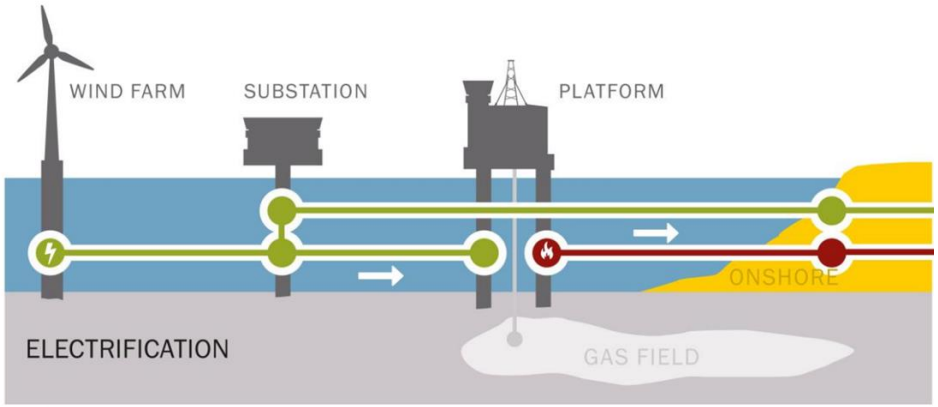
Opportunities
- 36 years of production performance
- Stabilized reservoir pressure
- Active aquifer
- Modern technology
- Maximum economic recovery
- Energy transition

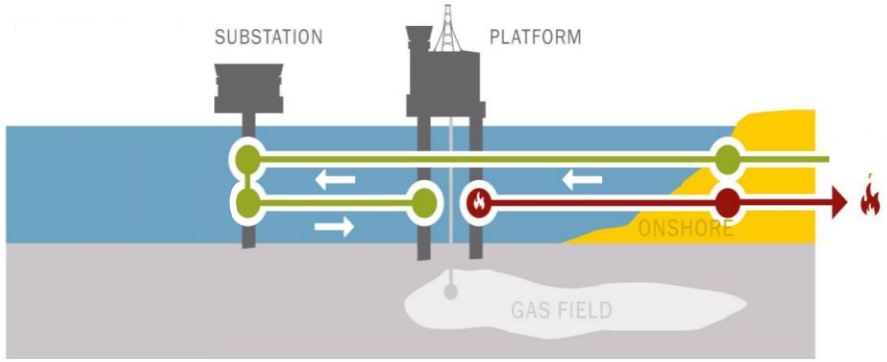


Greater Buchan Area conceptual development



Platform electrification – a new reality





Heating Medium System
270 tonnes
15 pieces of kit

Gas Fuel System
70 tonnes
16 pieces of kit

Instrument Air System
80 tonnes
78 pieces of kit

Facility simplification – a route to de-manning

Conclusions

- ✓ Buchan is a conventional clastic sandstone reservoir with oil storage in matrix
- ✓ 2018 PGS seismic has helped better structural characterization of the field
- ✓ Complex tectonics/faulting has resulted in fracture development
- ✓ Most wells have encountered fault cuts
- ✓ PLT has shown significant production from matrix dominated reservoir facies
- ✓ Fractures enhance the matrix permeability
- ✓ The GBA is a perfect candidate for regional hub development

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