Elemental Energies

The Bruce Field

Late life opportunities

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Serica Energy's questions

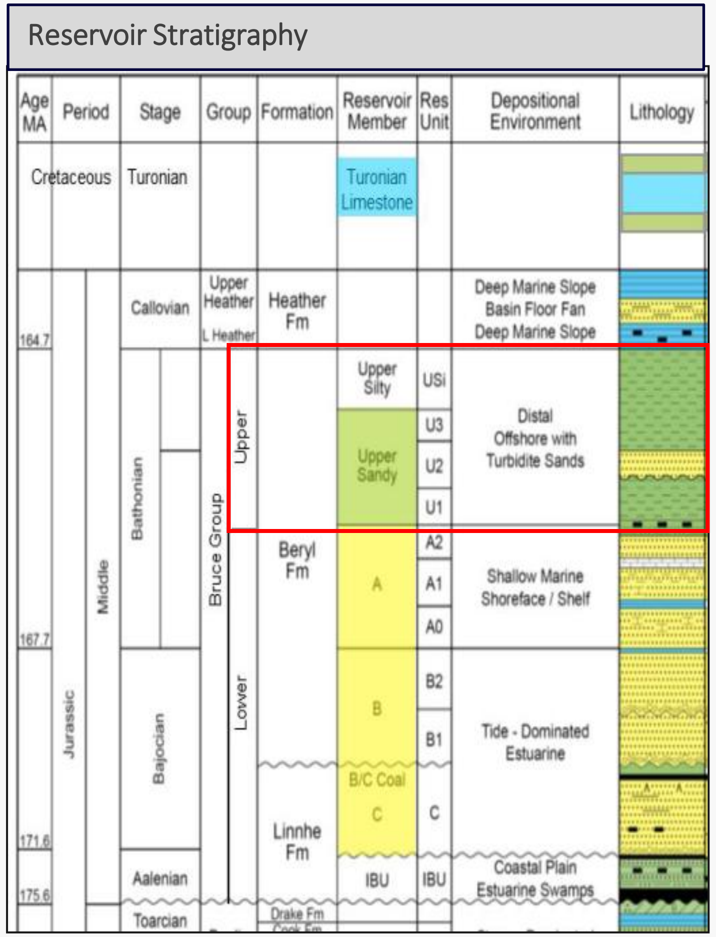
Over a TCF of gas in a stranded reservoir, is it there and how much is left?

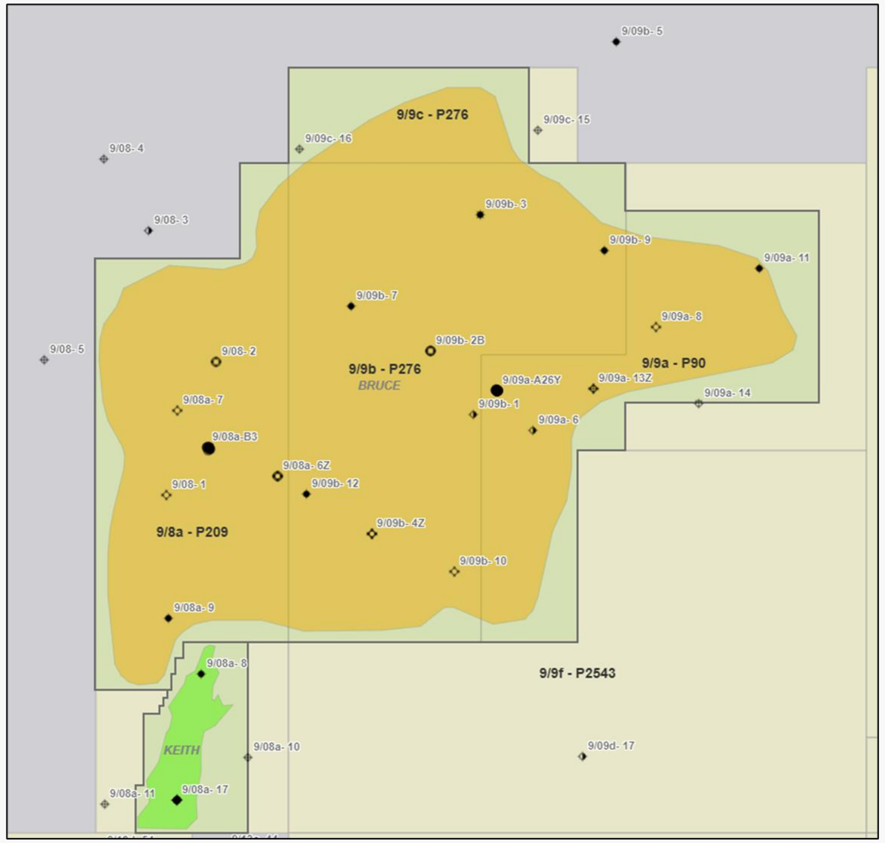
How do we produce this gas?

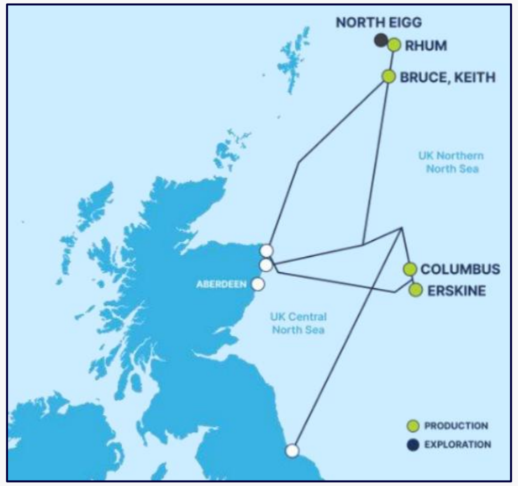
Why has it been so hard to unlock?

The Bruce Field

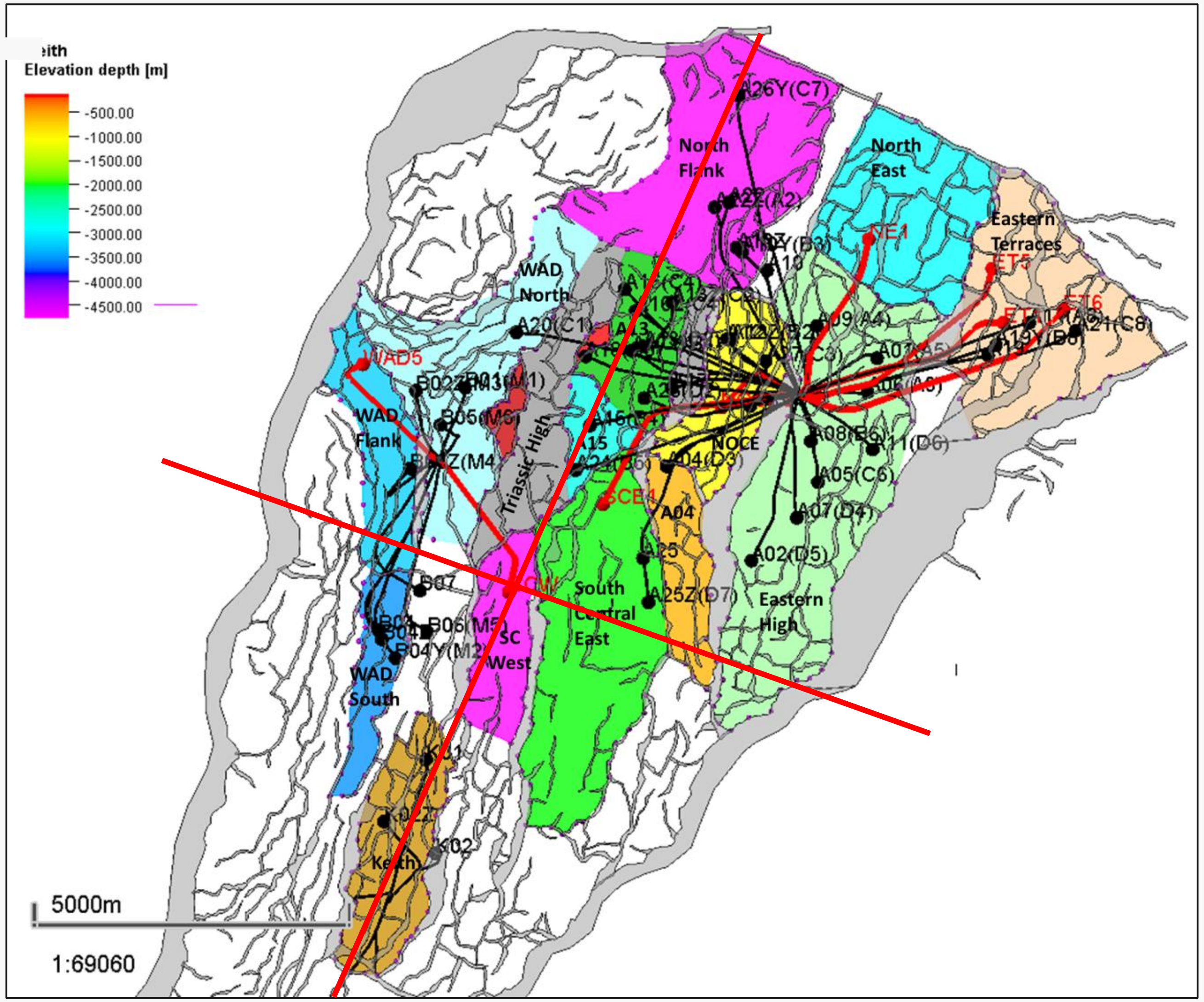
- Blocks 9/08a, 9/09a and 9/09b
- Discovered 1974, 26 appraisal wells, 1st Production: 1993
- 30 Production & Injection Wells (not inc. S/T)
- Reservoirs
  - Beryl and Linhe Formations
  - Upper Sandy member and Bruce A/B/C sands
  - Sand rich, shallow marine depositional environment
  - Eastern Terrace Cretaceous Turonian Limestone
- Trap
  - Western flank – large rotated fault blocks
  - Central panel – complicate fault collapse structures
  - East – horst block structure
- Seal
  - Heather and Kimmeridge shales
  - Cretaceous chalk (where not a reservoir)
- Fluids
  - Gas condensate
  - Compartmentalised field structure has resulted in variable fluid contacts and drainage patterns across the field

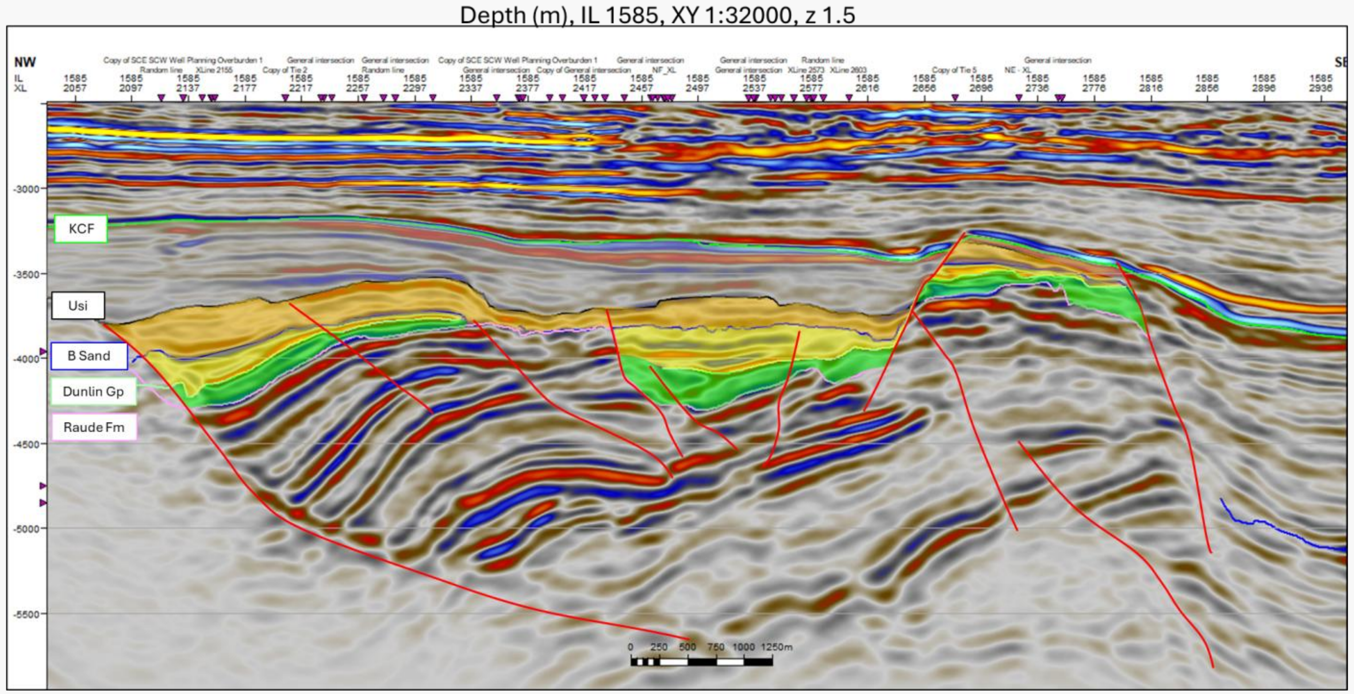


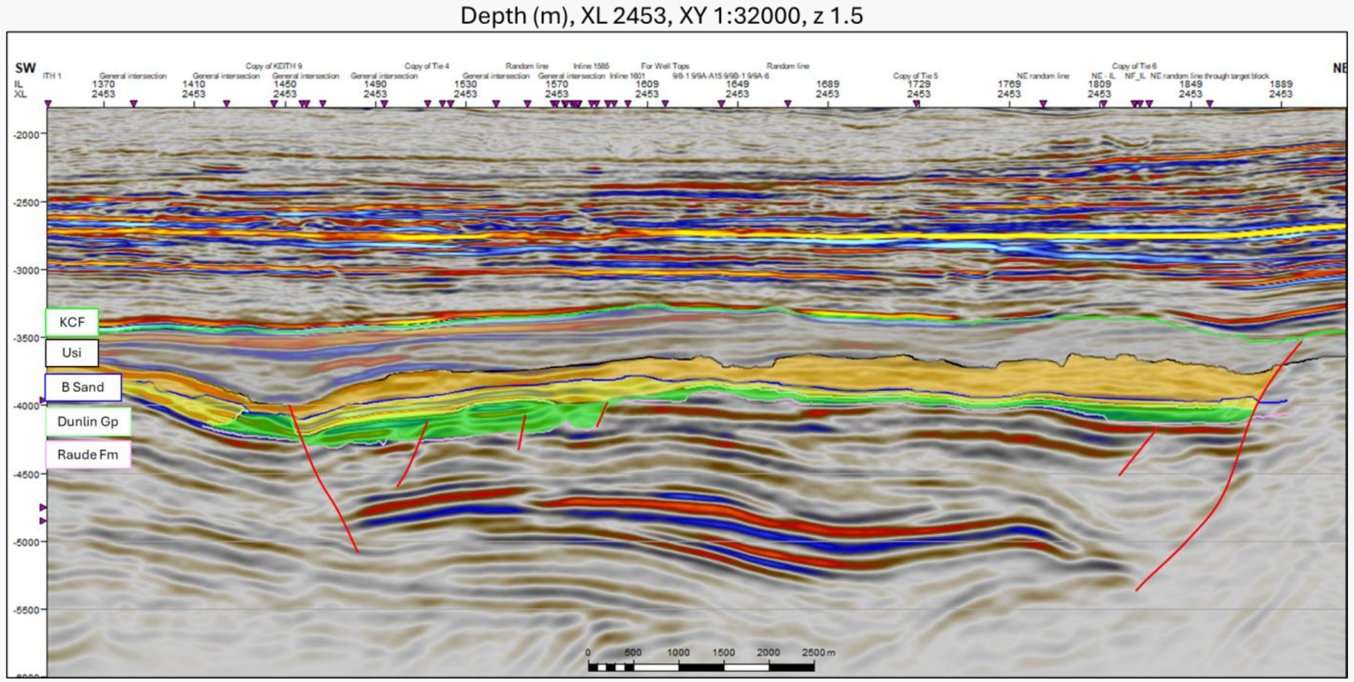




Field structure







- The field is heavily faulted
- Mapped with multiple compartments that have been developed with numerous wells in each region

Evaluation workflow

SCREEN

Legacy reported stranded gas was re-evaluated. Focus on the less developed Upper Sandy reservoir. Can we validate this?

LOCATE

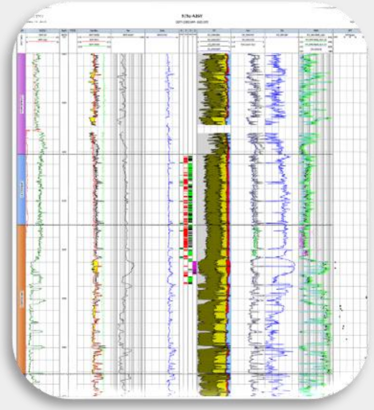
Static and dynamic models were built. Well locations & types + hydraulic frac assessment tested in one area of the field.

REFINE

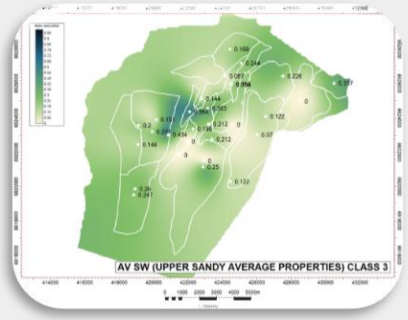
A refined static model and history matched dynamic model built. High value infill opportunity identified.

Screening workflow

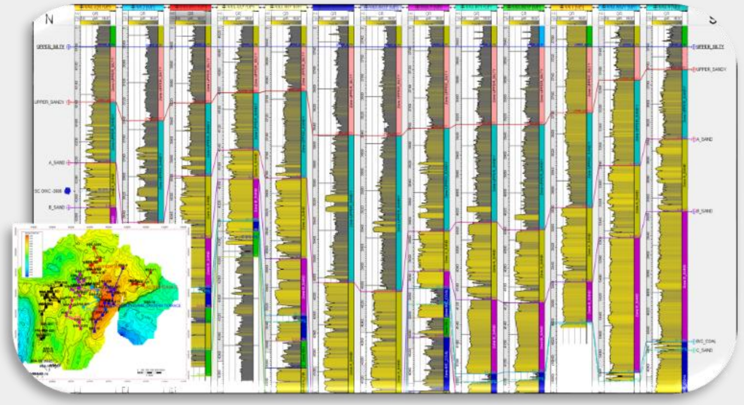
Static Understanding



Petrophysics



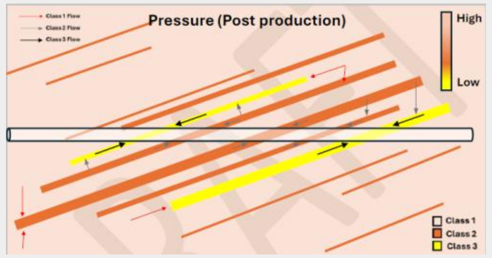
Reservoir quality distribution



Geology

Dynamic analytical review

- Well level production and pressure analysis to confirm compartmentalization => integrate with structural review
- Review PLT results to confirm production mechanism, particularly related to reservoir class contribution => integrate with petrophysics and reservoir distribution review



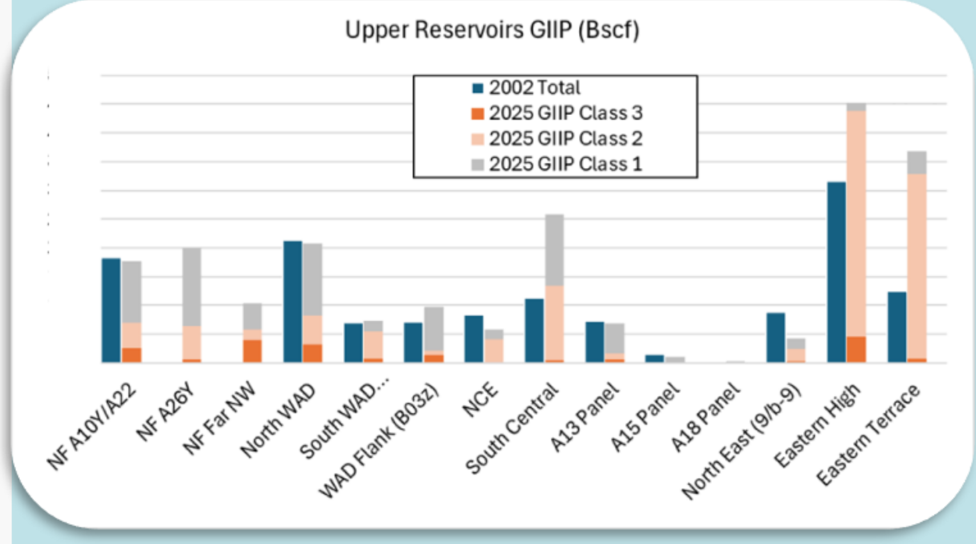
- Estimate produced gas per compartment, per reservoir, per class.
- Assess productivity per class and required well type, with or without hydraulic fractures, to maximise incremental recovery.

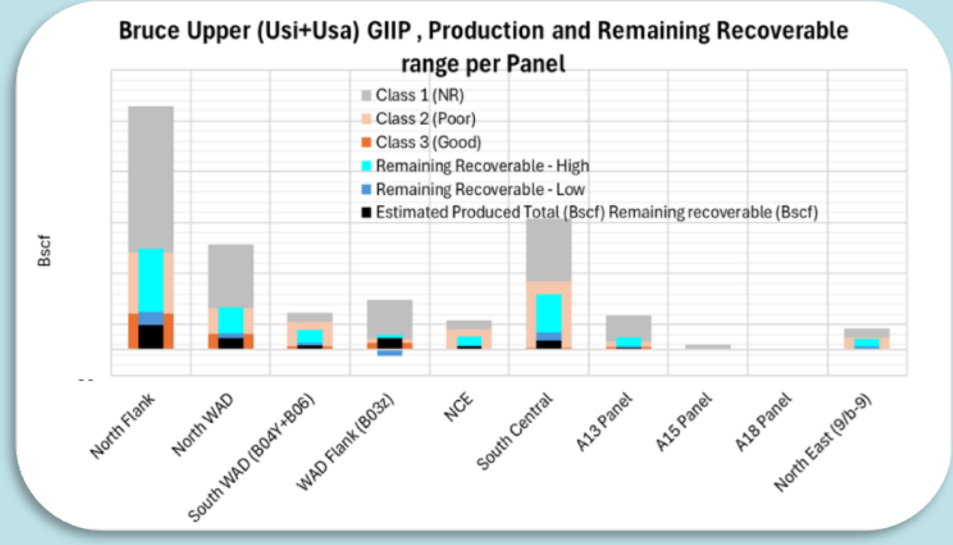
Validate GIIP for upper reservoir per fault panel

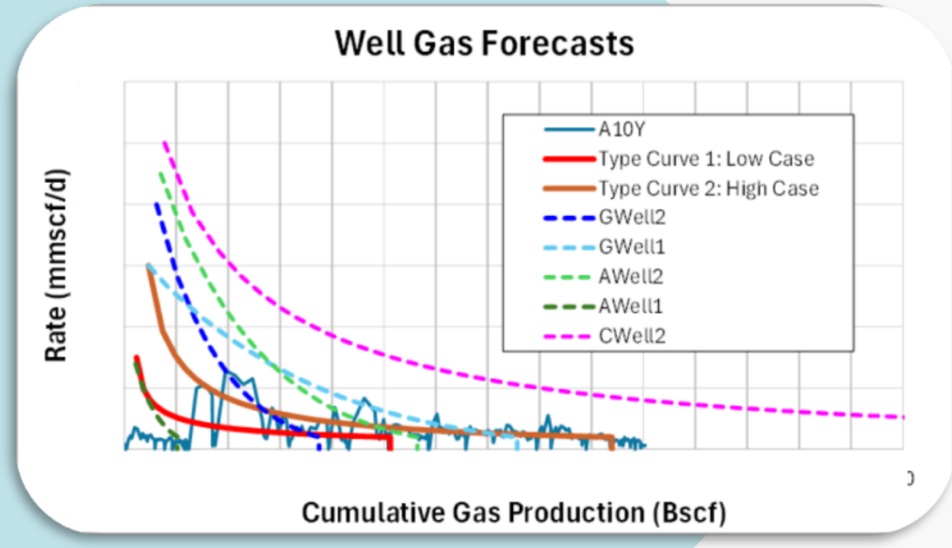
Estimate historical production from the upper reservoir per fault panel

Determine remaining GIP and recovery potential

Screening results



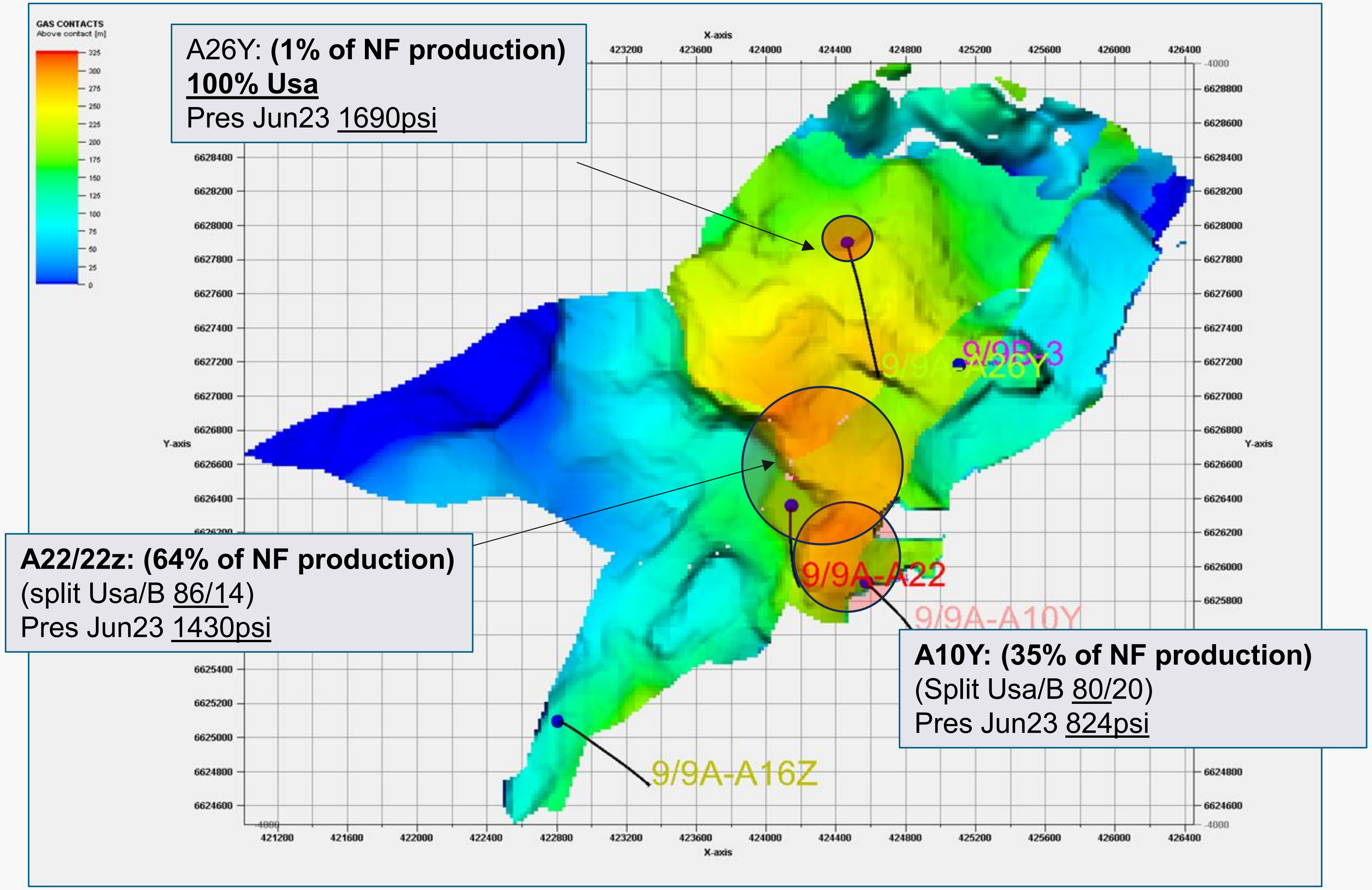




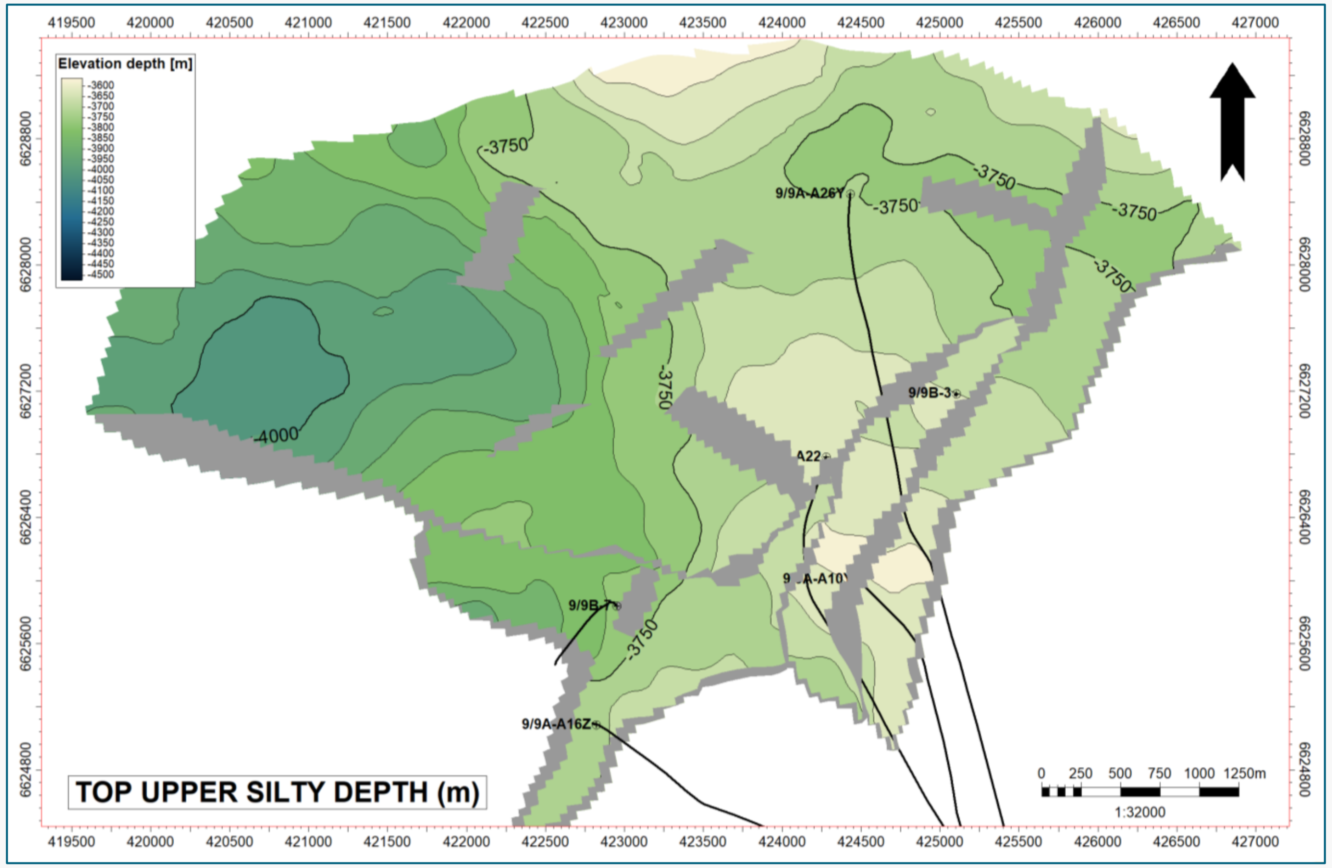
- Upper Sandy GIIP aligned with previous analysis for most fault panels
- Remaining recoverable volumes highlight that the North Flank, South Central and WAD segments are key areas to focus on
- Based on an analogue review of well performance in low permeability reservoirs, type curves were developed for a range of outcomes for non hydraulic fractured wells. Bruce wells lie within this range.
- It was decided at this point to focus further studies on the North Flank

North Flank selected for further assessment

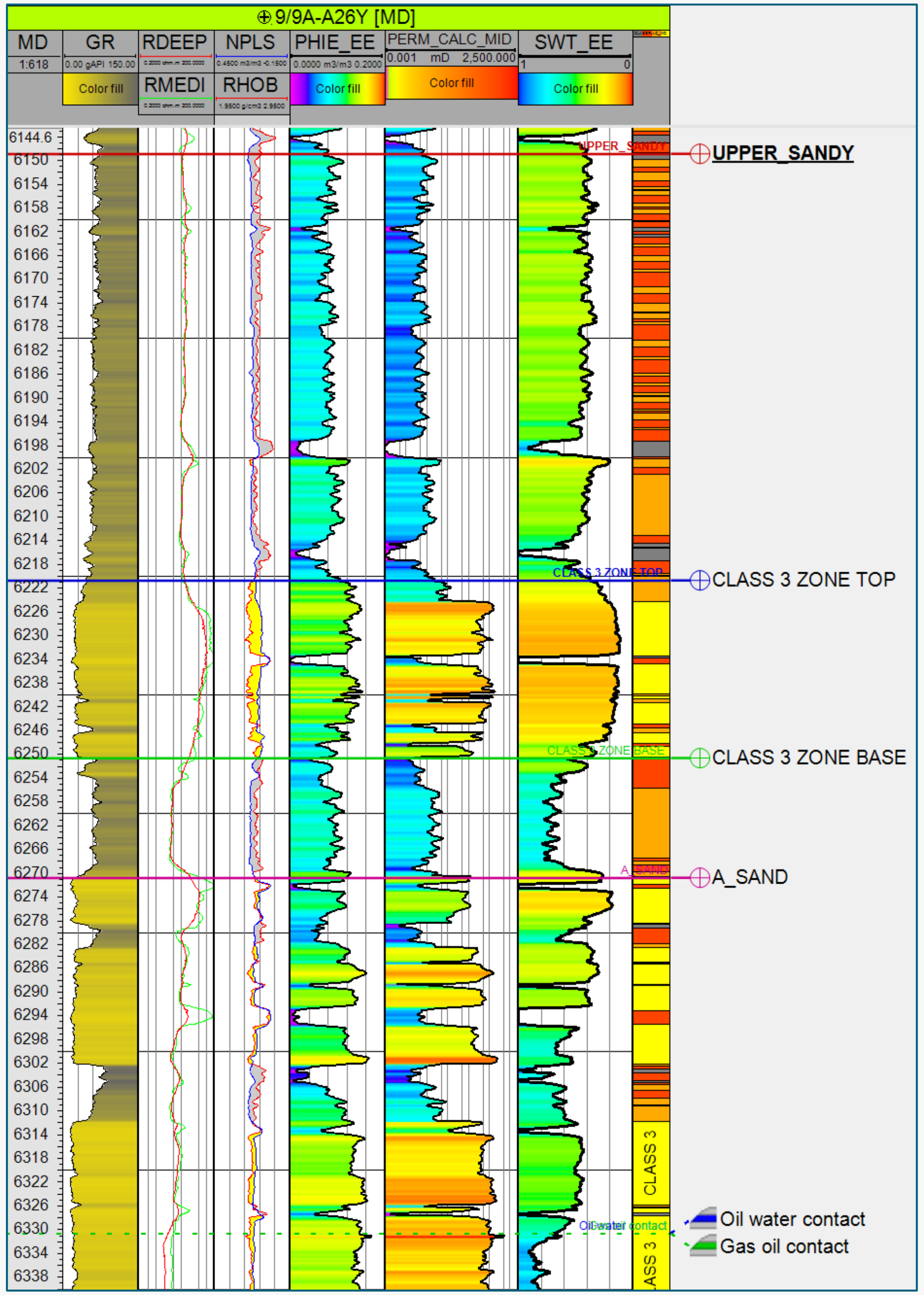
- Preliminary GIIP probabilistic range in line with 2002 results
- 11% of mapped GIIP produced at end 2025
- 85% of total production from the North Flank was from the Upper Sandy
- Complex structure and communication pathways between wells.
- Production mostly from 2 wells, A10y and A22. A26Y drilled in 2009 but failed to produce.
- Significant gas volume remaining in the A26Y fault panel.



A26Y well history

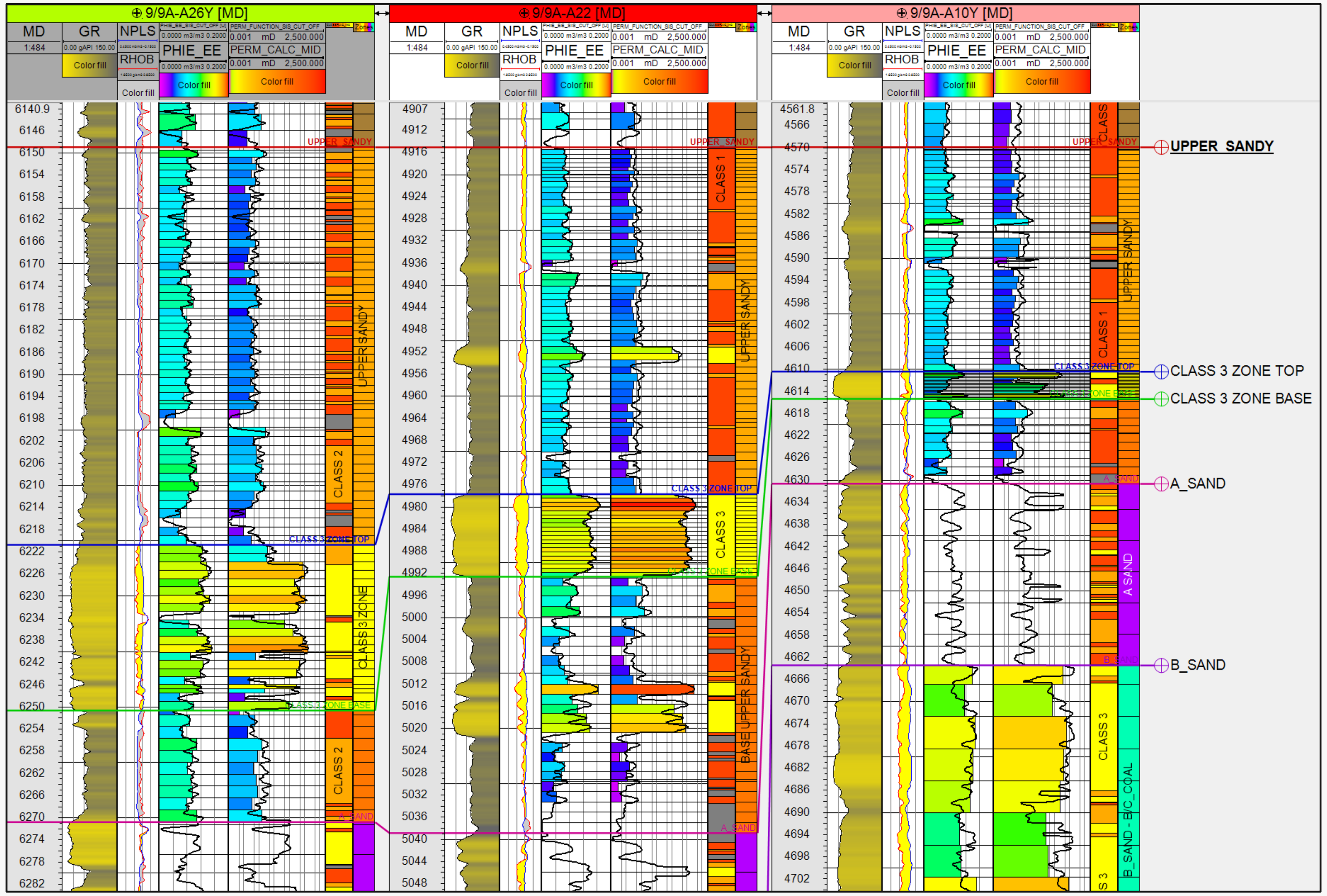


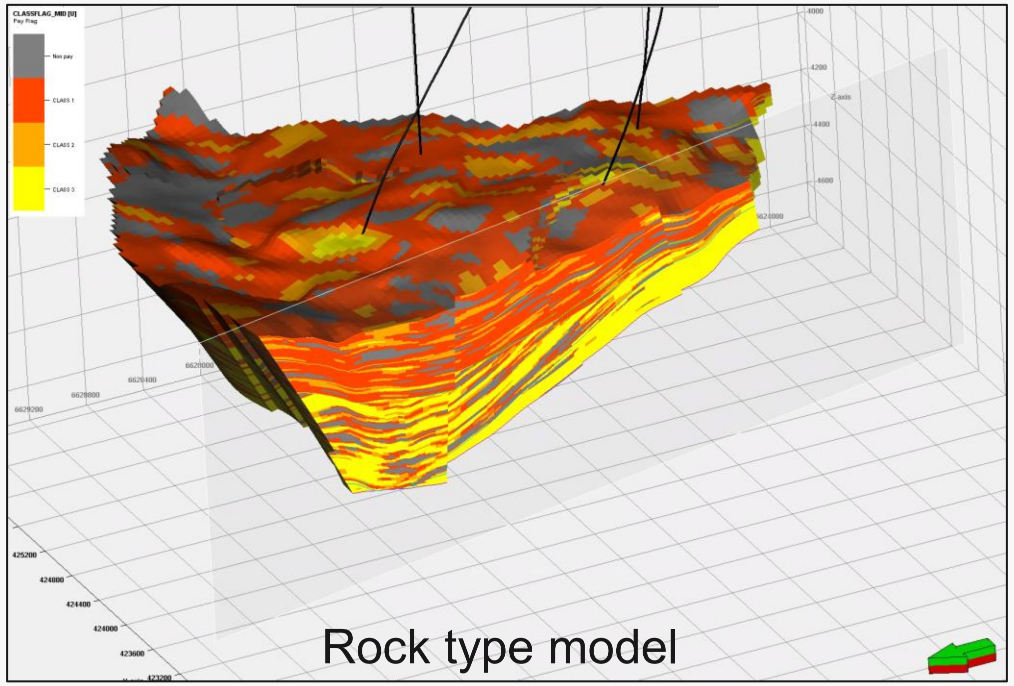
- 9/9a-A26Y drilled in 2008
- Encountered an excellent Upper Sandy section
- Depletion in the B sand was higher than expected
- Upper sand and Bruce sand disconnected
- Well perforated – found guns had failed to drop
- Production from the well ceased

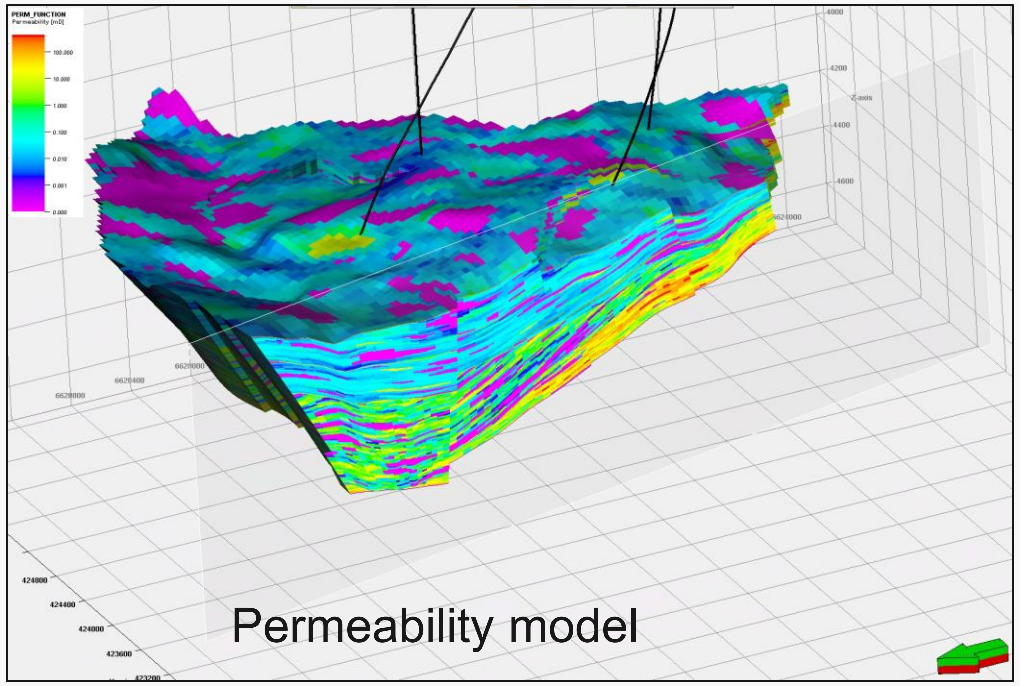


Av Phi	0.125
Av Sw	0.170
Av Vcl	0.048
Av K	137.5

North Flank sector model - well screening



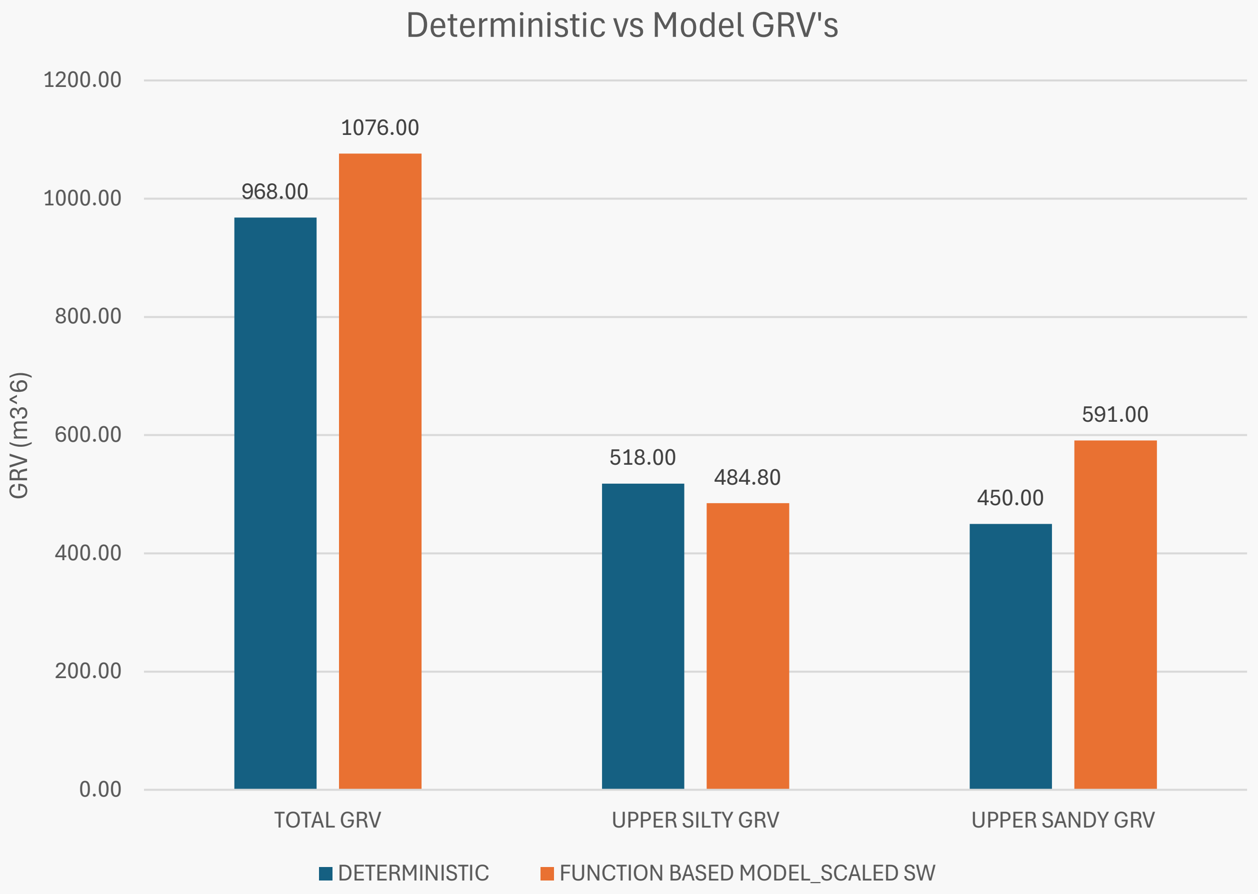




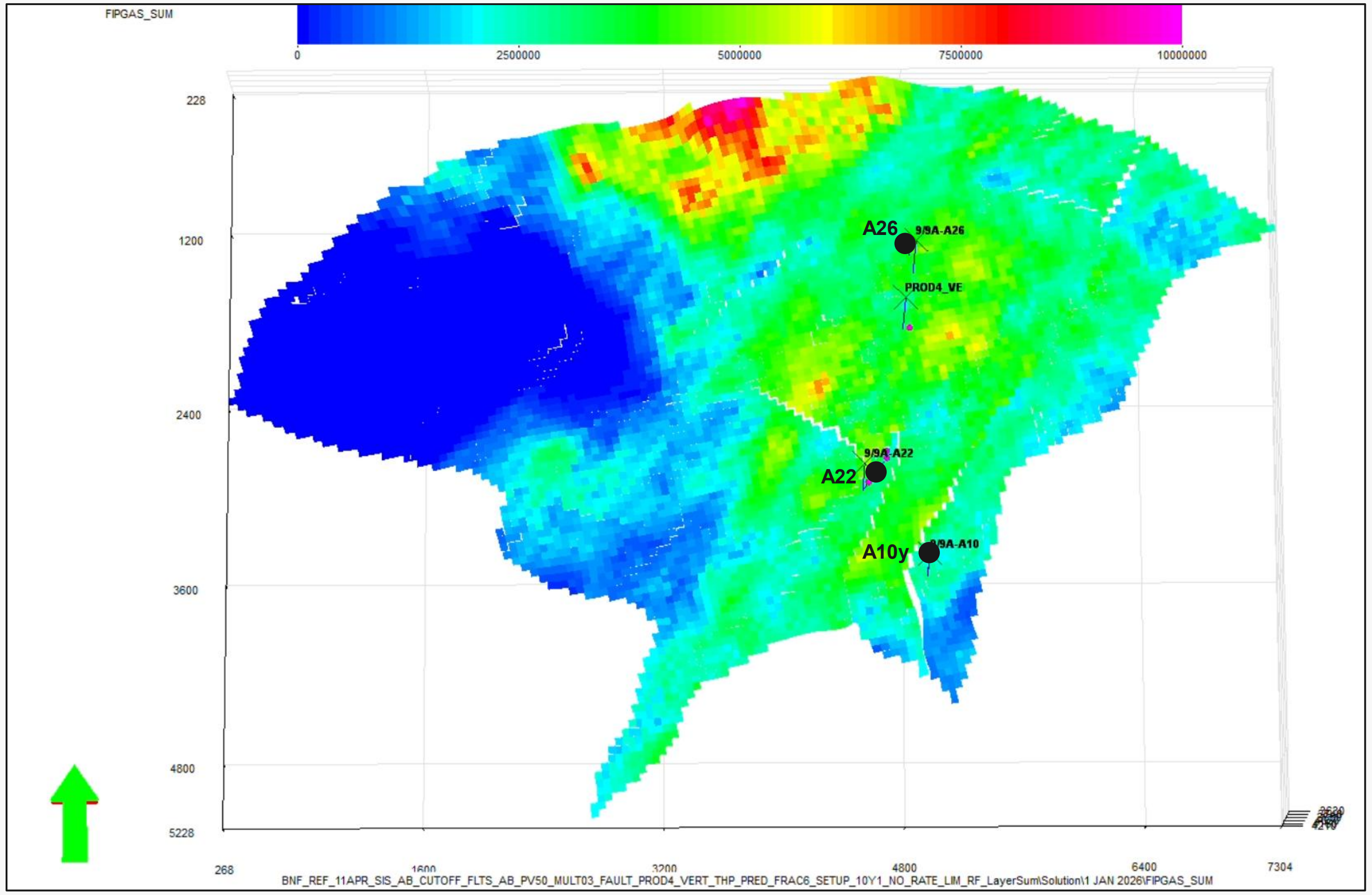
- Highest quality reservoir intervals in the Upper Sandy thicken to north of the North Flanks
- Rock type modelling was the reservoir classes developed during the screening phase - Class 1, 2, 3
- Use of a GPU base simulator allowed for refined modelling – 1m layers and 5.3 million cells (850k active cells)

Sector model GIIP compared to initial screening volumes

- Sector model GIIP close to initial screening volumes

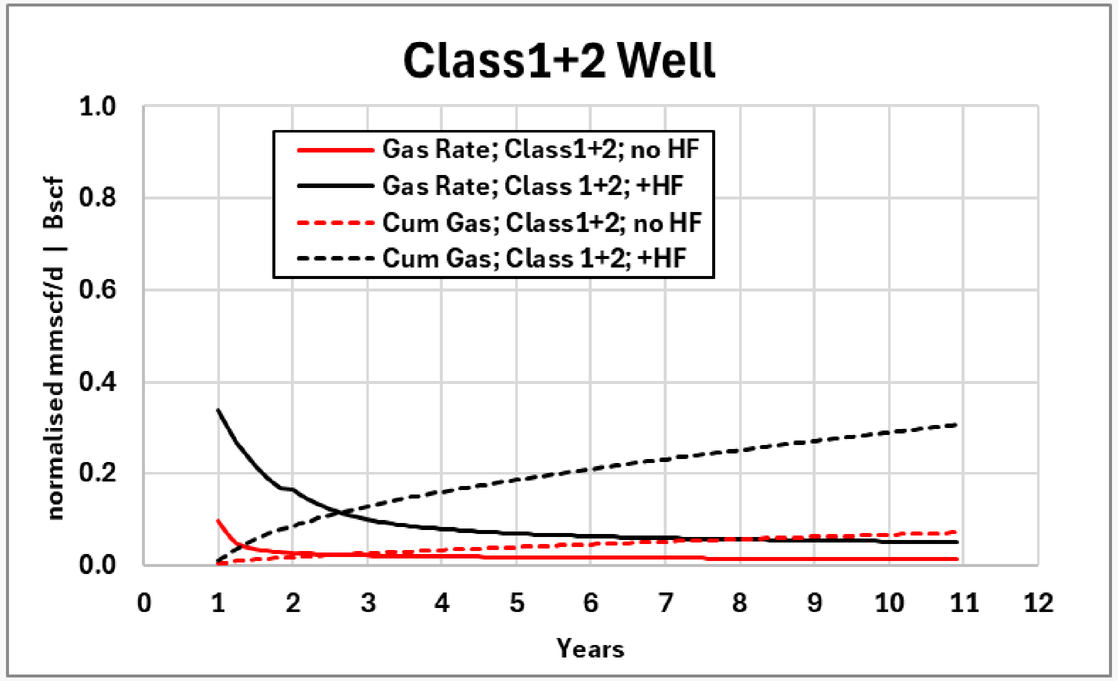


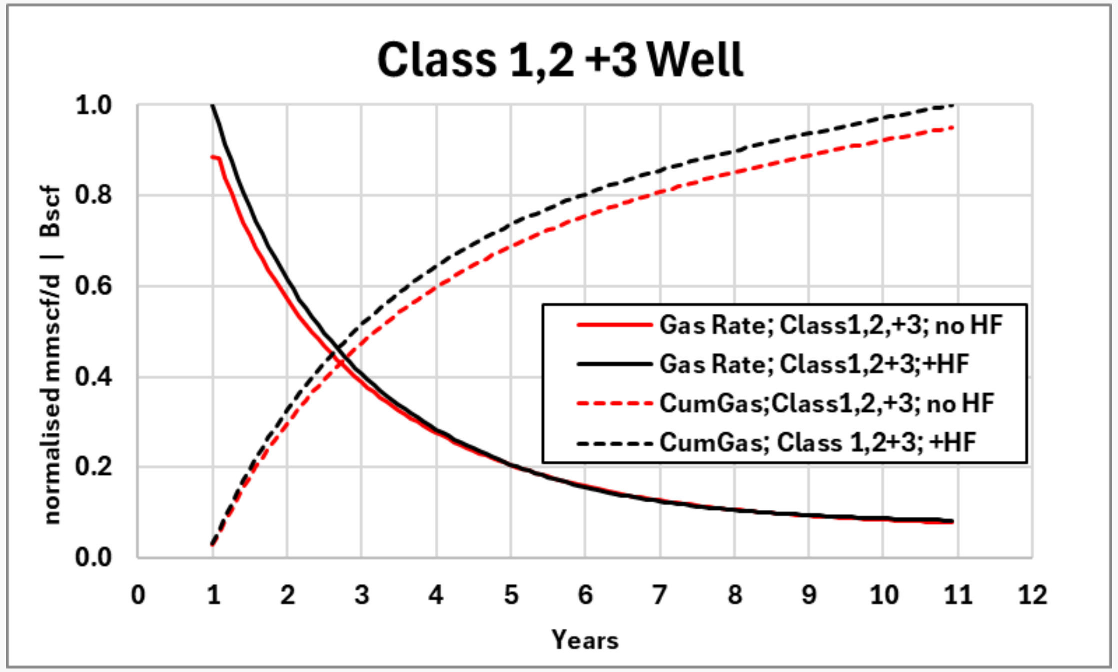
Gas in place distribution Jan26



Dynamic modelling: well productivity review

- Objective was to optimise well recovery from the upper zones by screening alternative well types and completion strategies – hydraulic fractures.
- Infill target well location selected for well performance screening using base case calibrated model
  - Poorly depleted gas volume within existing production well area
- Well performance significantly impacted by intersected permeability profile
  - Class 1 and Class 2 poor permeability
  - Class 3 good permeability
- 74% of GIIP contained within Class 1 and Class 2 reservoir
- Hydraulic fractures explicitly modelled in the simulator based on available fracture design study.
- If no Class 3 contributing, hydraulic fractures significantly improve productivity in a deviated well
- If Class 3 reservoir contributes, recovery much improved and hydraulic fractures offer minimal uplift ~ 5%



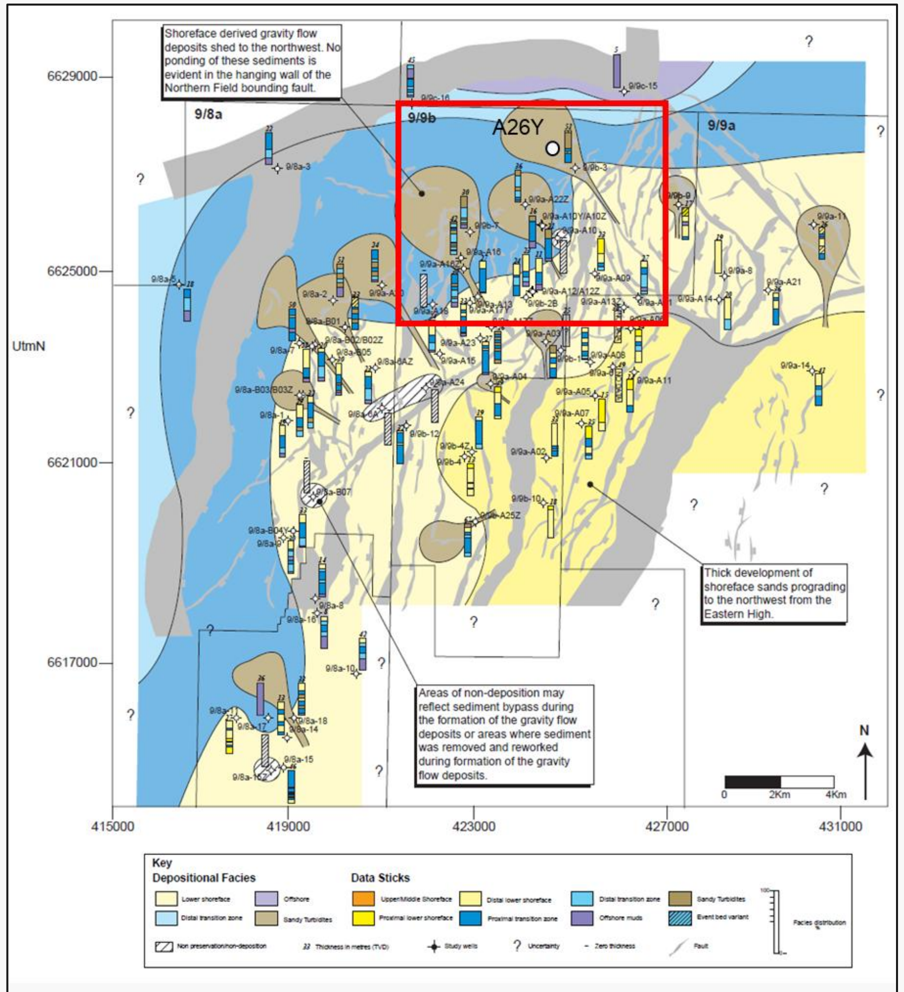


Where are we?

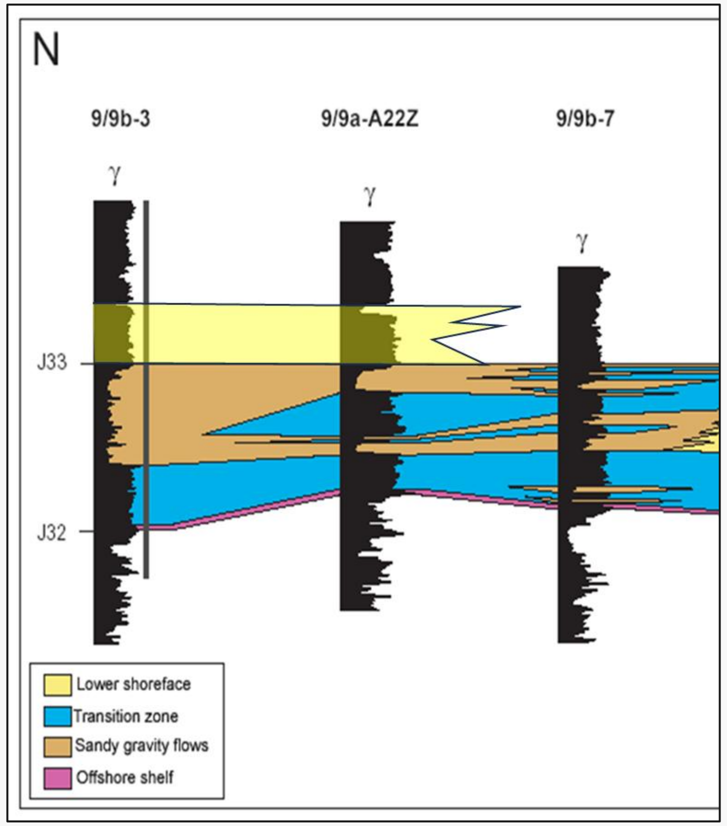
- Upper Sandy GIIP numbers validate – Screen ✓
- Remaining volumes showed the north flank was a key focus area ✓
- The use of a refined sector model indicated there was an attractive infill opportunity that could be worked up - Locate ✓
- Next step – Refine the model, generate infill forecasts and de-risk

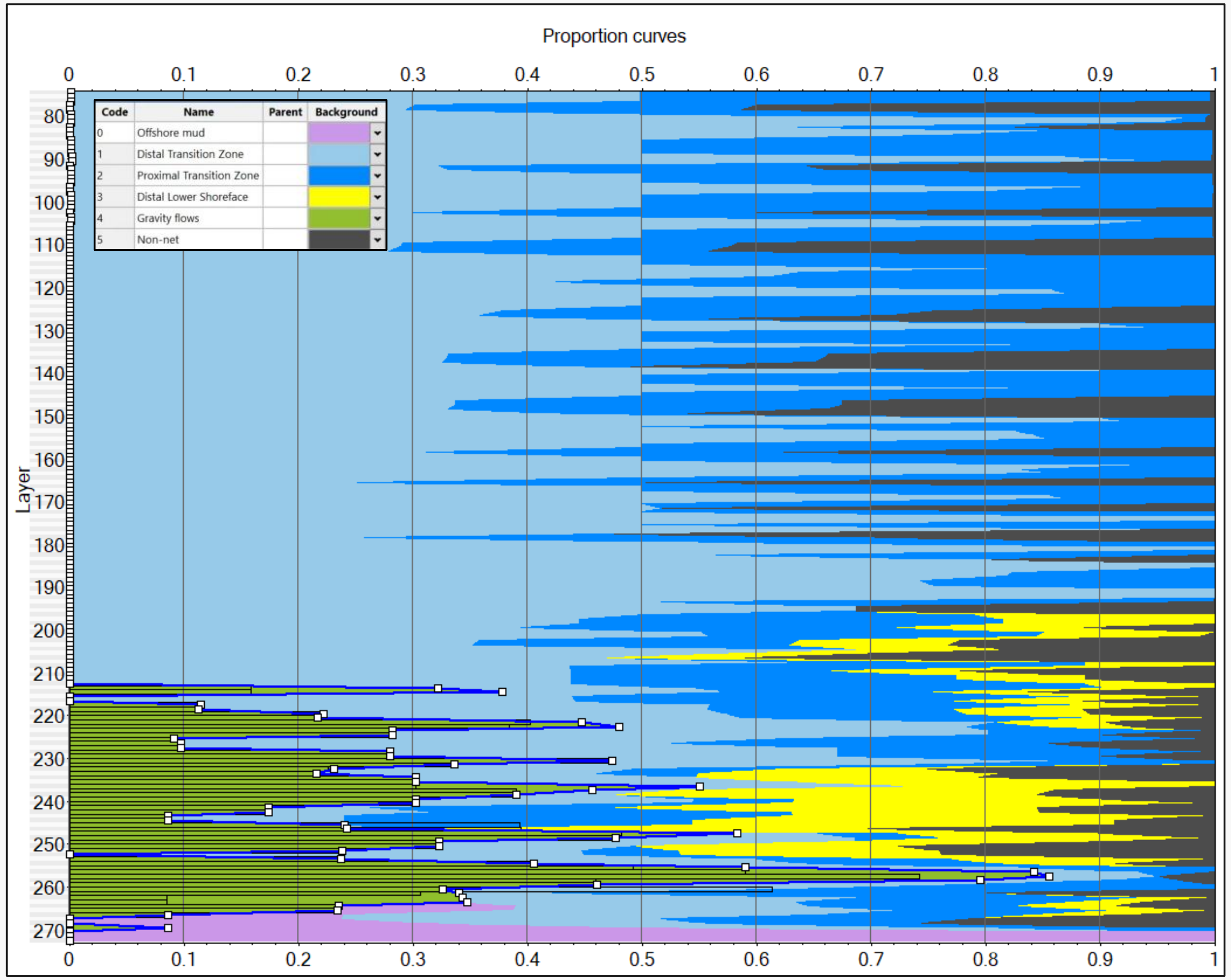
Upper sandy facies modelling

- Facies model built to try and represent the sequence stratigraphy of the Upper Sandy reservoir seen from the biostrat analysis
- No well control in the Upper Sandy above layer 170, these layers are in the deeper interval to the NW
- Concentration of the gravity flows to the North around 9b- 3 and A26Y



Base Upper Sandy

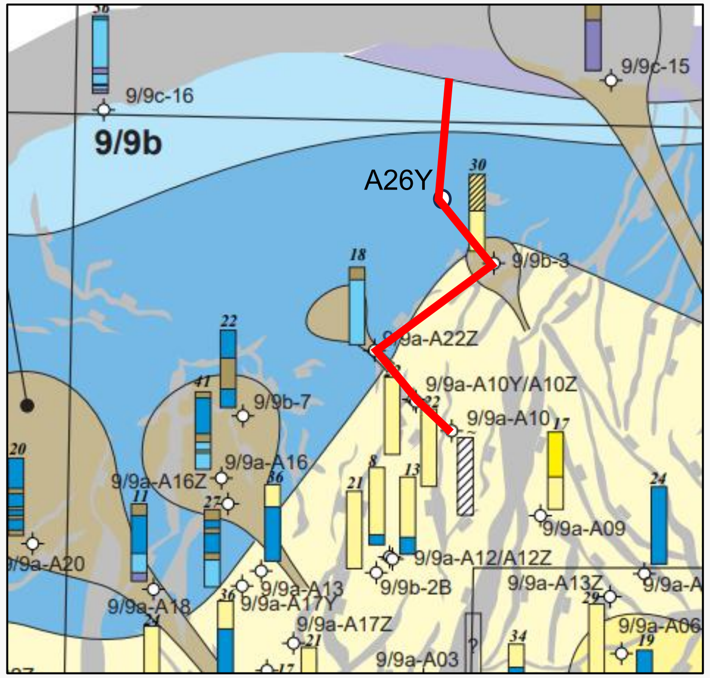


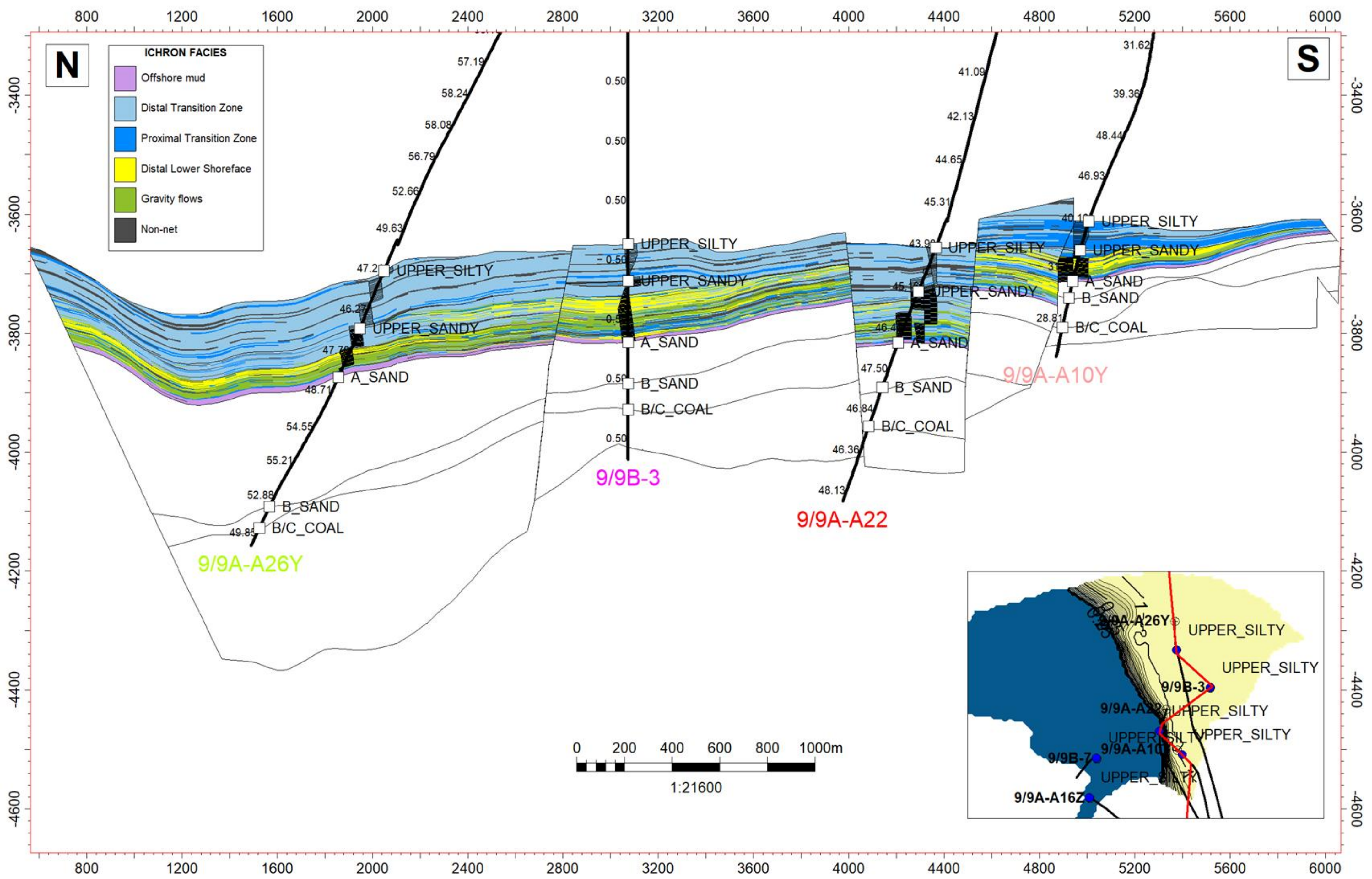


Ichron 2005 biostrat/sedimentology study

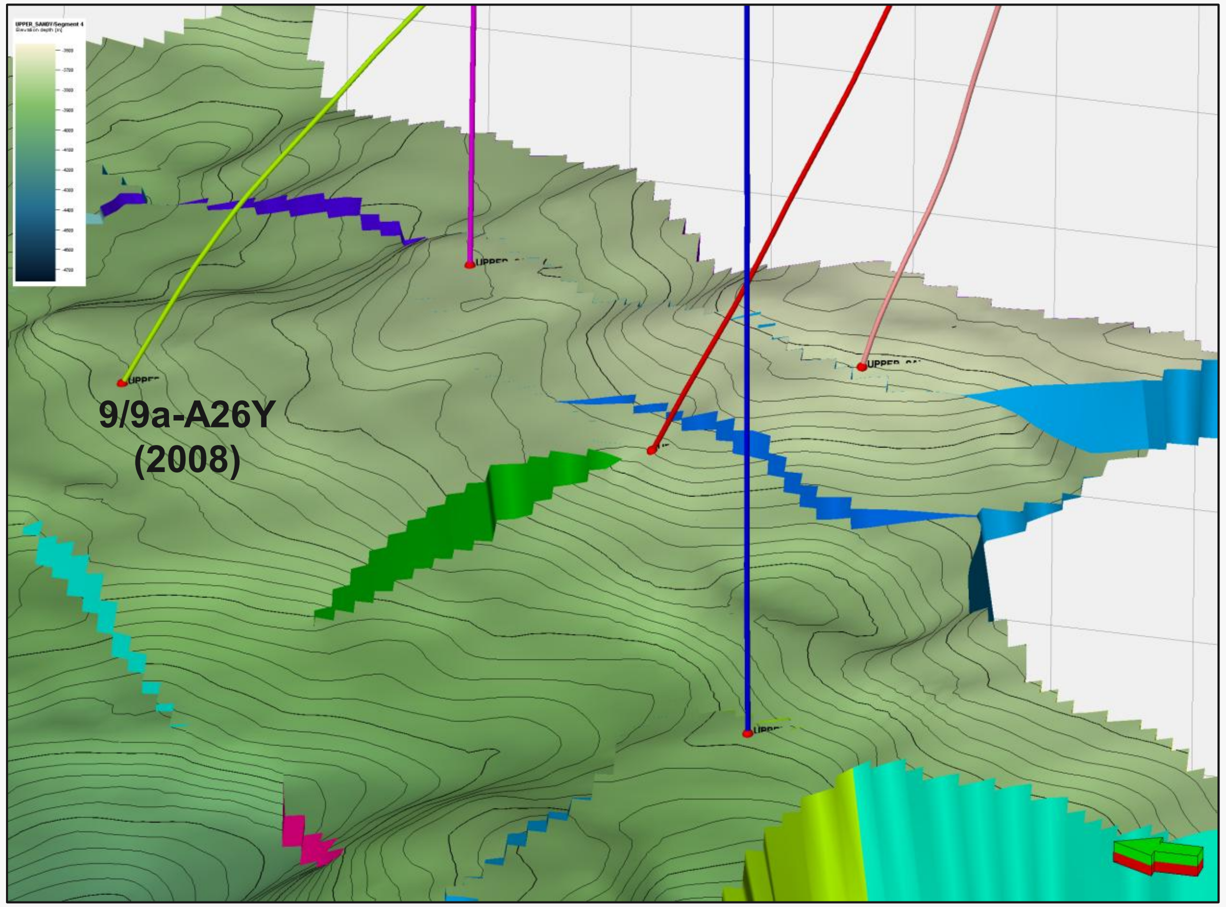
Refined static modelling

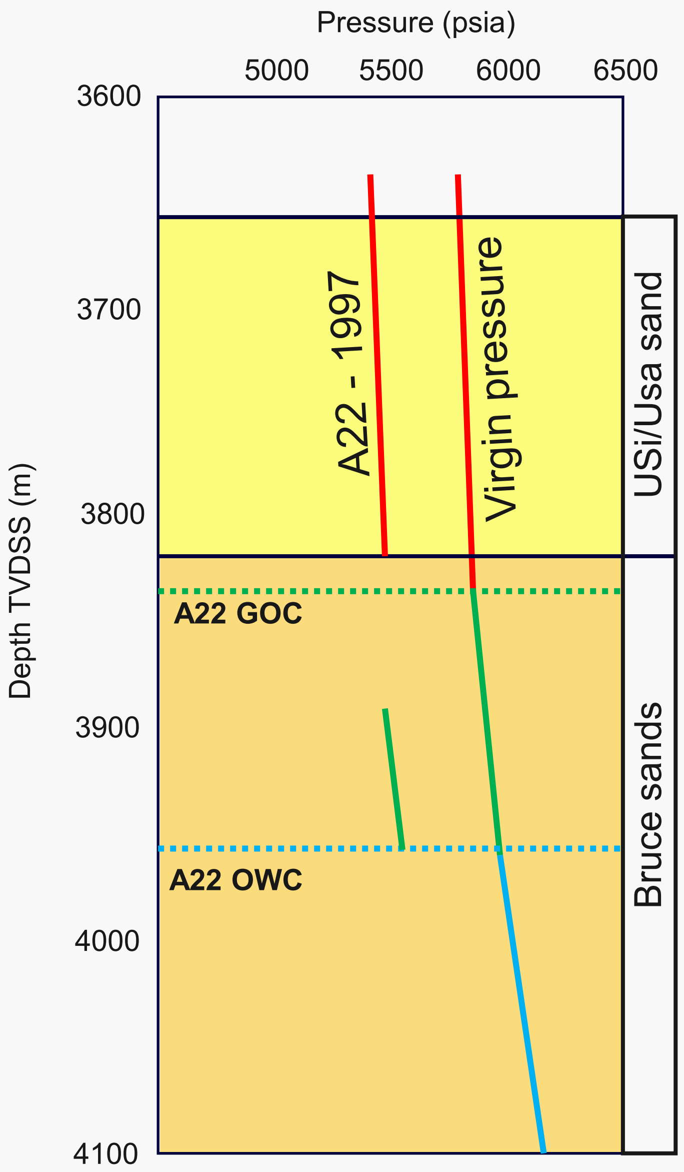
A26Y Pre-drill

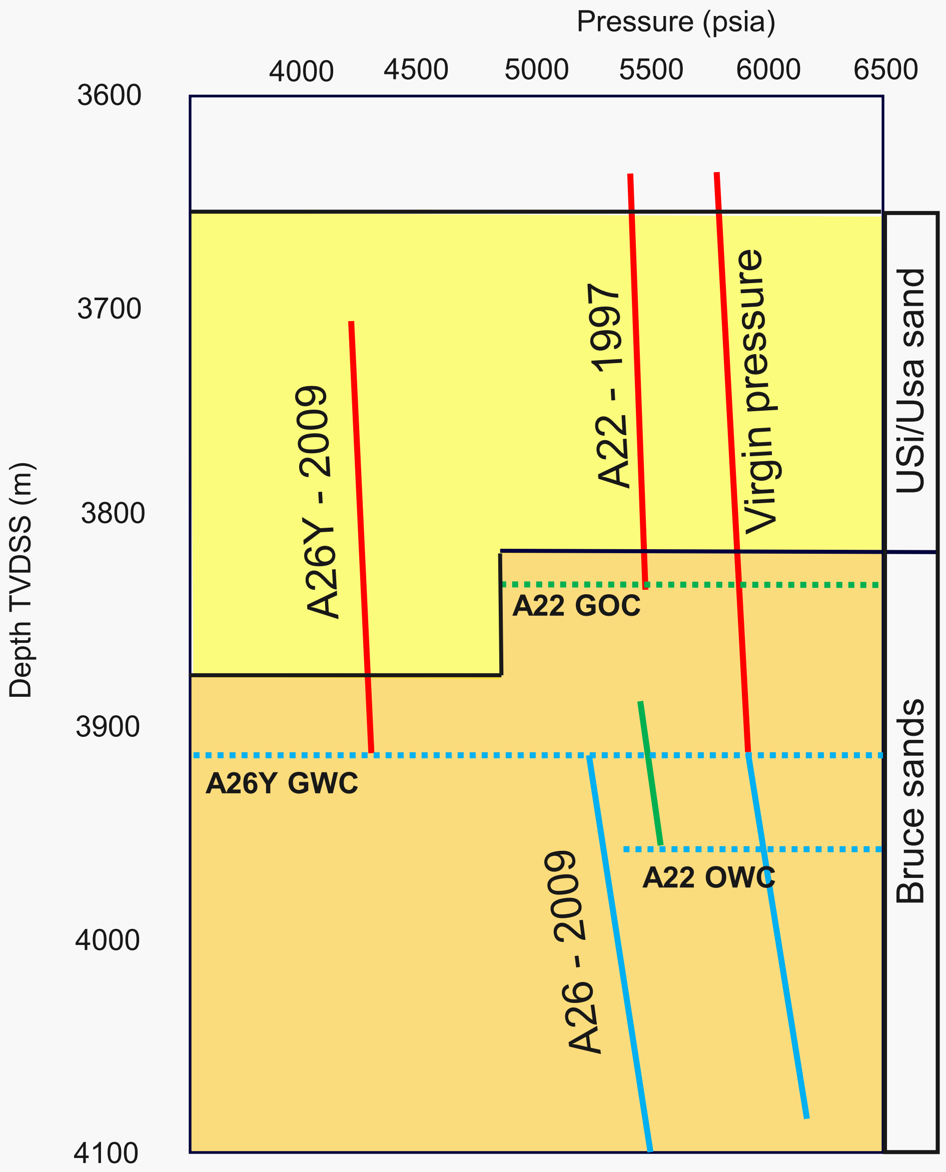




North Flank depletion story



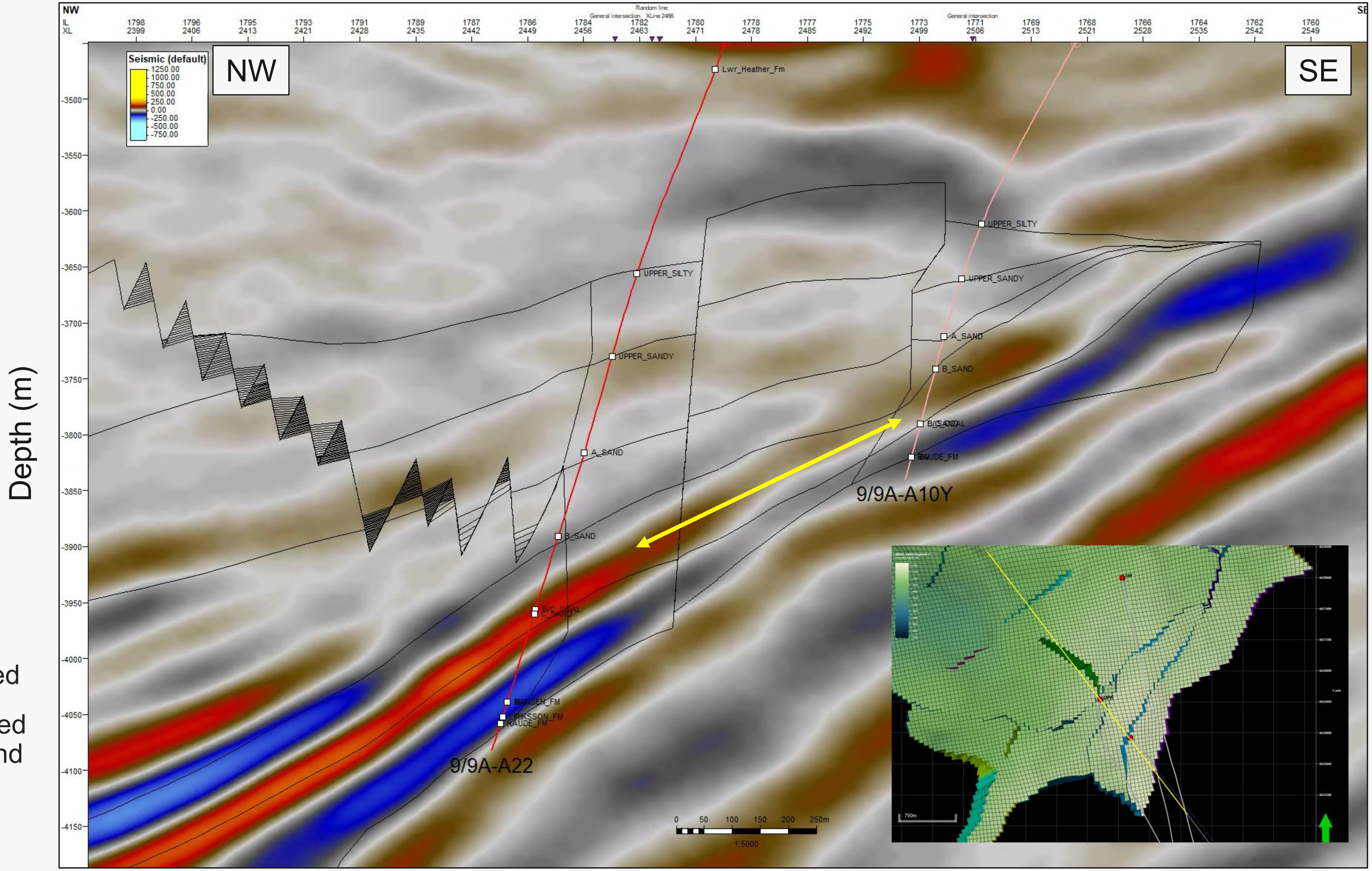




- Pressure depletion across the North Flank evolved overtime
- Multiple HC and water contacts
- A26Y has a possible gas contact (condensate) and deeper water contact

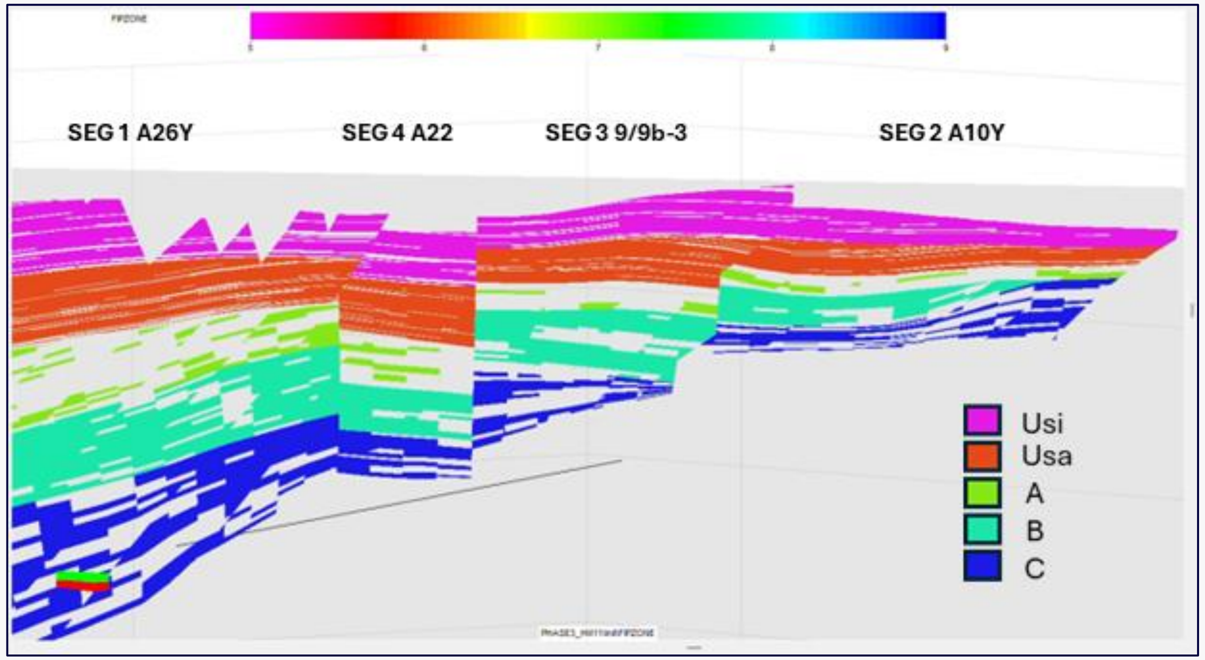
Fault juxtaposition – reservoir connectivity

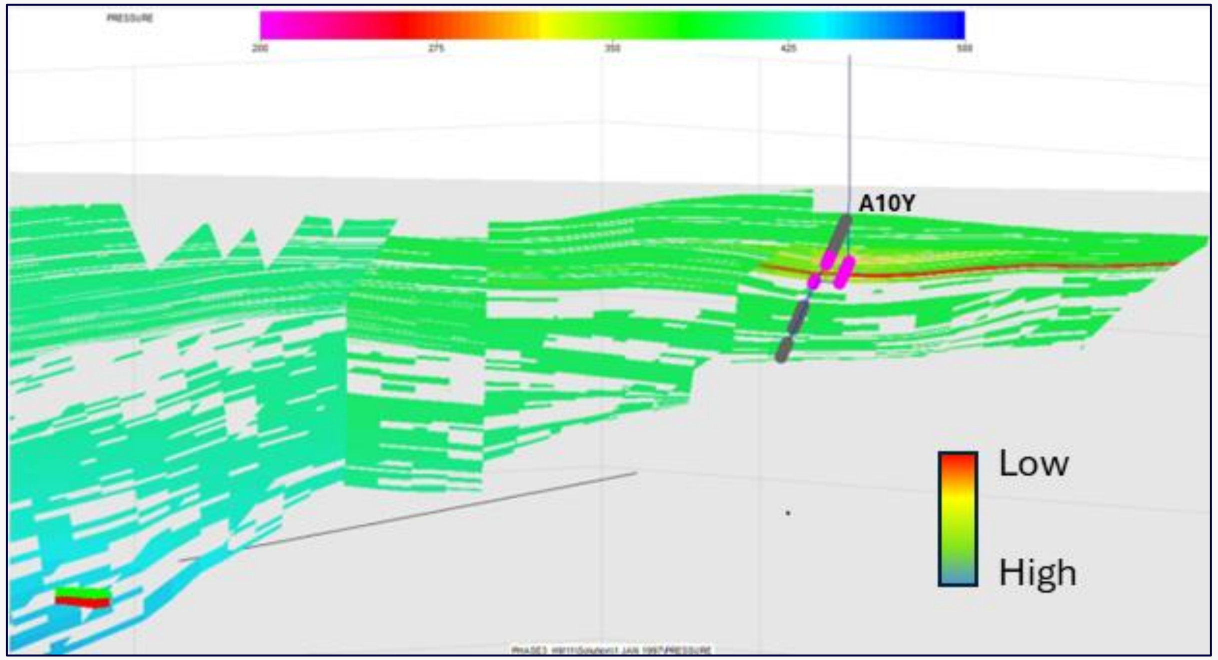
- Connection required between the A10Y and A22 wells in the B sand
- Significant offset in the original structural model



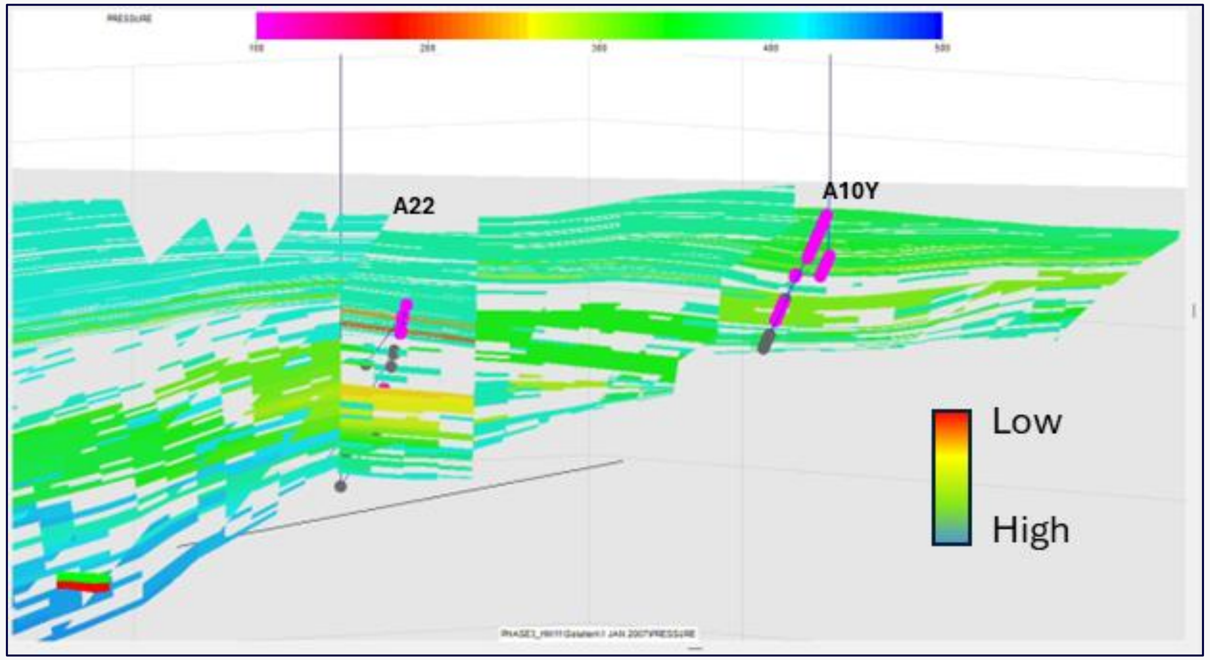
- Fault offset removed to allow full connectivity between the wells
- Faults still in the model to allow for transmissibility to be applied if needed
- Highlights the importance of integrated feedback with Elemental Energies and Serica

Pressure match achieved in the history matched model





- Pressure depletion across fault blocks critical to achieving the history match
- Sand on sand communication across the faults needs to be present
- High permeability zones show significant depletion compared to adjacent lower quality reservoir



Infill well sensitivity analysis

	UPPER SANDY WELL LENGTH MD m
GEOSTEERED	849

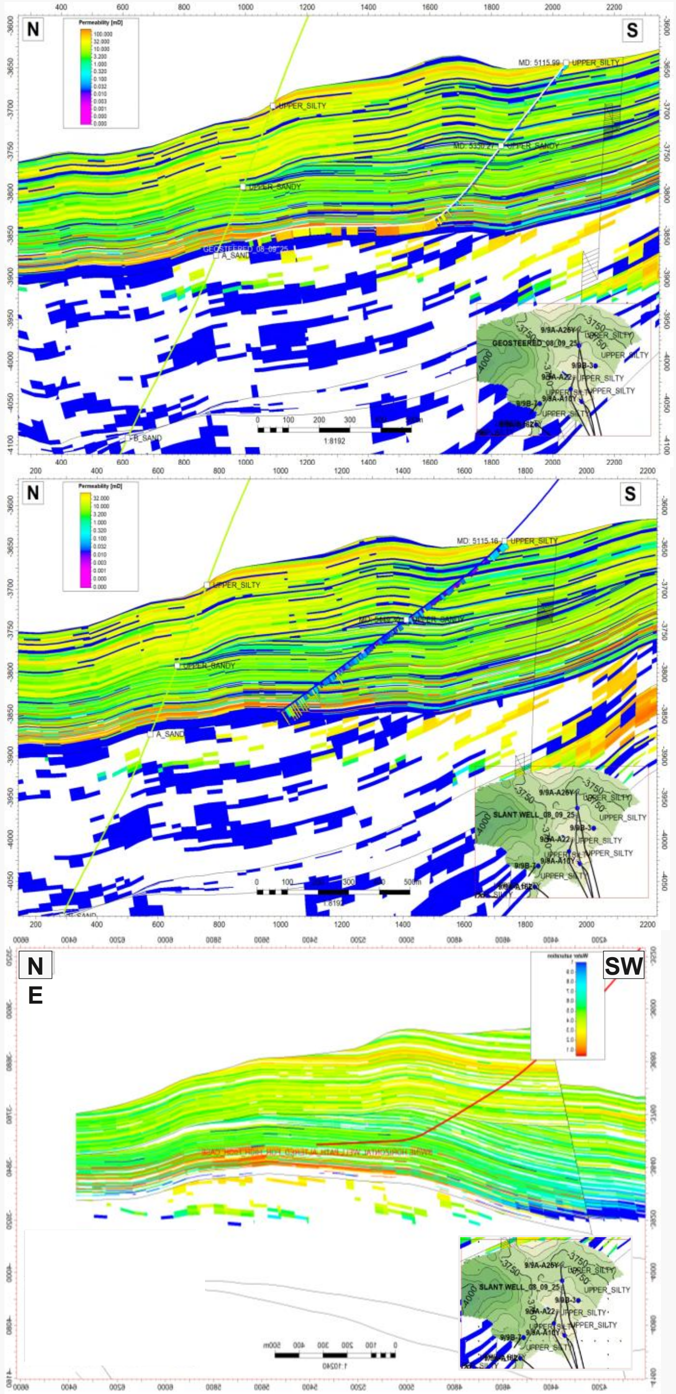
	K*L (mD*m)
GEOSTEERED	43137

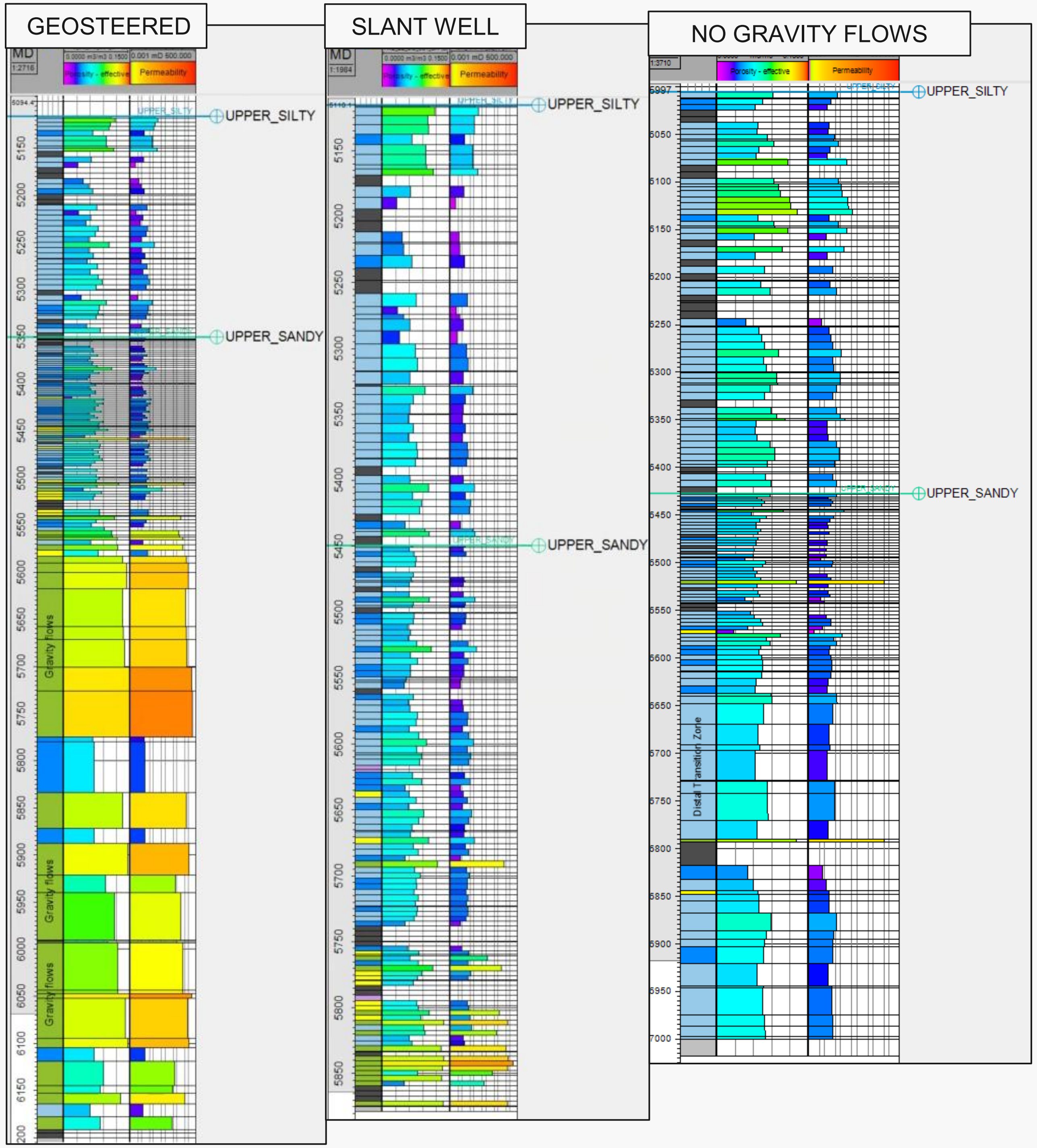
	UPPER SANDY LENGTH MD m
SLANT WELL	430

	K*L (mD*m)
SLANT WELL	1820

	UPPER SANDY LENGHT MD m
NO GRAVITY FLOWS	572

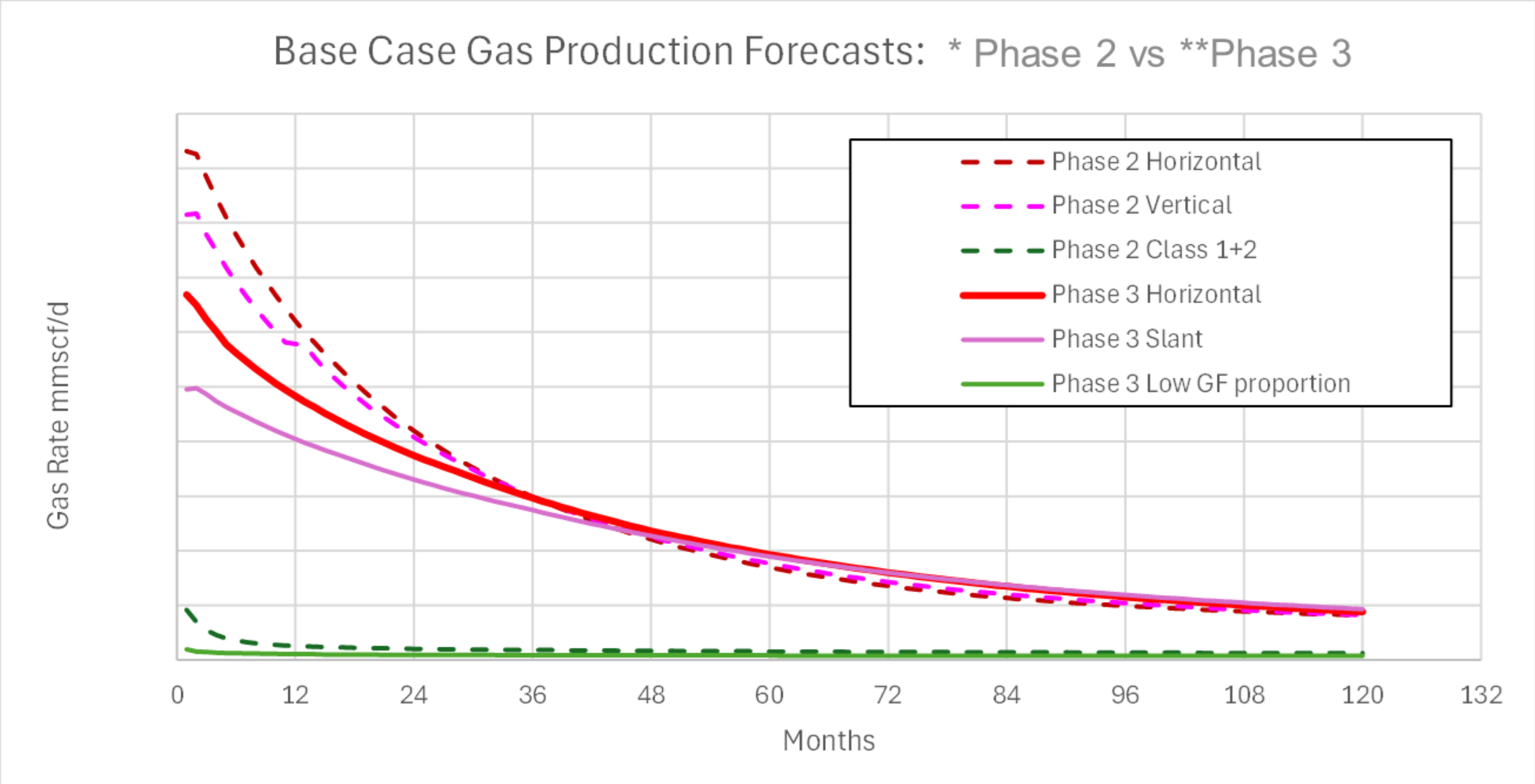
	K*L (mD*m)
SW/NE EXTENDED	379





Refined model infill well forecasts

- Final refined models inline with first phase of sector modelling
- A long horizontal well is the optimum scenario to drain the stranded gas in the north flank to reduce the risk of not intersecting the better quality gravity flow zones.
- If the well does not intersect the high-quality gravity flow reservoir it will not be a success



*Phase 2 = well productivity assessment modelling
**Phase 3 = refined modelling for infill well evaluation and planning

Conclusions

- **Screen** – Going back to legacy work can unlock reserves in the UK's mature producing assets
- **Locate** - Understanding the Upper Sandy reservoir allowed us to identify an attractive area for an infill well. The tight reservoir will drain into the higher quality sands
- **Refine** - Utilising refined static and dynamic models allowed multiple well types to modelled and key performance factors to be assessed. Ultimately an opportunity was identified that did not required hydraulic fractures
- Further sensitivities and well placement scenarios are being considered by Serica to unlock the North Flank potential
- **Thank you to Serica for permission to present this talk and for all the support during these projects**

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Thank you for listening

Any questions?