

# CarbonNet Project Update

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## The Story so far:

### The Gippsland Basin is Australia's first (and probably its best) Petroleum basin

- Because of this we have lots of information (wells and seismic data)
- We know how petroleum has been trapped in this basin for millions of years
- We can map similar, but empty structures for CO<sub>2</sub> storage
- In the (near?) future, when the giant oil and gas fields are closed, they may also become good storage sites

### Good Reservoirs

- Excellent quality sandstone reservoir rocks – High Injectivity (10x Gorgon)
- Excellent aquifer pressure support

### Good Topseals

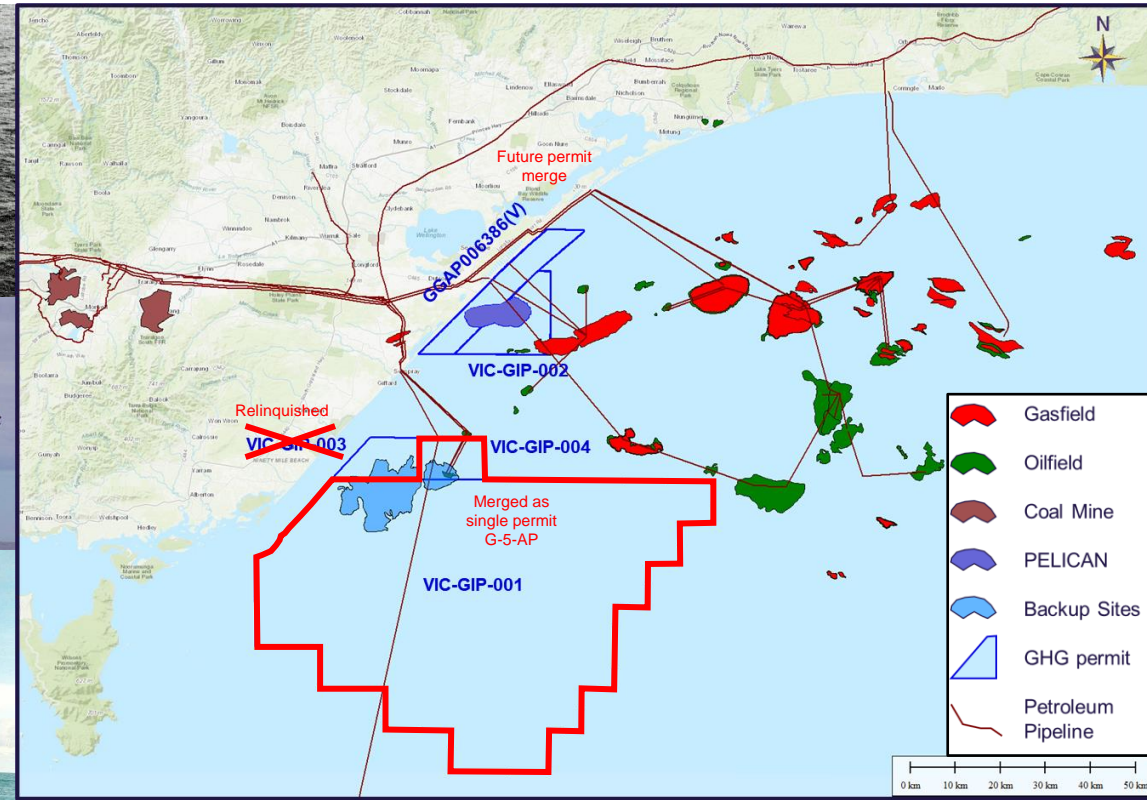
- Proven whole-basin topseal
- Proven additional seals at deeper levels
- Excellent Containment of CO<sub>2</sub> – multiple seals

### Giant Structures

- World-Class Structural Storage – High Capacity

### The Pelican site

- >125 Mt CO<sub>2</sub> capacity using SPE methodology
- Modelling CO<sub>2</sub> injection
- Easy to monitor stored CO<sub>2</sub>



## New Information:

- (3D seismic acquired 2018 over Pelican structure)
- (Appraisal Well Gular-1 drilled 2019-20)
- **SCAL programme on Gular-1 Appraisal Well progressing**
  - New Relative Permeability data for ultra high-perm reservoirs (incomplete)
  - New direct CO2 capillary measurements for brown coal seals (ongoing)
  - Geomechanical data for first few samples
- **Project advances**
  - World's first trial shipment of liquid hydrogen to Japan
  - Pipeline route optimisation / Pre-Feed studies in progress
  - Project Management/organisation refresh for final design/construction phase
- **Static and dynamic modelling**
  - New static model complete - based on 3D seismic and new well data
  - First dynamic model tests successful
  - Site volume confirmed (125 Mt)
- **Regulatory Steps**
  - GHG Permit consolidation (5 permits straddling 3 sites -> 2 permits, 2 sites)
  - Documentation for Regulatory filing in progress
  - Some political progress in Australian emissions management



# The CarbonNet Project

- Investigating the feasibility for a commercial-scale, multi-user CCS network in Gippsland, Victoria, Australia
- Jointly funded by the Australian and Victorian Governments since 2010
- Significant research investment to support CarbonNet
- Working collaboratively with industry to secure customers and investors

## What a CCS service enables

- Supporting negative emissions
- New low emissions industries, technologies & jobs
- Sustainment of existing industries in a carbon constrained economy



# Gular-1 Appraisal Well – Dec 2019/Jan 20

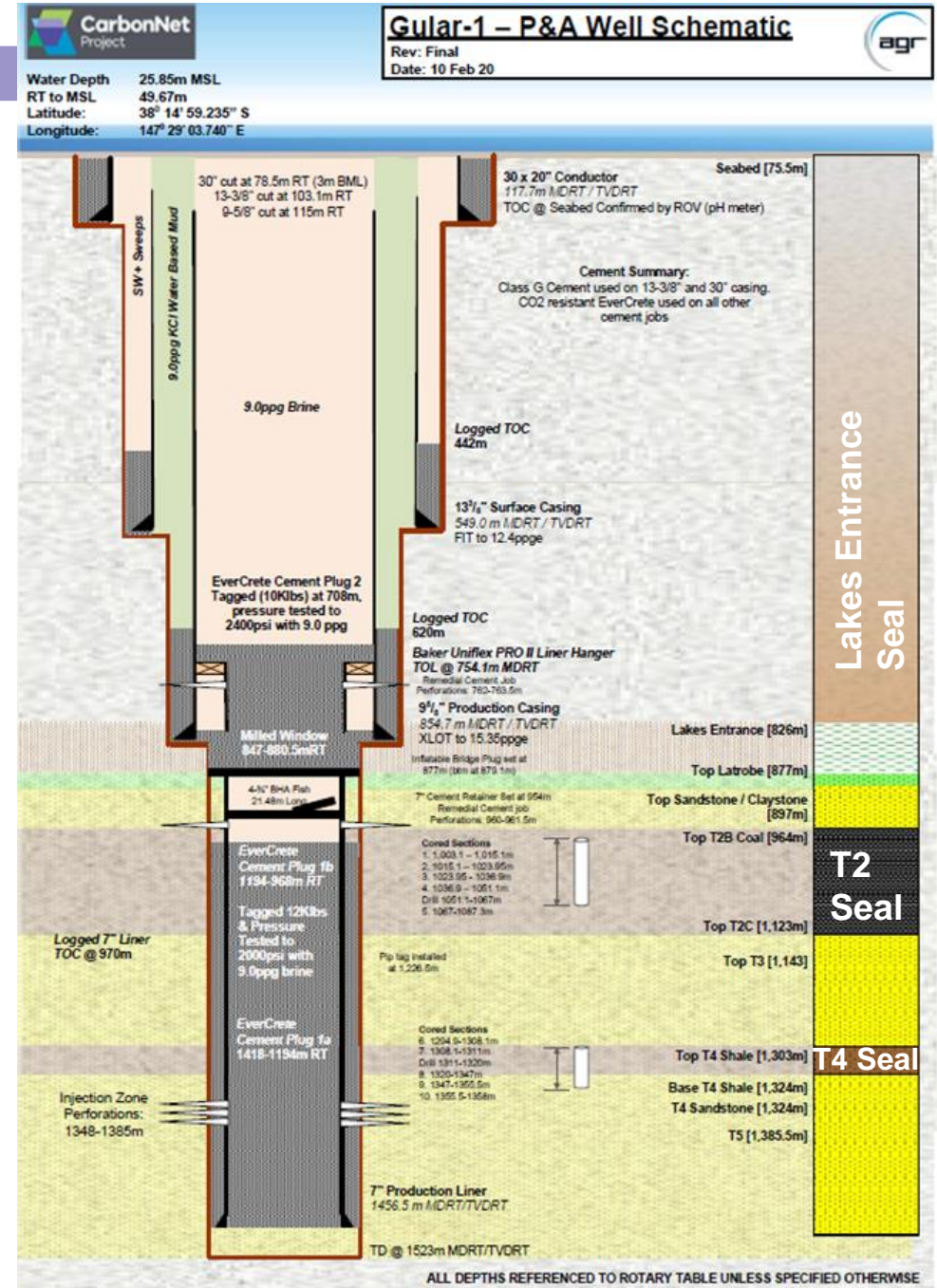
- Drilled and executed safely within quality and budget
- Location optimised, using 2018 3D seismic survey
- Australia's first offshore well for CCS
- Pelican site confirmed to have storage capacity of at least 5 million tonnes of CO<sub>2</sub> per year, for 25 years - potential upside capacity under review
- Analysis of core included leading edge analysis at CSIRO & Core Lab Australia



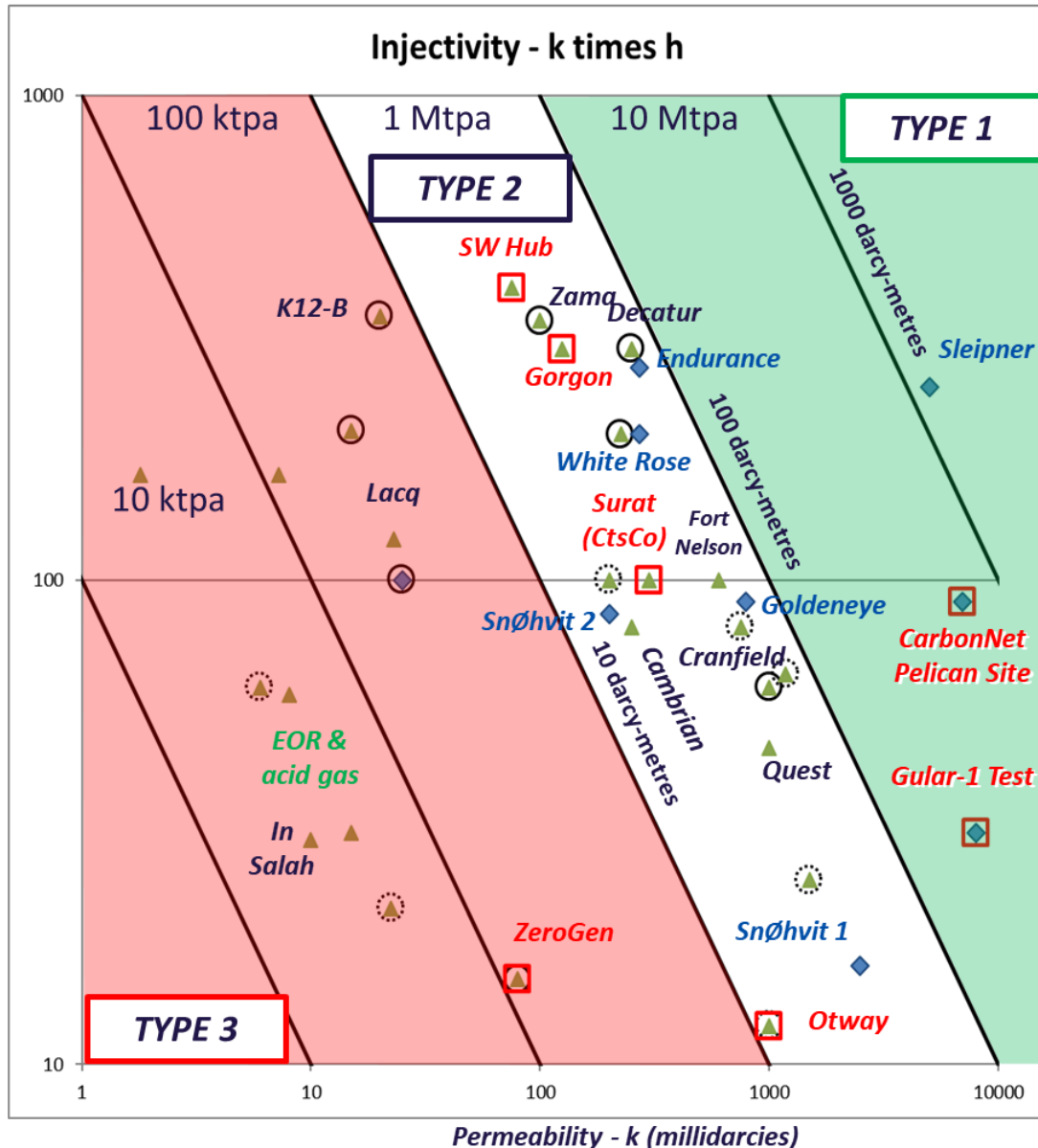
# Gular-1 Well Summary

## Outcomes compared to pre-well understanding:

- Depth prognosis and lithology as prognosed
- 89m high quality conventional core and wireline log data acquired over Seals / Reservoir
- T4 / T3 Reservoir quality better than prognosed
- T2B / T4 Seals present as prognosed. Two potential intra-formational seals found in the T3
- No hydrocarbons detected
- Well P&A'd safely
- Well completed with CO<sub>2</sub> resistant materials and safe for nearby CO<sub>2</sub> injection



# Injectivity- world projects - why the Gippsland Basin?



## World-Class basin, public data

- World-class oil and gas basin with excellent reservoirs
- Proven by >1,500 exploration and development wells.
- Basic data on all of these is open-file.

## Source-sink matching

- There are large stationary sources of CO2 nearby.

## Injectivity – the route to project success

- Injectivity is reservoir thickness (*h*) times permeability (*k*).
- Other factors (e.g. aquifer quality) can reduce long-term performance
- Good initial injectivity is crucial to success.

## Pelican:

- CarbonNet Gular-1 well injection test covered a 30m interval.
- Future development may use three wells, each with 30m interval

## Type 1 Reservoirs

Ideal for low-cost projects, both on- and offshore

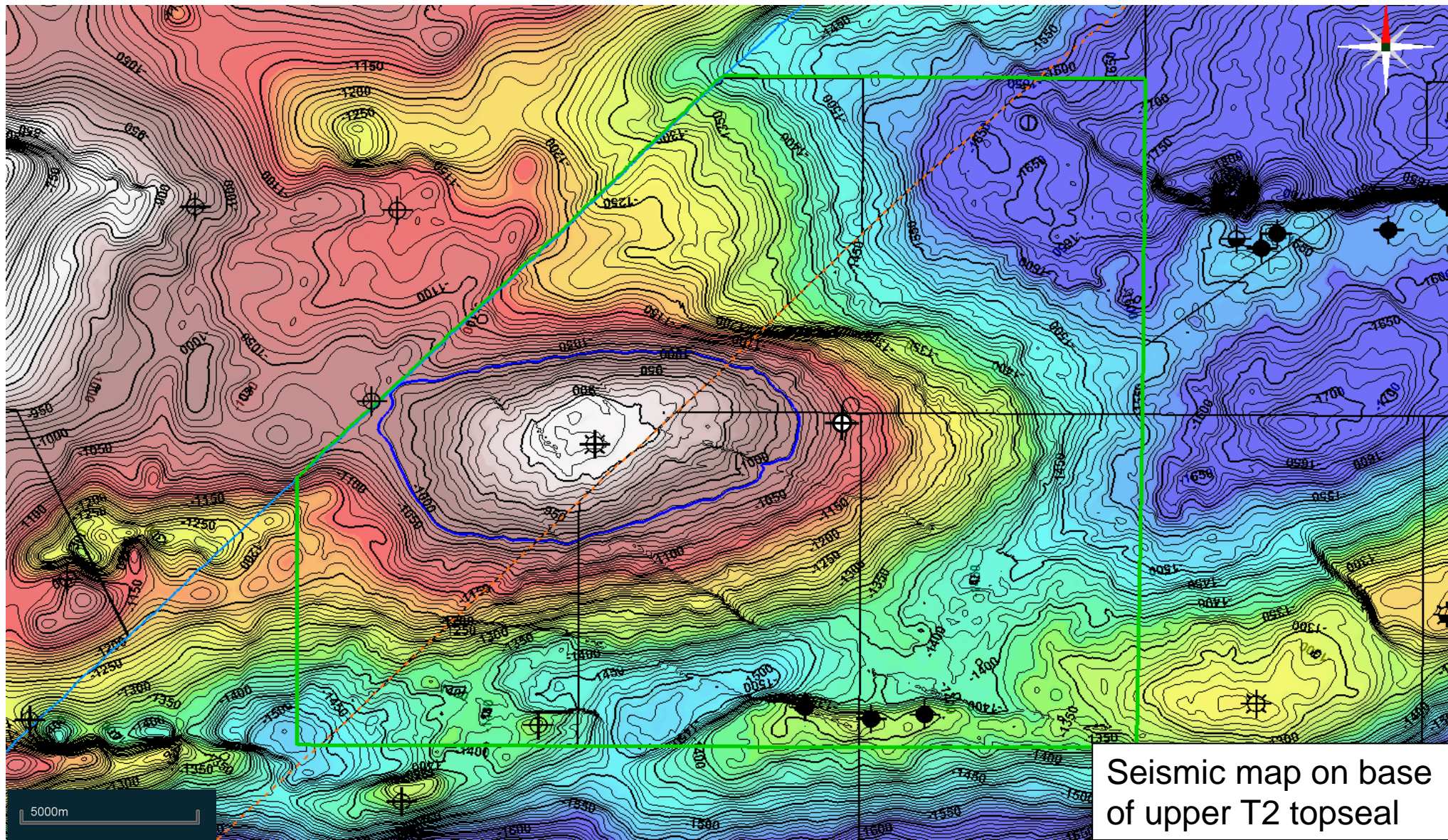
## Type 2 Reservoirs

Good for onshore injection, less suitable offshore

## Type 3 Reservoirs

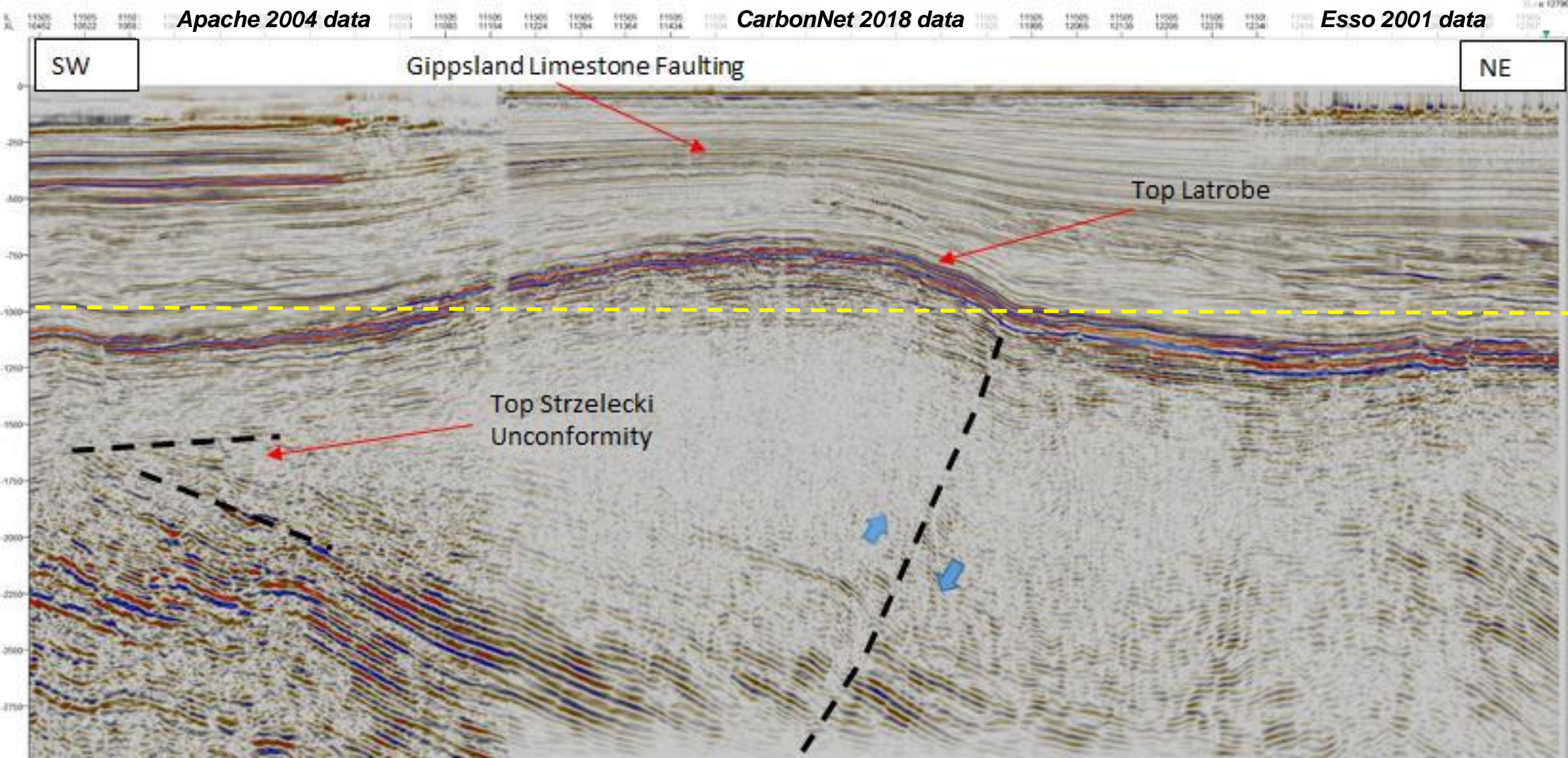
Only suitable for small research/pilot projects onshore

## More about the CarbonNet Pelican site

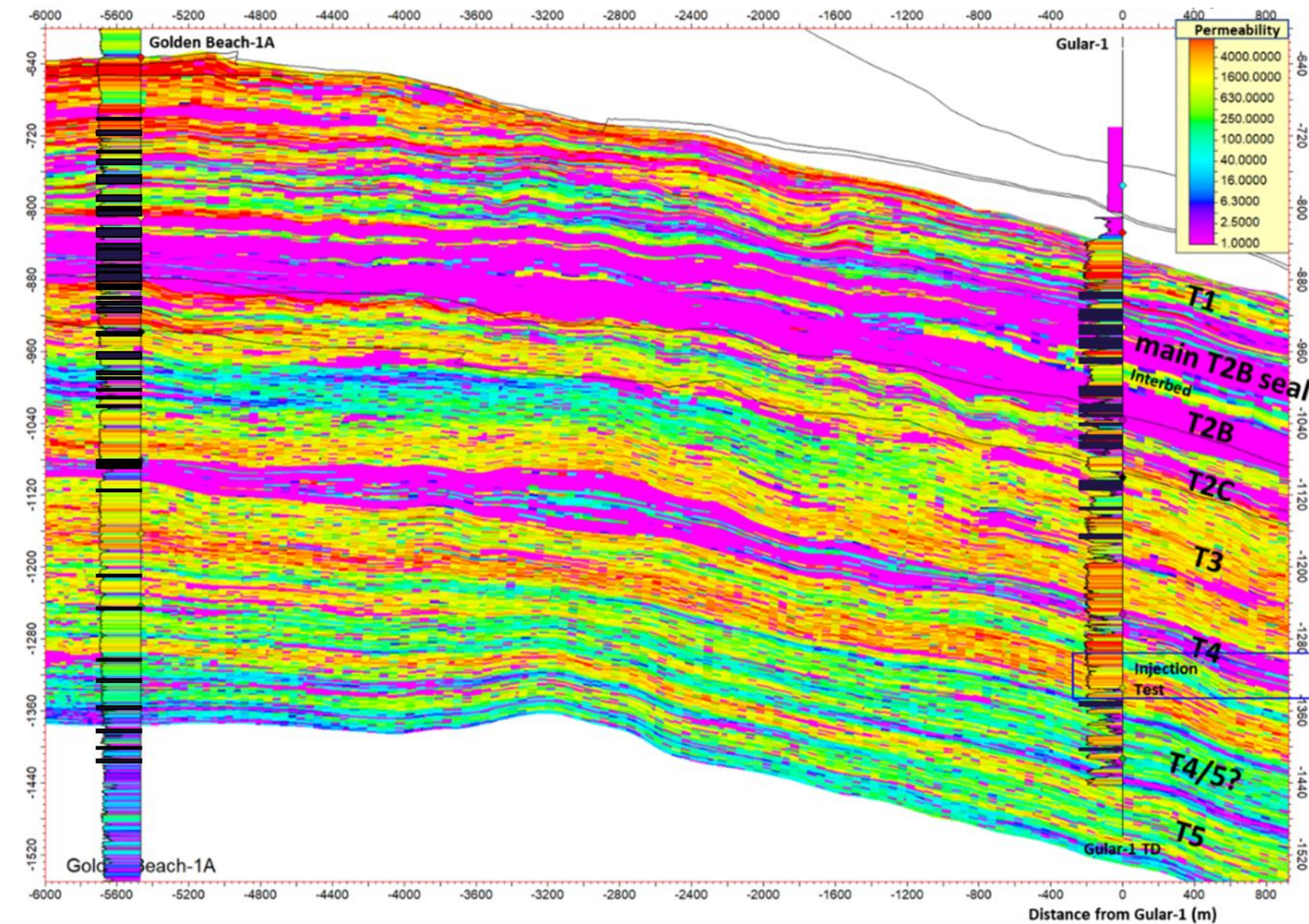




# Pelican – 3D seismic merge / structural context



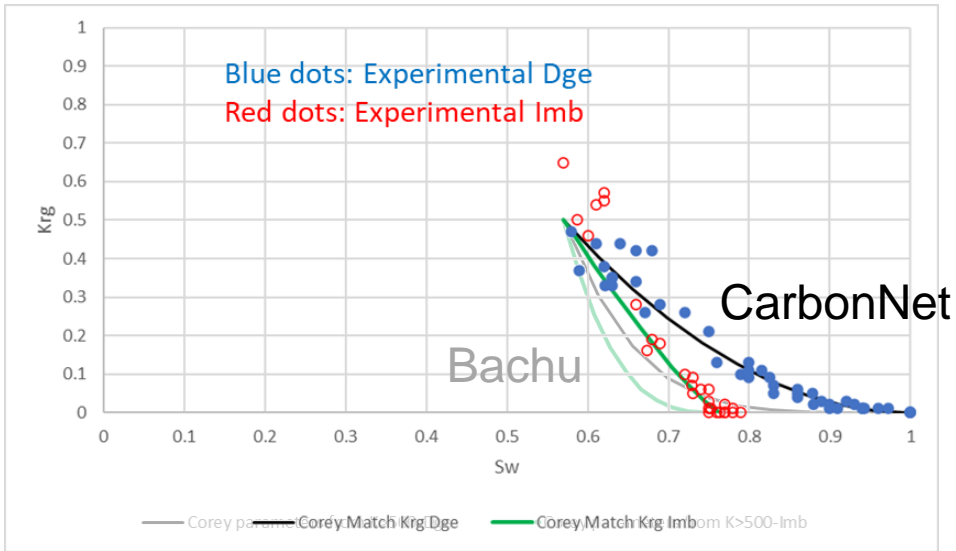
# Gular-1 post-well comparison to pre-well Static Model



Well Log permeability from CMR log (Timur-Coates equation) compared to pre-drill static model permeability derived from well data and seismic attribute

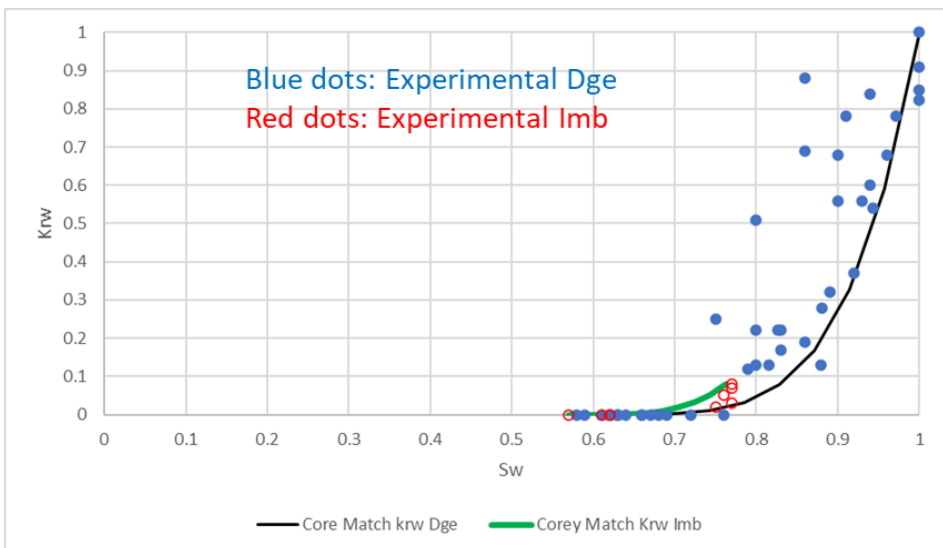
There is a very good correlation between the model (the pre-well prediction) and the well outcome, albeit with better poroperm than predicted, especially over the injection zone

# Relative Permeability data



- Data is preliminary, based on a small number of samples.
- Measurements with supercritical CO2 by CSIRO
- End-points are not well-defined, especially Swr
- A wider study is ongoing

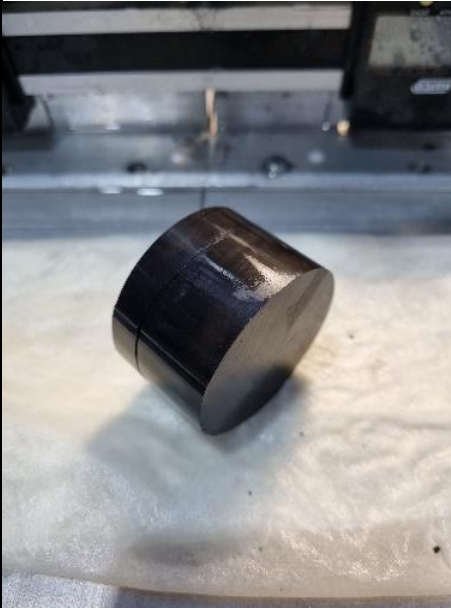
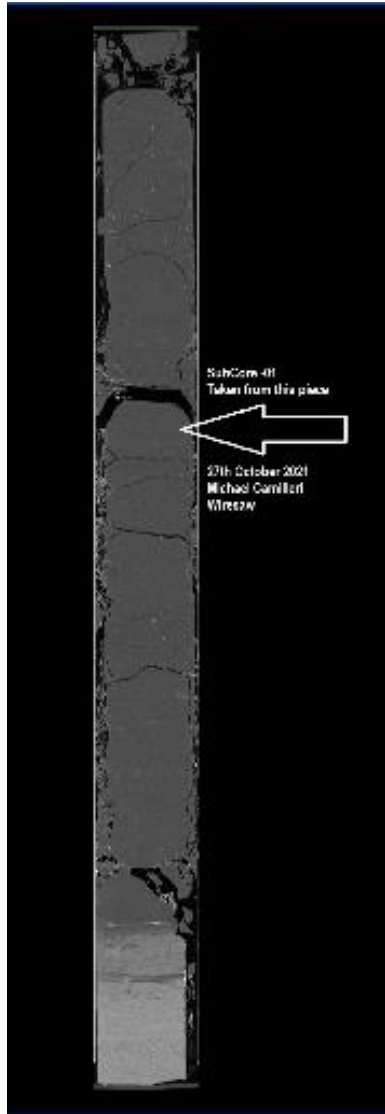
## New data for multi-darcy clean reservoirs



While S<sub>gt</sub> and S<sub>wr</sub> are consistent between CSIRO results and Bachu's database, The Corey exponents differ

Corey Exponents	Value
Ng (imb)	1.2
Ng (Dge)	2
Nw (Imb)	5
Nw (Dge)	4
Krgmax	0.5
Krwmax	0.08
Sgt	0.2375
Swr	0.57

# Coal Permeability



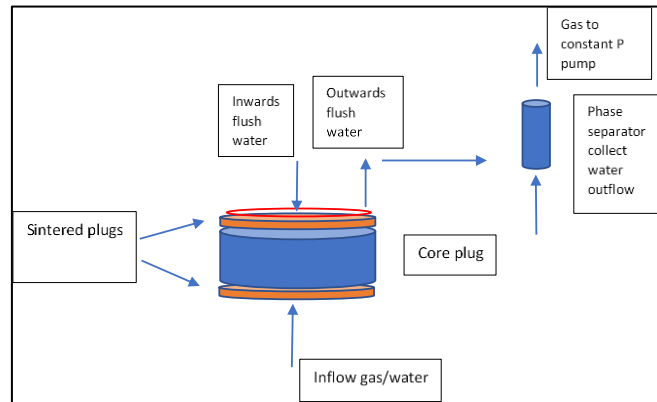
- Brown coal is not widely-studied compared to more mature black coals
- Brown coal is transitional between peat and higher-rank coal
- Brown coal is typically NOT cleated
- Data is preliminary, based on a small number of samples.
- Measurements with supercritical CO<sub>2</sub> by CSIRO

Water permeability of T2 brown coal sample = 0.001 md

Supercritical exposure @ 10 Mpa / 50° C:

- 1) Significant CO<sub>2</sub> entry pressure ( 380-430 kPa / column height ~50m)
- 2) Massive permeability reduction (3 orders of magnitude)

**Brown coals are a sealing lithology**



## Proposed CarbonNet facilities and infrastructure

**Umbilical Connections:** Multi-purpose umbilical connecting power, chemical, control signals and monitoring to subsea manifold, wellheads and monitoring equipment, from onshore.

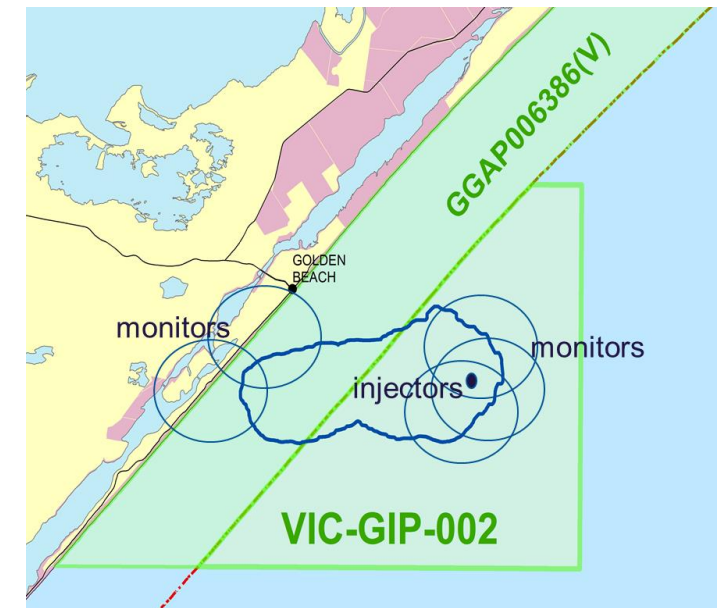
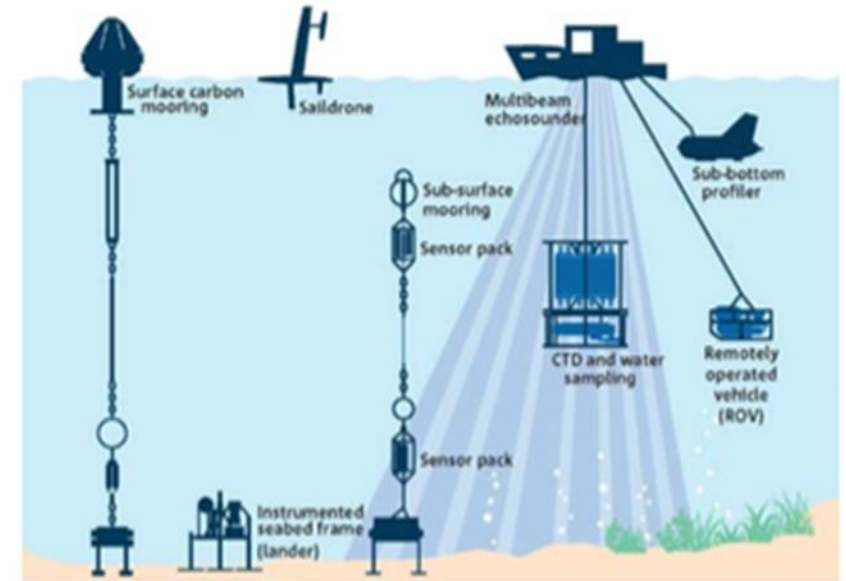
**Subsea Infrastructure:** Single main manifold, flowline connectors to (4) subsea wellheads and seabed deployed monitoring equipment. Expansion capability for future additional wells.

### **Injection and monitoring wells:**

- 3 x CO<sub>2</sub> injection wells (with monitoring capabilities)
- 1 x Offshore Monitoring well
- 1 x Onshore Monitoring well

## Testing Equipment

- CarbonNet has invested in targeted R&D for processes and equipment that may be used in our monitoring plan, to de-risk
- The GipNet project deployed monitoring technologies in the Gippsland region and at the Pelican site between 2016 and 2019.
- This initiative monitored the ocean, atmosphere and seismology around the Pelican site and has established data around existing natural variation and proved the equipment in the challenging environment of Bass Strait
- The CO2CRC Stage 3 project has shown the capabilities for downhole permanent monitoring that can deliver on-demand surveillance



## Next steps

- Incorporating appraisal well data into a new static and dynamic simulation
- Redo risk register
- Apply lessons learned from R&D projects (GipNet & OS3)
- Commence FEED
- Commence Regulatory Approvals for entire system
- Develop final site development plan and new risk based MMV plan to gain Injection License



**CarbonNet**  
Project  
Enabling a Net Zero Future



**International Workshop on  
Offshore Geologic CO<sub>2</sub> Storage**

*Thank You*

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Australian Government  
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