



UKCS Licence P2601,  
Block  
Relinquishment Report

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February 2022

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## 1. Licence Information

This report documents the full relinquishment of UKCS Licence P2601 which included blocks 211/18j, 211/23a and 211/24a awarded to EnQuest Heather Limited (100%) with a start date of the 1<sup>st</sup> of December 2020 as part of the 32<sup>nd</sup> UK licence round.

The location and extent of the licence area is illustrated in Figure 1. A summary of the licence is presented below in Table 1.

<b>Licence Number</b>	P2601
<b>Fields (Ceased Production)</b>	
<b>Block Number(s)</b>	211/18j, 211/23a & 211/24a
<b>Licence Type</b>	Innovate with Phase C only
<b>Licence Round</b>	32nd
<b>Operator / Partners (%)</b>	EnQuest Heather Limited (100%; operator)
<b>ISP reference</b>	2021-ISP-LE-0169
<b>Regulator reference</b>	LAA/2021/205/1

**Table 1: Licence summary**

Block 211/18j, defined on the 1<sup>st</sup> December 2020, is the region bounded by the following coordinates:

- (1) 61°21'00.000"N 1°30'00.000"E
- (2) 61°21'00.000"N 1°34'00.000"E
- (3) 61°20'00.000"N 1°34'00.000"E
- (4) 61°20'00.000"N 1°30'00.000"E
- (5) 61°21'00.000"N 1°30'00.000"E

The above coordinates were specified using "European Datum 1950".

The lines joining coordinates (1) to (5) are navigated as loxodromes.

Block 211/23a is the region bounded by the following coordinates:

- (1) 61°20'00.000"N 1°24'00.000"E

- (2) 61°20'00.000"N 1°36'00.000"E
- (3) 61°12'00.000"N 1°36'00.000"E
- (4) 61°12'00.000"N 1°34'00.000"E
- (5) 61°13'00.000"N 1°34'00.000"E
- (6) 61°13'00.000"N 1°32'00.000"E
- (7) 61°15'00.000"N 1°32'00.000"E
- (8) 61°15'00.000"N 1°34'00.000"E
- (9) 61°17'00.000"N 1°34'00.000"E
- (10) 61°17'00.000"N 1°29'00.000"E
- (11) 61°16'00.000"N 1°29'00.000"E
- (12) 61°16'00.000"N 1°27'00.000"E
- (13) 61°18'00.000"N 1°27'00.000"E
- (14) 61°18'00.000"N 1°26'00.000"E
- (15) 61°17'00.000"N 1°26'00.000"E
- (16) 61°17'00.000"N 1°24'00.000"E
- (17) 61°20'00.000"N 1°24'00.000"E

The above coordinates were specified using "European Datum 1950".

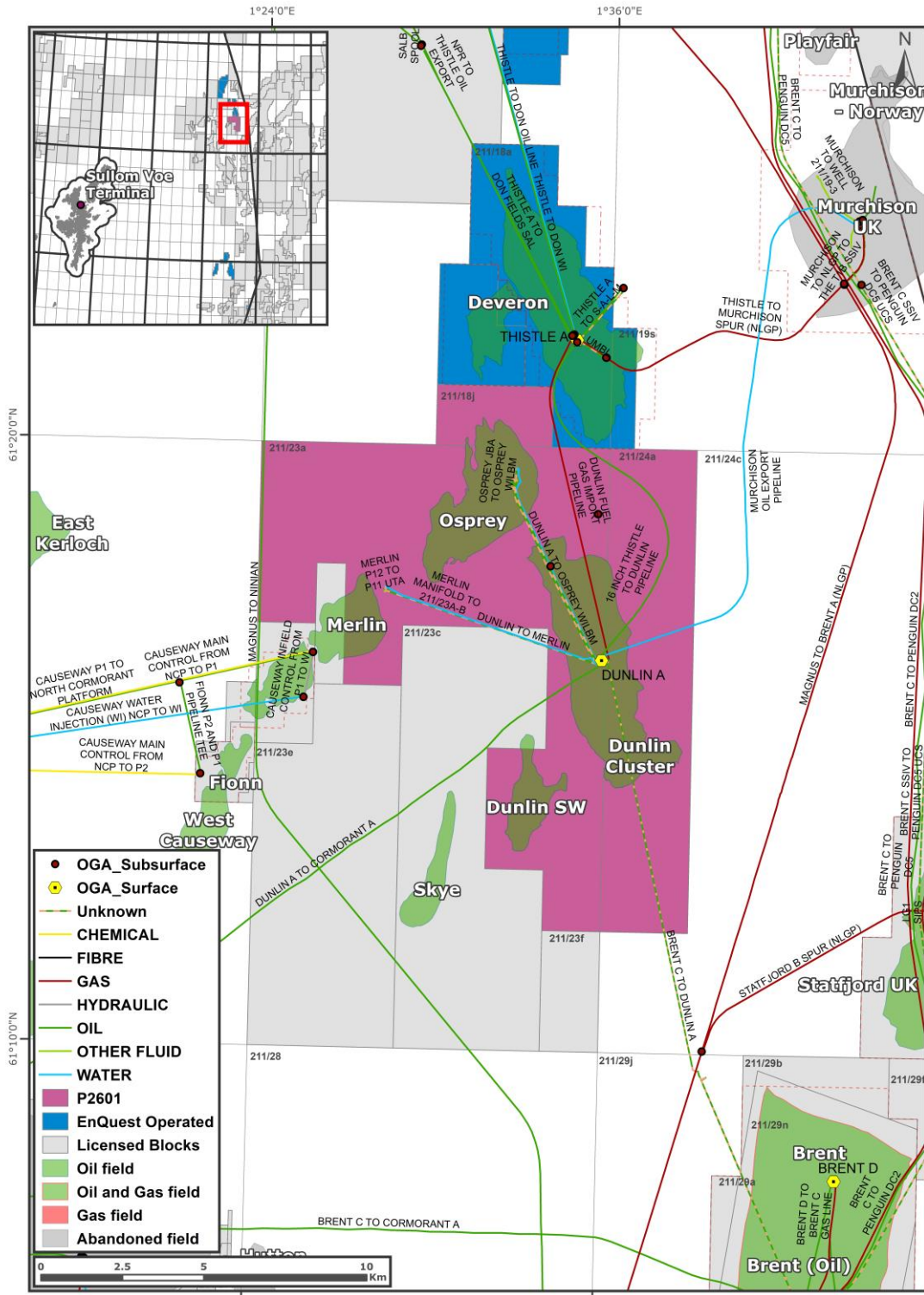
The lines joining coordinates (1) to (17) are navigated as loxodromes.

Block 211/24a is the region bounded by the following coordinates:

- (1) 61°20'00.000"N 1°36'00.000"E
- (2) 61°20'00.000"N 1°39'00.000"E
- (3) 61°12'00.000"N 1°39'00.000"E
- (4) 61°12'00.000"N 1°36'00.000"E
- (5) 61°20'00.000"N 1°36'00.000"E

The above coordinates were specified using "European Datum 1950".

The lines joining coordinates (1) to (5) are navigated as loxodromes.



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### P2601 Infrastructure

Figure 1: Licence P2601 location map

## 2. Licence Synopsis

UKCS Licence P2601 which included blocks 211/18j, 211/23a and 211/24a was awarded to EnQuest Heather Limited (100%) with a start date of the 1st of December 2020 as part of the 32nd UK licence round.

The application area included the Dunlin, Dunlin SW, Osprey and Merlin fields which were developed by Shell between 1978 and 1986. All fields are currently undergoing decommissioning, with Cessation of Production driven by a combination of low production levels, high operating costs and costs associated with life extension.

Prior to application, EnQuest reviewed the area and evaluated the remaining potential and considered that an opportunity existed to re-develop Osprey by drilling an extended reach well from the Thistle Alpha platform and potentially re-develop other fields as a subsea cluster tied back to an existing or new hub facility. Both options could support the extension of the Thistle Alpha life.

These opportunities are detailed in **Table 3** below.

Re-development Opportunity	STOIP	Cumulative Oil	Recovery Factor	Estimated Remaining Reserves	Potential Redevelopment Option
	MMstb	MMstb	%	MMstb	
Osprey	211-234-252	92.3	44-39-36	1.7-3.0-4.2	ERD well from Thistle platform
Dunlin SW	25-40-60	11.6	46-29-19	1.6-3.7-7.2	Single well subsea tie-back
Dunlin (Block 10/14)	68-85-102	31.4	46-37-31	3.0-5.0-10.0	Producer injector pair with subsea tie-back

**Table 2: Redevelopment Opportunities**

However, since the application, EnQuest announced it will not re-start production at the Thistle field. The ability to drill the Osprey Horst opportunity from the Thistle platform was a key factor in the redevelopment of the licence area. Since this is no longer an option, EnQuest has taken the decision not to pursue the FDP and instead will relinquish the licence.

Block 14 and Dunlin SW subsea re-development was assumed to be tied back to a future facility at Galapagos. Subsequent reviews of development options for Galapagos have proved to be at best marginal to sub-economic.

### 3. Subsurface Description and Work Programme Summary

#### 3.1 Regional and Tectonic Setting

The Dunlin Cluster and adjacent fields lie in the East Shetland Basin in the northern North Sea, bounded to the west by the Palaeozoic East Shetland Platform, to the east and south by the Viking Graben, and to the north by the ENE-WSW trending Magnus Embayment. Located on the broad western flank of the North Viking Graben, the half graben of the East Shetland Basin subsided rapidly during a period of Permo-Triassic rifting and reached its maximum structural development by the end of the Jurassic. This period of rifting was followed by a phase of post-rift thermal subsidence in the early and middle Jurassic. A second phase of tectonic activity during the Late Jurassic and Early Cretaceous produced a pattern of generally north-south trending rotated fault blocks characteristic of the East Shetland Basin which strongly overprinted the earlier phase of Permo-Triassic rifting. This phase of rifting can be demonstrated by the development of an extensional fault system, which became active towards the end of the Brent Group to early Heather Formation deposition, as evidenced by the syn-rift thickening of the Heather and Kimmeridge Clay formations in the palaeo-lows and their corresponding thinning onto palaeo-highs. Post-rift thermal subsidence continued from the Cretaceous through Cenozoic.

The predominant structural regime is extensional, with throw on planar, normal faults, displaying several significant trends (Figure 2). The area is dominated by large NE-SW trending faults, which define the footwall highs of Thistle, Murchison and Statfjord and is more strongly influenced by the NE-SW-oriented More and Faroe Basin rift system rather than the N-S trending North Viking Graben.

The accumulations within the Dunlin cluster are aligned along one of two NE-SW trend: the northernmost being the Osprey ridge which extends from Osprey, down through Merlin towards Fionn and Causeway to the southwest; and a southern ridge of accumulations including Dunlin, Dunlin SW, Spoonbill, Skye and the Skylark prospects. Almost perpendicular to this are NNW-SSE trending faults, such as those bounding the Dunlin and Thistle, which punctuate the NE-SW trending ridges resulting in the separate accumulations of the Dunlin cluster. These faults often terminate where they intersect the NE-SW faults, accommodating local footwall uplift, due to stress release, along the NE-SW extensional faults. Between the larger field-defining faults, numerous smaller faults are seismically distinguished such as the north south trending faults which define the Osprey Horst and the north south fault which downthrows Blocks 10/14 from the main Dunlin field. Most do not substantially offset the reservoir and typically do not significantly impede fluid movement. However, significant fault offsets >150ft often baffle and indeed confine the flow of injection water and can result in separate OWC across individual fields such as the differing OWC contacts observed between Osprey Horst and Osprey Western Pools.



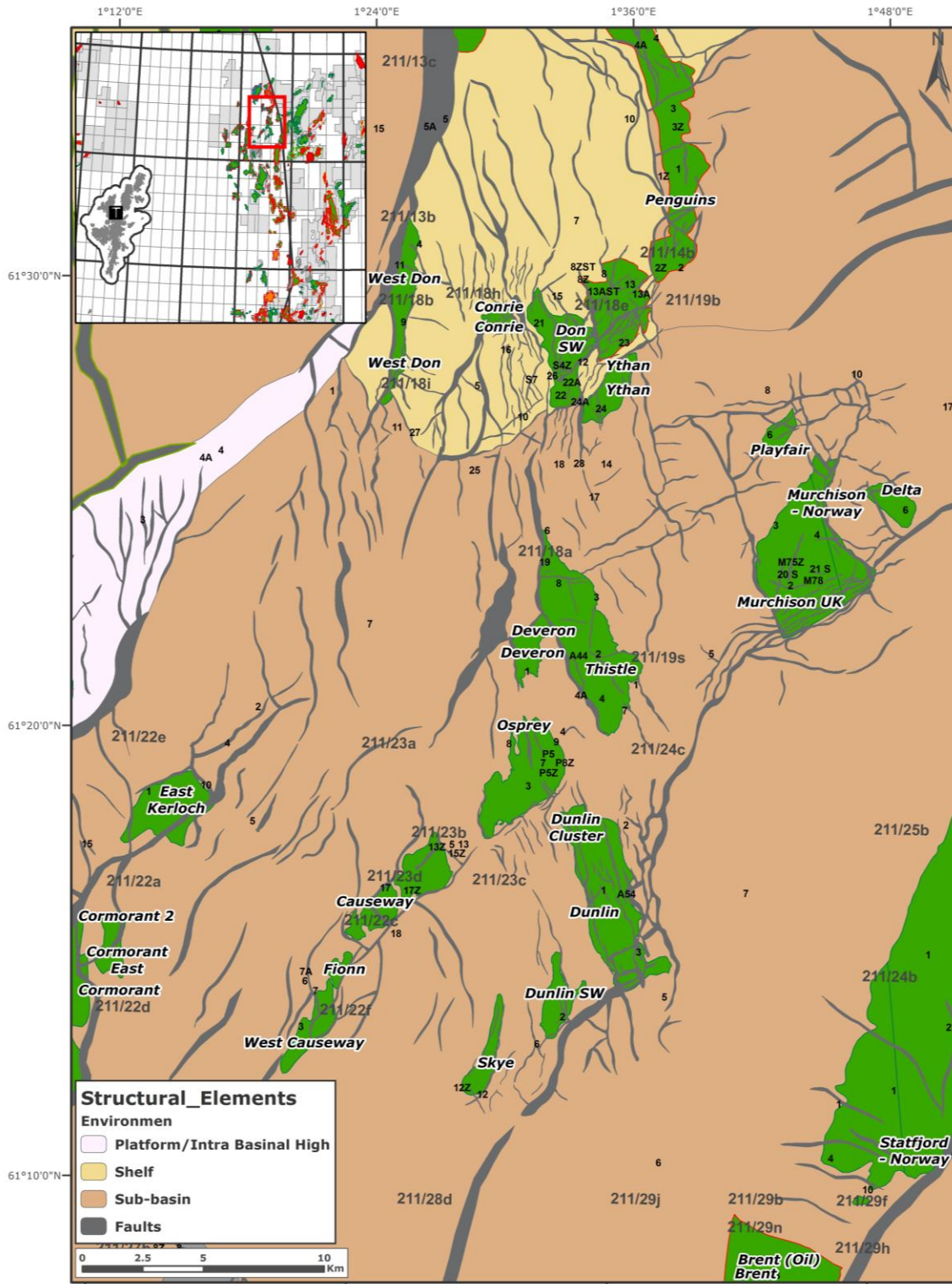


Figure 2: Regional Structural Elements

### 3.1.1 Stratigraphy

The sedimentary record of the area of study starts in the Triassic with the distal flood plain deposition of continental claystones and sandstones sediments of the Cormorant Formation. These terrestrial sands and siltstones are overlain by the coastal plain sands of the Upper Triassic Statfjord formation. Further deepening of the Viking Graben / East Shetland basin areas is reflected by the open marine shales and siltstones of the Lower Jurassic Dunlin Group. In the middle Jurassic this marine period was followed by a shallowing and the progradation of a deltaic system across the Viking Graben and East Shetland Basin in a northward direction depositing the sand/shale sequence of the Brent Group. At the beginning of the Late Jurassic the progradation of the Brent delta was halted by a deepening and transgression, which led to the deposition of the marine Humber Group comprising shales and siltstones of the Heather Group and the organic rich shales of the Kimmeridge Clay Formation. A relative fall in sea-level, accompanied by widespread tectonic activity brought Humber Group deposition to a close and this event is represented by the Base Cretaceous Unconformity which forms a seismic marker of regional extent. Above the BCU the Lower Cretaceous Cromer Knoll Group of marls and limestones were deposited as an onlap sequence during a marine transgression. These were succeeded in Late Cretaceous times by a monotonous sequence of Shetland Group Claystones. Since Cretaceous times, only minor structural movements have occurred and from Cromer Knoll to seabed the area is characterised by a layer cake sequence of marine shales and sands.

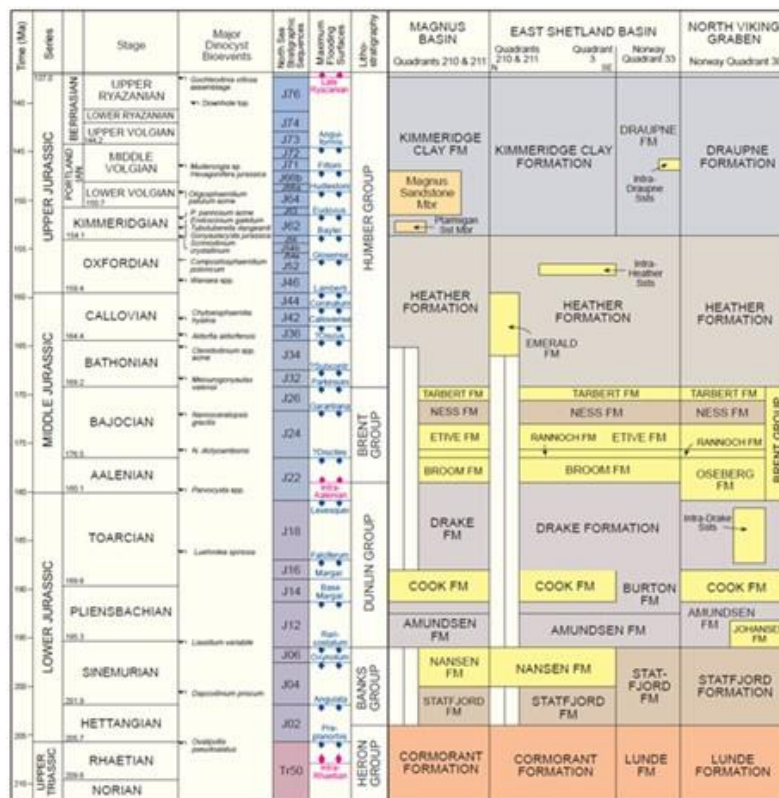


Figure 3: Jurassic Stratigraphy NNS - after Ternan 2005

### 3.2 Work Program Summary

EnQuest sought to go straight to second term, requesting the second term of the licence to be six years. The commitment was to produce an FDP for licenced area with the redevelopment of Osprey the priority area. The intent was to complete an evaluation of the Osprey Horst opportunity (drilled from the Thistle platform) within the first 3 years of the licence.

EnQuest proposed to engage in a technical work-programme to evaluate the whole area for redevelopment with multiple well subsea tiebacks and engage in feasibility and concept select studies. EnQuest have a data-sharing agreement in place with Fairfield and believed this data sufficient for assessing the technical feasibility of a redevelopment of the area.

The term length was driven by an ambition to redevelop the wider area and reflects the number of field and host studies necessary to mature a larger subsea cluster re-development: two or more re-developments were expected to be required to reach commerciality.

The work programme was therefore to produce an FDP or relinquish the licence.

In summary:

- Technical feasibility study of redevelopment of Osprey drilled from Thistle within the first three years
- Feasibility study for redevelopment of the wider area as a subsea cluster, evaluating multiple host options.
- Complete concept select for the wider area within six years.

### 3.3 Summary of Prospectivity and/or Development options

EnQuest had evaluated the remaining potential and believed that an opportunity existed to re-develop areas of these fields as either an ERD well from the Thistle platform and/or a subsea cluster tied back to an existing or new hub facility. Three opportunities were identified:

- 1.1. Osprey Horst re-development
- 1.2. Dunlin SW re-development
- 1.3. Dunlin Block 10&14 re-development

These opportunities are detailed in **Table 3** below.

Re-development Opportunity	STOIP	Cumulative Oil	Recovery Factor	Estimated Remaining Reserves	Potential Redevelopment Option
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Dunlin (Block 10/14)	68-85-102	31.4	46-37-31	3.0-5.0-10.0	Producer injector pair with subsea tie-back

**Table 3: Redevelopment Opportunities**

A map showing the field outlines of the opportunities in the bid, how they relate to one another and the fields/discoveries in the area, together with block boundaries is shown **Figure 1**.

**Figure 4** shows the locations of the orthogonal seismic traverses from the regional PGS mega-merge survey through each opportunity. Further details are available in Appendix B of the P2601 Licence Application.



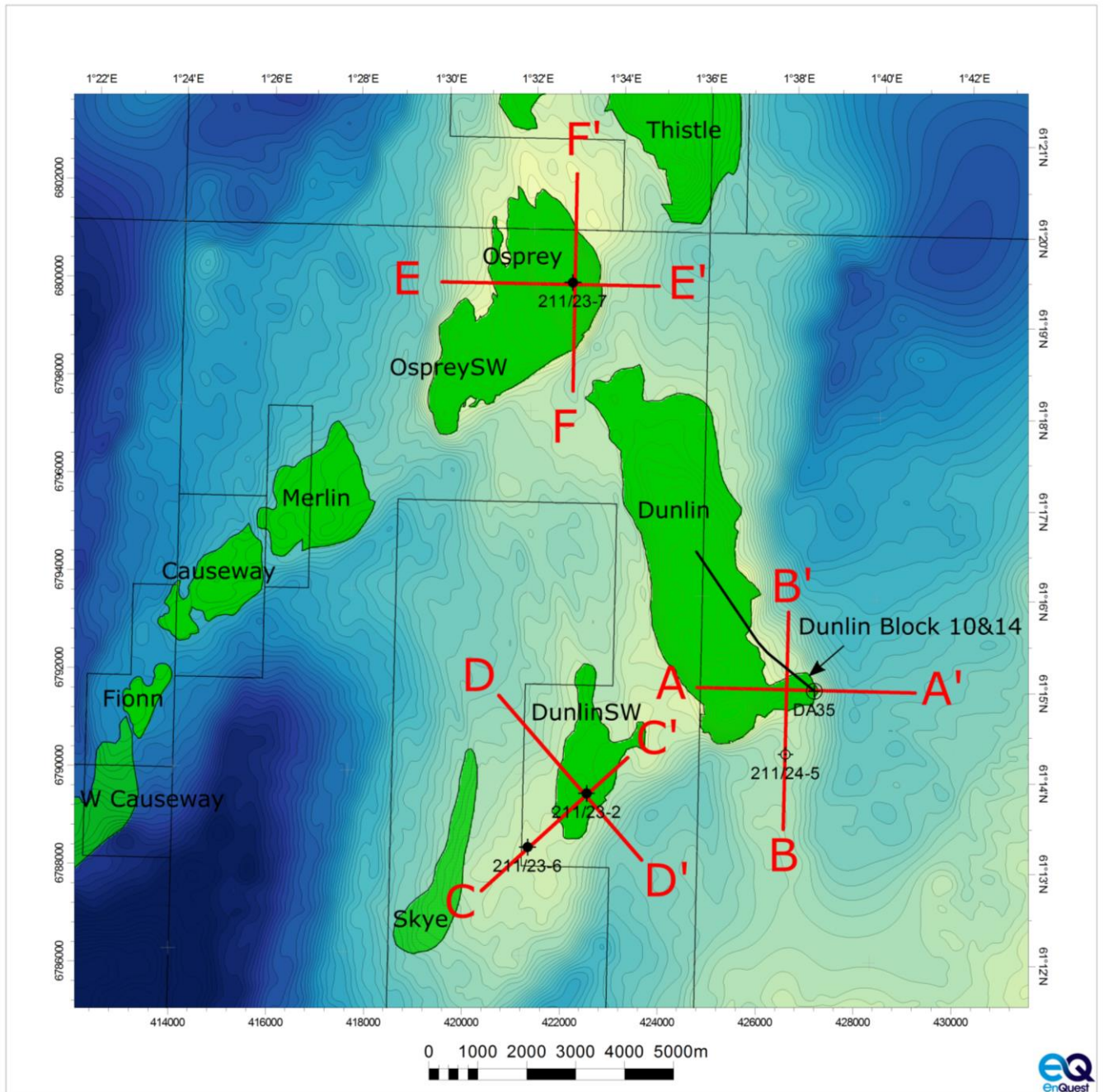


Figure 4: Map showing location of seismic sections through identified remaining opportunities

## 4. Database

### 4.1 Previous Work / Geotechnical Database

#### 4.1.1 Previous Work

This is a mature and established region of the Northern North Sea Brent province and the licence area is situated close to several of EnQuest's existing hubs of Thistle and Dons where EnQuest have a proven track record in operating late life fields.

Using a combination of EnQuest's current knowledge of the Brent province in the Northern North Sea, published material including UK Oil and Gas fields Commemorative Millennium Volume and propriety information from previous operators including relinquishment reports etc., EnQuest evaluated the remaining potential and believed an opportunity existed to re-develop areas of these fields. Either a subsea cluster tied back to an existing or new hub facility, or via Extended Reach Drilling (ERD) from existing infrastructure were considered as valid options.

#### Well Data

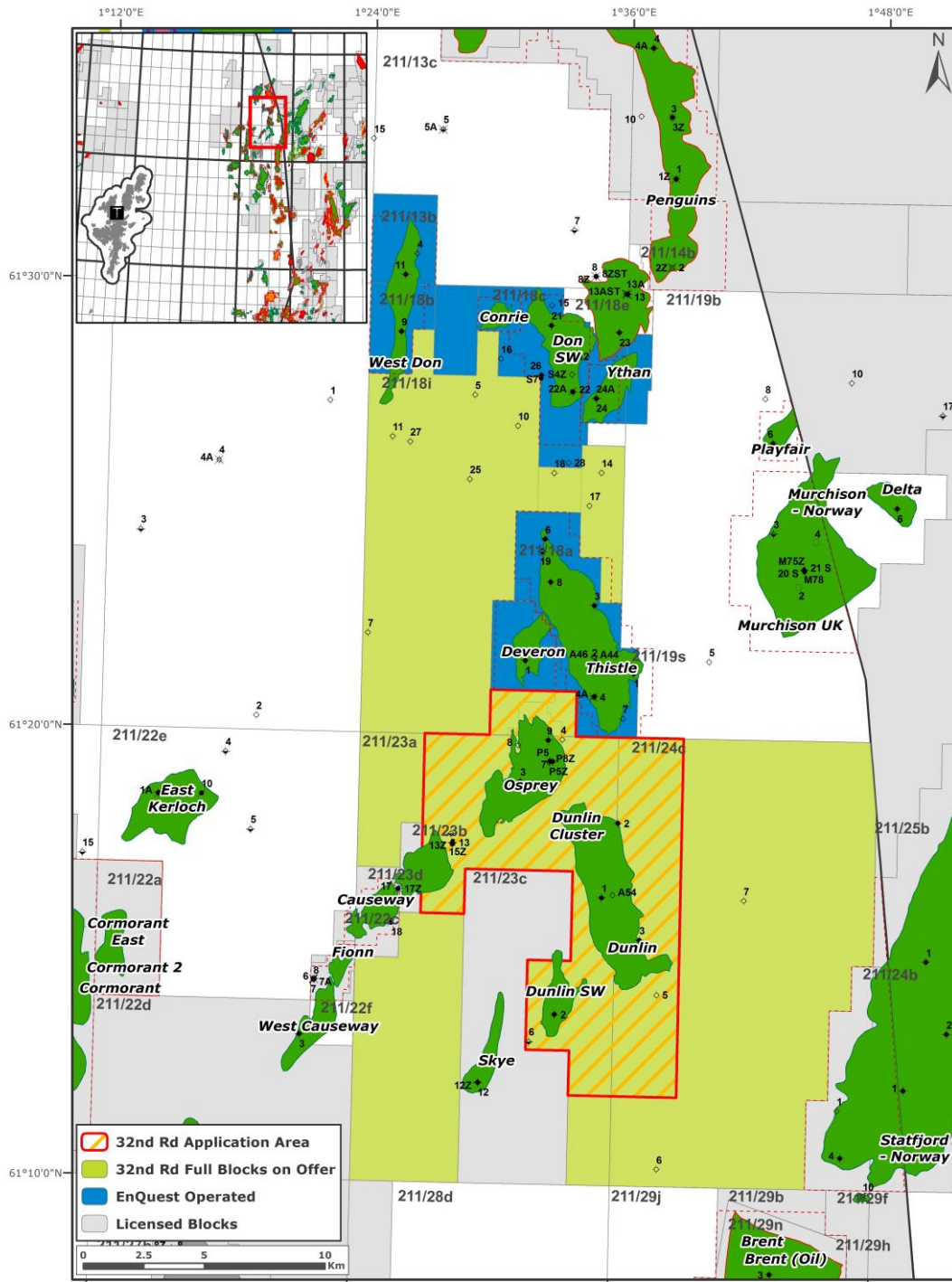
EnQuest has access to an extensive well database in this region as shown in **Table 4**, which includes well reports, composite logs and wireline log data. All the relevant released well data in the surrounding acreage has been acquired from the Oil and Gas Authority National Data Repository and analysed. In addition to the E&A wells listed below, EnQuest have also been granted access to all well and production data for Osprey, Dunlin and Dunlin SW production wells.

Well	Year Drilled	Status	Target	TD Formation	Results
211/18-1	1972	P&A Oil Well	Exploration - Deveron discovery	Heron Group - Cormorant Fm	Drilled on the North flank of a gently plunging faulted anticline. Objectives were the Middle & Lower Jurassic sandstone. Three potential producing zones encountered in the well but only one thin (24 foot) layer in Mid Jurassic flowed oil. Encountered 100 feet net sand in Mid Jurassic 82 feet net in Lower Jurassic (Water Saturation 80-100%) 57 feet net sand in pre-Jurassic (Water Saturation 80%).
211/18-2	1973	P&A Oil Well	Exploration - Thistle discovery	Heron Group - Cormorant Fm	The well was drilled to test a base Cretaceous structure. The well tested two perforated intervals from a net Jurassic Brent pay zone estimated by electric log interpretation to total 315 feet.
211/18-3	1973	P&A Oil Well	Appraisal - Thistle	Dunlin Group - Cook Formation	The well was drilled to appraise Middle Jurassic Brent sandstones encountered in 211/18-02. The well tested a 20 foot perforated interval within a net pay zone estimated by electric log interpretation to total 371 feet. The well flowed oil and confirmed the commerciality of the Thistle field. Oil flowed through a one inch surface choke and a 1/2 inch bottom
211/18-4A	1973	P&A Oil Well	Appraisal - Thistle	Heron Group - Cormorant Fm	The well was drilled to appraise the Brent sandstones of the Thistle field first encountered in 211/18-02. The sandstones were located in an easterly dipping tilted fault block. Tested from a 20 foot perforated interval within a net pay zone estimated by electric log interpretation to total 271 feet. The well tested oil through a 1/2 inch surface choke and a 3/4 inch bottom choke.
211/18-5	1974	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	Dry hole
211/18-6	1974	P&A Oil Well	Exploration - Thistle Area 6	Heron Group - Cormorant Fm	Drilled on the "Area Six" structure. Interval tested the Brent sands that were proven productive in the Thistle field. The sands flowed oil on a 7/8 inch surface choke and a one inch bottom choke. The well is located north of a fault which separates the structure from the Thistle field.
211/18-7	1974	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	No significant shows were encountered minor traces of oil were seen in tight silty to sandy laminae within the Cretaceous. The well was not tested or cored.
211/18-8	1975	P&A Oil Well	Appraisal - Thistle	Heron Group - Cormorant Fm	The well tested oil through a restricted choke from the main Thistle Brent sandstone reservoir.
211/18-10	1975	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	Some small quantities of hydrocarbons were encountered but were of no significance. Well abandoned by Benroran in July 1982
211/18-11	1976	P&A Dry Well	Exploration	Lower Jurassic	Dry hole
211/18-14	1977	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	Drilled to test a separate feature on a down thrown fault block between the THISTLE field and 211/18-12.
211/18A-17	1978	P&A Dry Well	Exploration	Jurassic	Dry hole
211/18A-18	1978	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	Dry hole
211/18A-19	1979	P&A Oil Shows	Appraisal - Thistle	Heron Group - Cormorant Fm	Water injector to the Thistle field.
211/18A-20	1979	P&A Dry Well	Appraisal - Thistle	Banks Group - Nansen Formation	Dry hole
211/18B-25	1992	P&A Dry Well	Exploration	Heron Group - Cormorant Fm	Dry hole
211/18C-27	2008	P&A Dry Well	Exploration - Prospero prospect	Upper Triassic (Lunde Fm)	This well was drilled on the Prospero prospect which straddles blocks 211/17 and 211/18c. Valiant operated the well on behalf of block operator Petrofac. The well failed to encounter hydrocarbons in either the Brent Group or Triassic horizons and was plugged and abandoned.

Well	Year Drilled	Status	Target	TD Formation	Results
211/23-1	1973	P&A Oil Well	Exploration - Dunlin discovery	Heron Group - Cormorant Fm	Discovered and tested oil from the Middle Jurassic Brent group. Discovery named DUNLIN.
211/23-2	1973	P&A Oil Well	Exploration - DunlinSW discovery	Dunlin Group	Drilled on the southern most part of the Dunlin field.
211/23-3	1974	P&A Oil Well	Exploration - Osprey discovery	Heron Group - Cormorant Fm	The well encountered 62 feet of net oil bearing Brent sands from a separate structure to the north-west of Dunlin. Core taken between 8986 feet to 9003 feet and 9071 feet to 9095 feet in Middle Jurassic.
211/23-4	1974	P&A Dry Well	Appraisal - Osprey	Heron Group - Cormorant Fm	The well was located 2.5kms north east of the Osprey discovery well but no hydrocarbons were encountered and no tests were run.
211/23-5	1976	P&A Oil Shows	Exploration	Heron Group - Cormorant Fm	Drilled on a separate structure to the far west of Dunlin.
211/23-6	1976	P&A Oil Shows	Exploration - Spoonbill prospect	Brent Group - Jurassic Basal Sand Formation	Drilled on a separate fault block to the south west of the Dunlin field. No DSTs (Drill Stem tests) carried out. RFTs (Repeat Formation Tests) recovered oil samples from the Jurassic.
211/23-7	1982	P&A Oil Well	Appraisal - Osprey	Heron Group - Cormorant Fm	Well was drilled to evaluate a horst block between wells 211/23-3 and 211/23-4. The well encountered 269 feet of net oil sandstones within the Rannoch Formation with an oil-water contact (OWC) at 8764 feet total vertical depth subsea (TVDSS).
211/23-8	1985	P&A Oil Shows	Appraisal - Osprey	Dunlin Group	Well was drilled to evaluate the western flank of the Osprey field. An OWC was encountered at 8918 feet TVDSS.
211/23-9	1986	P&A Oil Well	Appraisal - Osprey	Dunlin Group	The well was drilled in the northern part of the Osprey field horst block. Oil was encountered in the Ness and Tarbert Formations (8918 feet TVDSS).
211/23-P5	1992	P&A Dry Well	Exploration		The well is being deviated from the OSPREY platform location.
211/23A-P5Z	1992	P&A Dry Well	Exploration		The well is deviated to OspreySW from the OSPREY platform location.
211/23B-11	1992	P&A Oil Well	Exploration - Causeway discovery	Heron Group - Cormorant Fm	This well was drilled to investigate the Middle Jurassic Brent Group sandstones. The structure comprises a fault and dip-bound tilted fault block that plunges from the culmination in the Osprey field down to the south-west. The Osprey Ridge is cut by north-west/south-east cross faults providing the potential trapping mechanism for the prospect. Vertical and lateral seal was provided by the Humber Group mudstones. The Brent Group contained oil and was tested but the Statfjord Formation was water wet.
211/23B-12	1994	P&A Oil Well	Exploration - Skye prospect	Heron Group - Cormorant Fm	This well targeted the Brent Group sandstones with the Statfjord Formation Sandstone as the secondary objective. The well was drilled on the Skye prospect which comprises a fault and dip bound north-south trending tilted fault block that plunges from its culmination on the Dunlin Ridge down to the west. The prospect is bounded to the east by a north-south fault which downthrows to the east providing vertical and lateral seals via the Humber Group claystones. The Tarbert Formation sands were found to contain oil and was tested (see table). A sidetrack (211/23b-12Z) was then drilled to test the extent of the discovery into Shell-operated part-block 211/23a.
211/23B-12Z	1994	P&A Oil Shows	Appraisal - Skye prospect	Dunlin Group	After drilling #12 the rig was released to Shell with Amerada Hess acting as operator for a sidetrack into part-block 211/23b. This deviated well was designed to establish the extent of the Brent target. 20 feet of hydrocarbon-bearing Ness Formation sands were encountered.
211/23-P8Z	1996	P&A Oil Well	Exploration	Dunlin Group	
211/23A-13	1996	P&A Oil Shows	Exploration	Shetland Group	This well encountered small quantities of oil in a separate structure to Merlin. It was geologically sidetracked.
211/23A-13Z	1997	P&A Oil Well	Exploration - Merlin discovery	Heron Group - Cormorant Fm	This well was drilled to evaluate the Upper Ness Formation and the Etive Formation of the Middle Jurassic Brent Group in the Merlin prospect. It was a geological sidetrack which kicked off from 6142 feet. Two tests were carried out in the Brent Formation (see table). This well was suspended for use as a future producer.
211/23-A54	1997	P&A Dry Well		Dunlin Group - Amundsen Formation	This well drilled an exploration target from the Dunlin platform.
211/23A-15Z	1999	Completed Oil and condensate well	Exploration	Dunlin Group - Drake Formation	This exploration well is a geological sidetrack drilled from a Merlin development well. This was a joint well with Amerada Hess and Statoil which are licensees in part-block 211/23b. The objective was to establish reservoir presence to define fluid contacts and understand a layer of connectivity between Merlin West the adjacent field and the 211/23b-11 discovery.
211/23D-17	2006	P&A Oil Well	Exploration - Causeway		The tested zone flowed at multiple stabilised rates of up to 7 mbbls/d oil. The oil is light sweet 32 degree API crude with a low gas-oil ratio (GOR) of approximately 100 scf/bbl. During a second test the Ness Formation in the western fault block produced at multiple stabilised rates of up to 7.5 mbbls/d of 32 degree API sweet oil at 1006 psi through a 42/64 inch choke. A stabilised rate of 14.5 bbls/d oil was recorded from the combined Ness and Tarbert Formations in the western fault block.
211/23D-18	2008	Suspended Oil Well	Appraisal - Causeway	Dunlin Group - Cook Formation	Part of a multi-well appraisal programme to be drilled on Causeway 211/23d-18 targeted a group of Brent sandstones in the East Causeway fault compartment. The well encountered two oil accumulations; the first being a 50 foot oil column with 25 feet net pay within the Ness Formation and the second being a 15 foot oil column with a 8 foot net pay zone within the Etive Formation. The presence of oil within the Etive Formation had not previously been encountered within this area of the Causeway discovery. The two reservoirs are said to be of high quality with average porosity and permeability measurements at 20% and 800mD respectively. Both the Ness and Etive Formations were subject of modular dynamic tests which flowed light oil with no water. The well was completed as a future produce

Well	Year Drilled	Status	Target	TD Formation	Results
211/24-2	1973	P&A Oil Well	Appraisal - Dunlin	Banks Group - Statfjord Formation	Drilled to establish OWC (Oil-Water Contact) that was not found in 211/23-1 discovery. Encountered similar sequence to that in well 211/23-1 and established OWC at c.9300 feet. Ran 6 FIT's (Formation Interval Testers).
211/24-3	1974	P&A Oil Well	Appraisal - Dunlin	Banks Group - Statfjord Formation	Ran 5 FIT's of which one recovered hydrocarbons.
211/24-5	1976	P&A Dry Well	Appraisal - Dunlin	Banks Group - Statfjord Formation	Drilled on a separate fault structure south-east of Dunlin. No hydrocarbons were encountered and the Brent Formation was wet.
211/24A-6	1991	P&A Dry Well	Exploration	Dunlin Group	This well was mechanically sidetracked at 4261 feet due to hole problems in the 17 1/2 inch hole. It was drilled to test the Middle Jurassic Brent Group within a northwest-southeast trending fault block. The trap is a fault bound structure with closure at top Middle Jurassic level and sealed by overlying Heather Formation shales. The Brent Group was penetrated but no hydrocarbons were encountered in the sands. The well was deviated to avoid a pipeline.
211/24C-7	1993	P&A Dry Well	Exploration	Brent Group - Ness Formation	This well was drilled to test a seismic anomaly found towards the southern end of the Upper Jurassic low. The prospect was an Upper Jurassic submarine fan play contained within a structure/stratigraphic trap in an arcuate half graben. The Upper Jurassic sandstones were absent with the Kimmeridge Clay Formation directly underlain by the Heather Formation claystones.

Table 4: Wells Database



MXD: A4P\_32ndRd\_17Sep2019  
 Created: 01 November 2019  
 Release: Suitable For External Use

Figure 5: Wells Database

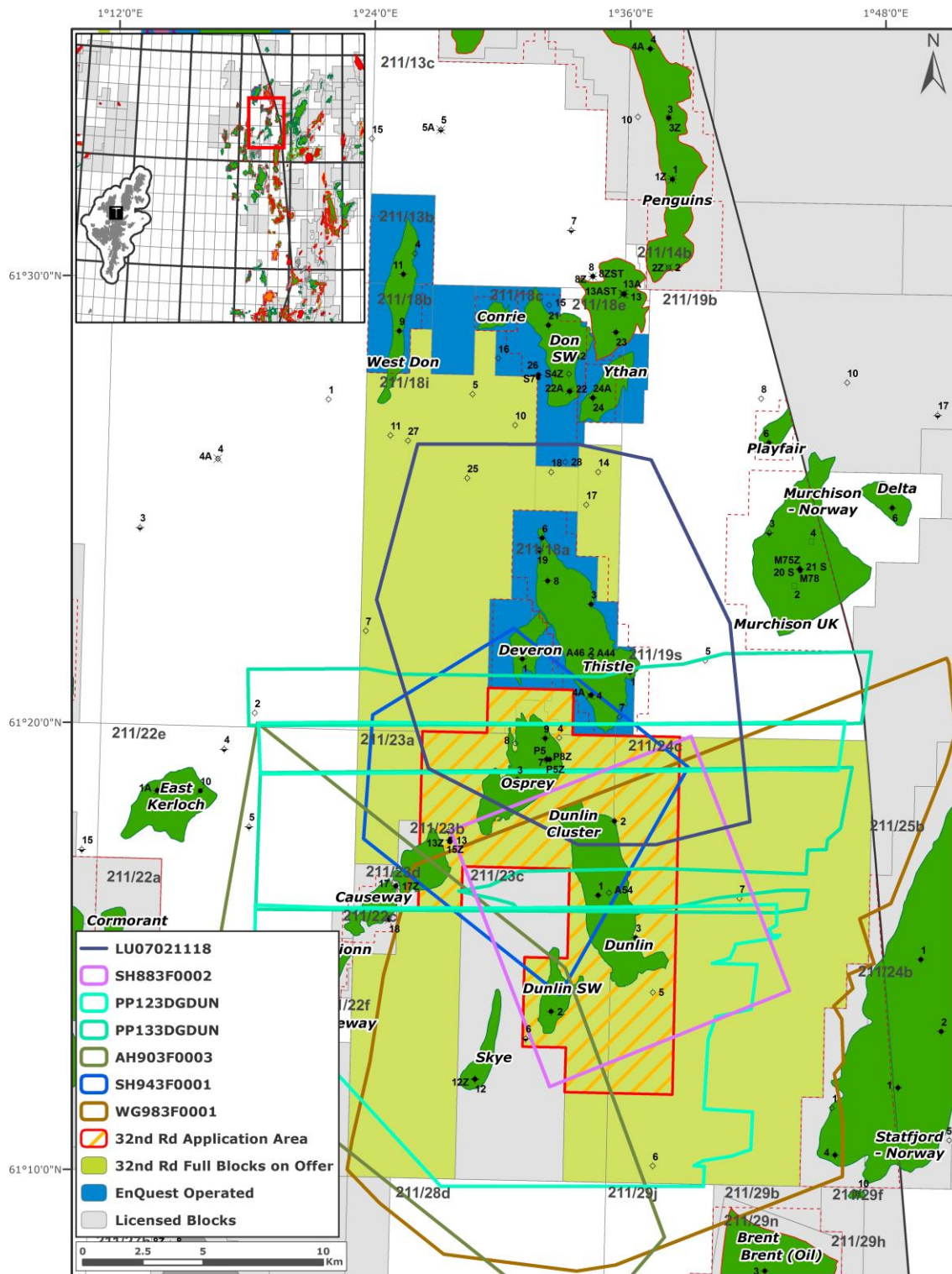


### 4.1.3 Seismic Data

The 3D seismic database available in the area is detailed in **Table 5** and shown in **Figure 6**. The surveys used for in EnQuest's evaluation of the area include the PGS mega-merge survey which incorporates surveys shot in the late 80s /early 90s, and a more recent survey shot by Lundin in 2007 over Thistle which includes Osprey main. This survey was reprocessed for PSDM in 2015 and a re-interpretation of this survey was performed in 2015/16, primarily for the Thistle Phase II drilling campaign, but was also extended to cover the main Osprey field due to its close proximity to the spill point from Deveron. PGS DUN2013 is the Broadband Geostreamer survey which covers the full area of interest and, depending on the results of initial studies, broadband seismic data may be licensed, as it could be important in unlocking potential. The broadband seismic data is not considered to be required for the drilling of an Osprey Horst well from Thistle.

Survey Name	Volume Description	Data types available	Year	Areas Covered	Total (Km <sup>2</sup> )	Block Coverage (Km <sup>2</sup> )
PGS Mega Merge Survey: AH903F0003 – Amerada Hess  SH943F001 – Shell UK  SH883F0002 – Shell UK	Licensed PGS merged 3D seismic dataset	Full stack PSTM	Various 1988 1990 1994	Regional Coverage	N/A	112
LU07021118	PGS 3D conventional acquisition	Full, angle stacks PSDM	2007, repro 2015	Thistle / Deveron / Osprey Main	200	45
DUN2013	PGS 3D Geostreamer Acquisition	PSTM Full / Near / Mid Far stacks + Angle Gathers	2013	Osprey / Merlin / Dunlin / DunlinSW / Skye	430	120
WG983F0001	WGC Dunlin 3D MC	PSTM	1998	Dunlin / DunlinSW / Skye	392	72

**Table 5: Seismic Database**



MXD: A4P\_32ndRd\_17Sep2019  
 Created: 04 November 2019  
 Release: Suitable For External Use

Figure 6: Seismic Database

## 5. Prospectivity Update

### 5.1 Osprey

#### 5.1.1 Summary

Osprey 'Western pool' was discovered by the 211/23-3 well in 1974. The well encountered 62ft net sandstone. An OWC was identified at -8918ft TVDss in the Tarbert Formation. In 1982 the "Horst Block" was evaluated with well 211/23a-7, the well penetrated 269ft of net oil sandstone with an OWC at 8764ft TVDSS in the Rannoch Formation. The field was developed with first production in 1991 (Shell) with water injection via two subsea manifolds, one for oil production and one for water injection. The crude was piped to a dedicated processing module on the Dunlin A platform, and the injection water provided from Dunlin A. Fairfield acquired the asset in May 2008 and two subsea producers were completed in October 2009. The field was shut-in mid 2012 to mid 2013 due to leaks. Osprey ceased production in 2015 when the Dunlin cluster of fields were being decommissioned. Oil originally in place for the field is estimated at 234 MMstb of which 92 MMstb has been produced; a recovery factor of 39%.

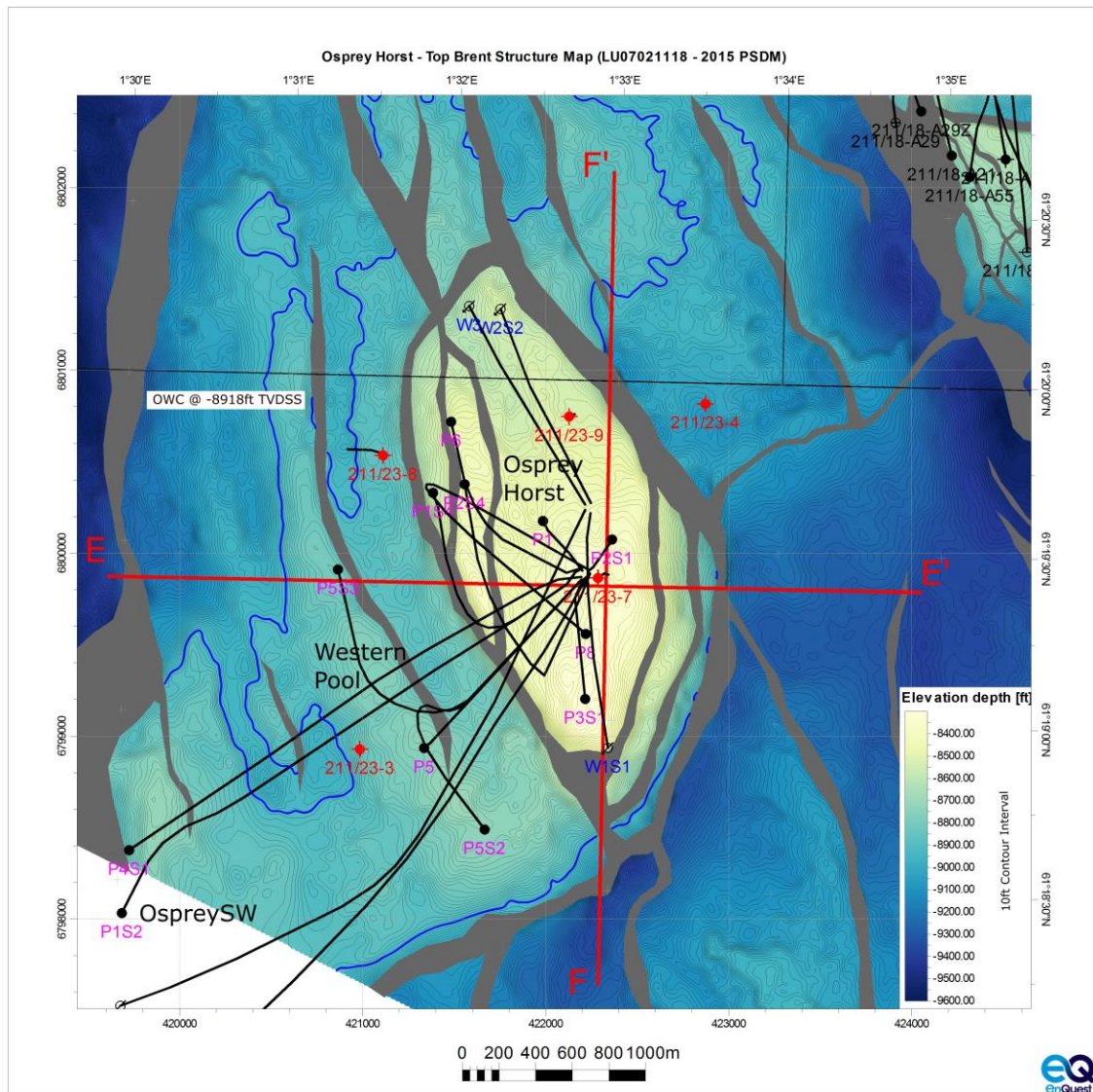


Figure 7: Top Brent Structure Map over Osprey Field



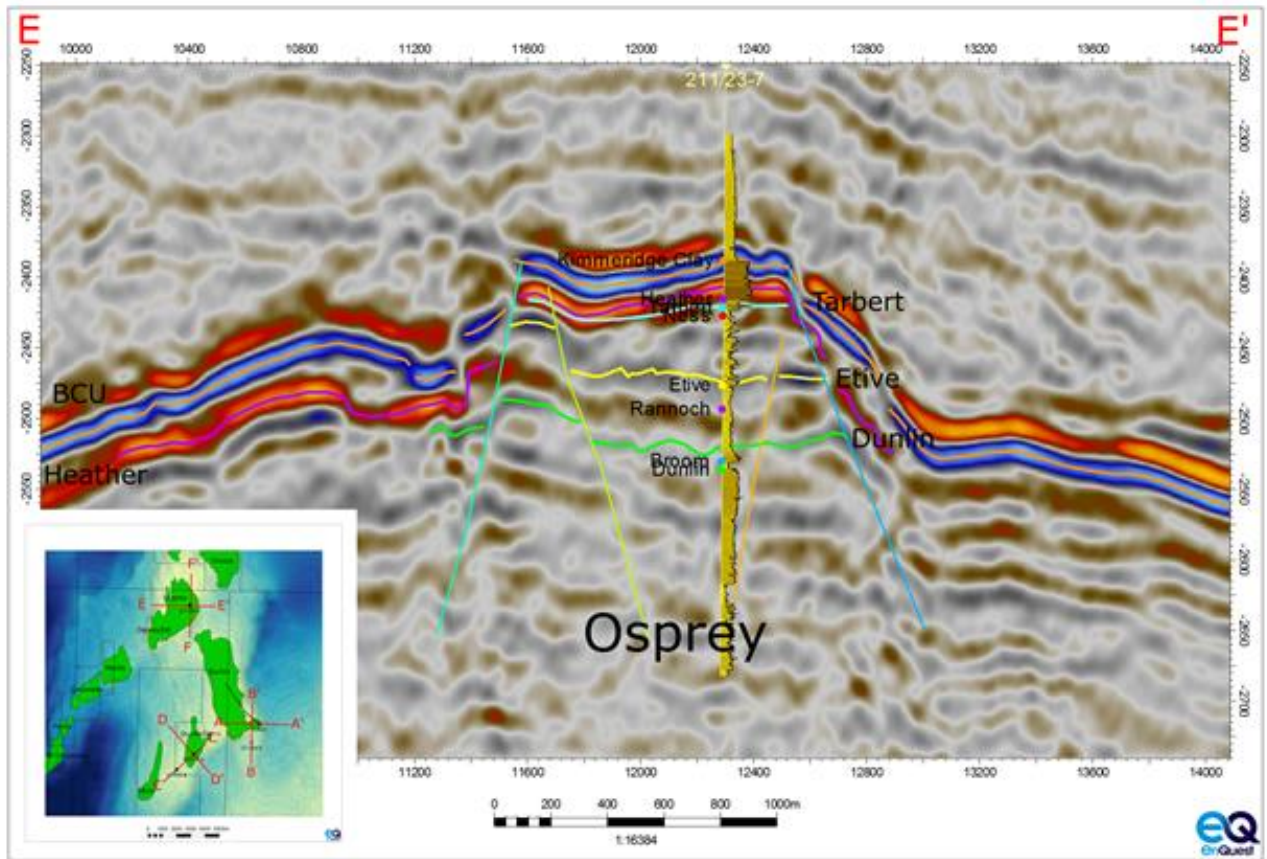


Figure 8: East-West seismic traverse through Osprey Horst

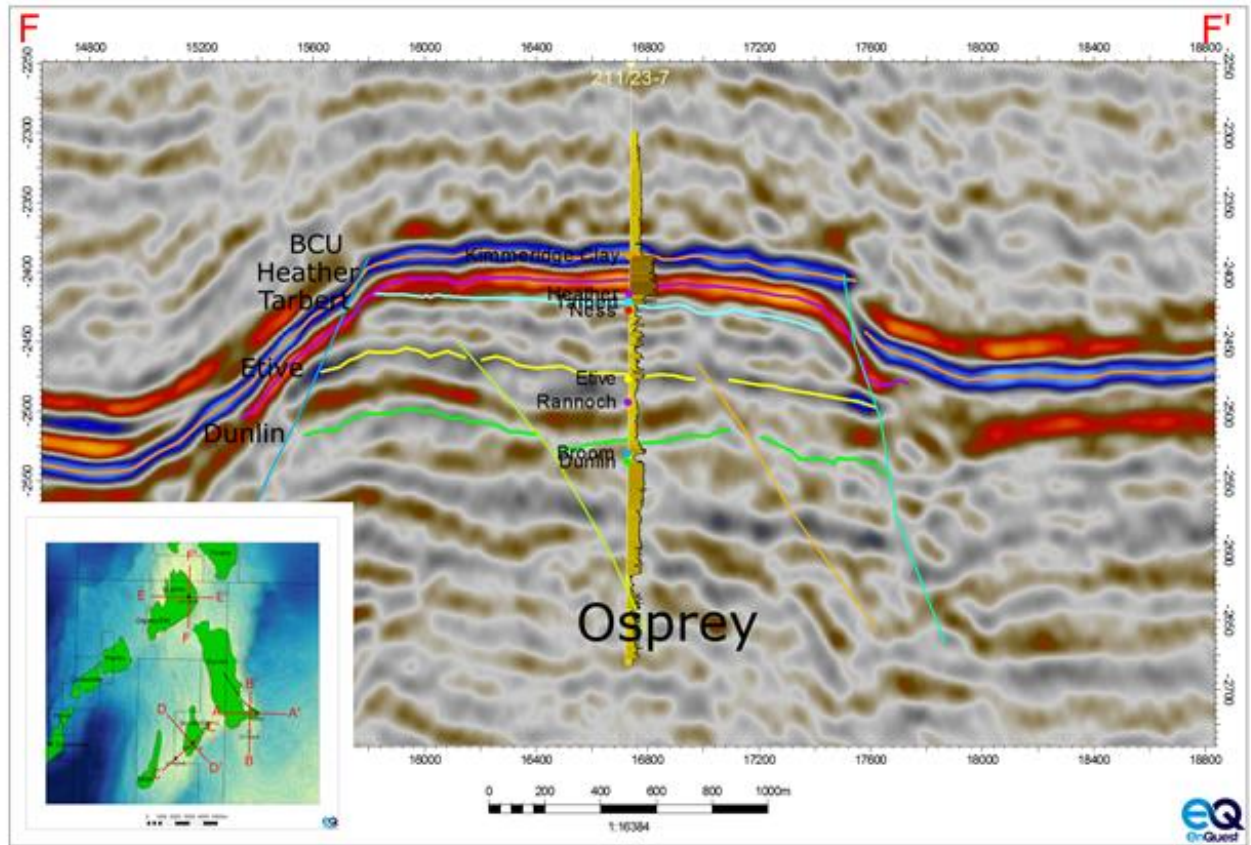


Figure 9: North South seismic traverse through Osprey Horst

### 5.1.2 Volumetric Resources

GRV Case	Area	Thickness	GRV	Porosity	NTG	Sw	STOIIP	Recovery Factor
	MMm2	ft	MMm3	pu		%	MMstb	%
Low	4.115	295	370	0.205	0.87	0.43	211	44
Mid	4.115	295	370	0.216	0.87	0.40	234	40
High	4.115	295	370	0.225	0.87	0.38	252	36

Note : Assumes a formation volume factor of 1.09 rb/stb

Table 6: Osprey In-place volumes and resources

### 5.1.3 Indicative Development Plan

Brent reservoirs with similar characteristics are capable of achieving recovery factors of 30% (Merlin) to 56% (Thistle), and typically 49%. Most fields were developed with waterfloods and many have injected multiple pore volumes of water. Most also suffer significant layer heterogeneity which has resulted in by-passed oil. The current recovery factor for Osprey is 39%.

There is thought to be remaining resource in the vicinity of the P3S1 (211/23-P4Z) well with an estimated range of 1.7 to 4.2 MMstb with a P50 of 3 MMstb (after 6 years production). This assumes an ESP with a liquid constraint range of 5 to 15k blpd. This one well development is without the need of water injection. The average rates for the first year are in the range 980-2600 bopd (**Figure 10**).

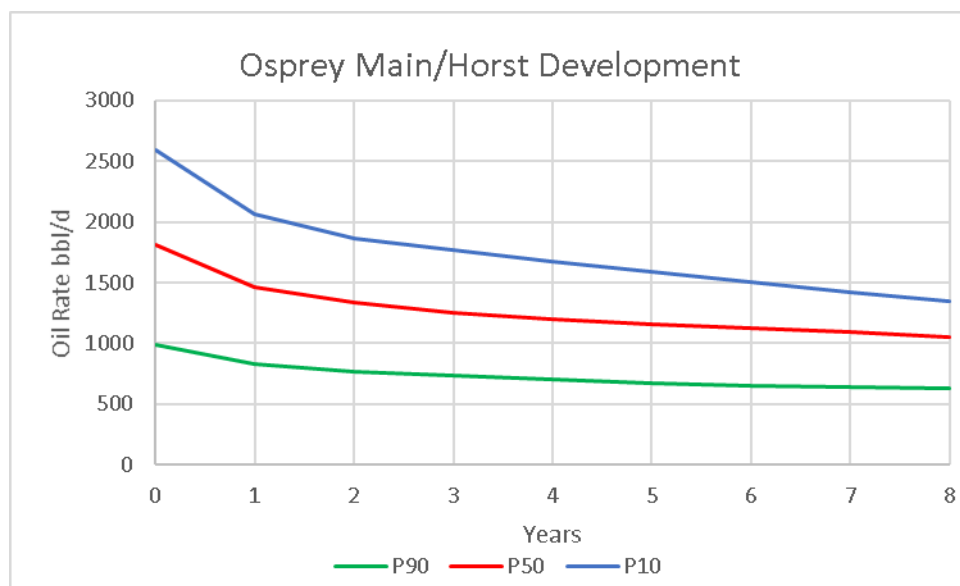


Figure 10: Osprey Single well development oil rate

## 5.2 Dunlin SW

### 5.2.1 Summary

Dunlin SW (Figure 11) was discovered by the 211/23a-2 well in 1973. The well encountered 77ft gross Tarbert unit, which was oil bearing. The remaining Brent Group units were water wet, in common with other discoveries in the terraces to the west and SW of the Dunlin Field. The field was developed via two production wells, DA26S6 (211/23-A52Y) (1996) and DA30S6 (211/23-A57W) (1998). Both were drilled from the Dunlin Alpha platform with first oil in 1996.

Dunlin SW ceased production in 2015 and the Dunlin cluster of fields are being decommissioned. Oil originally in place for the field is estimated at 40 MMstb (with a range of 25-60 MMstb); 11.6 MMstb has been produced, a recovery factor of 29% (19-46%). Analogues fields indicate that a recovery factor of 37% is achievable. However, the remaining uncertainty in STOIP leaves significant uncertainty in the re-development potential, with the most important unknown being the Free Water Level (FWL).



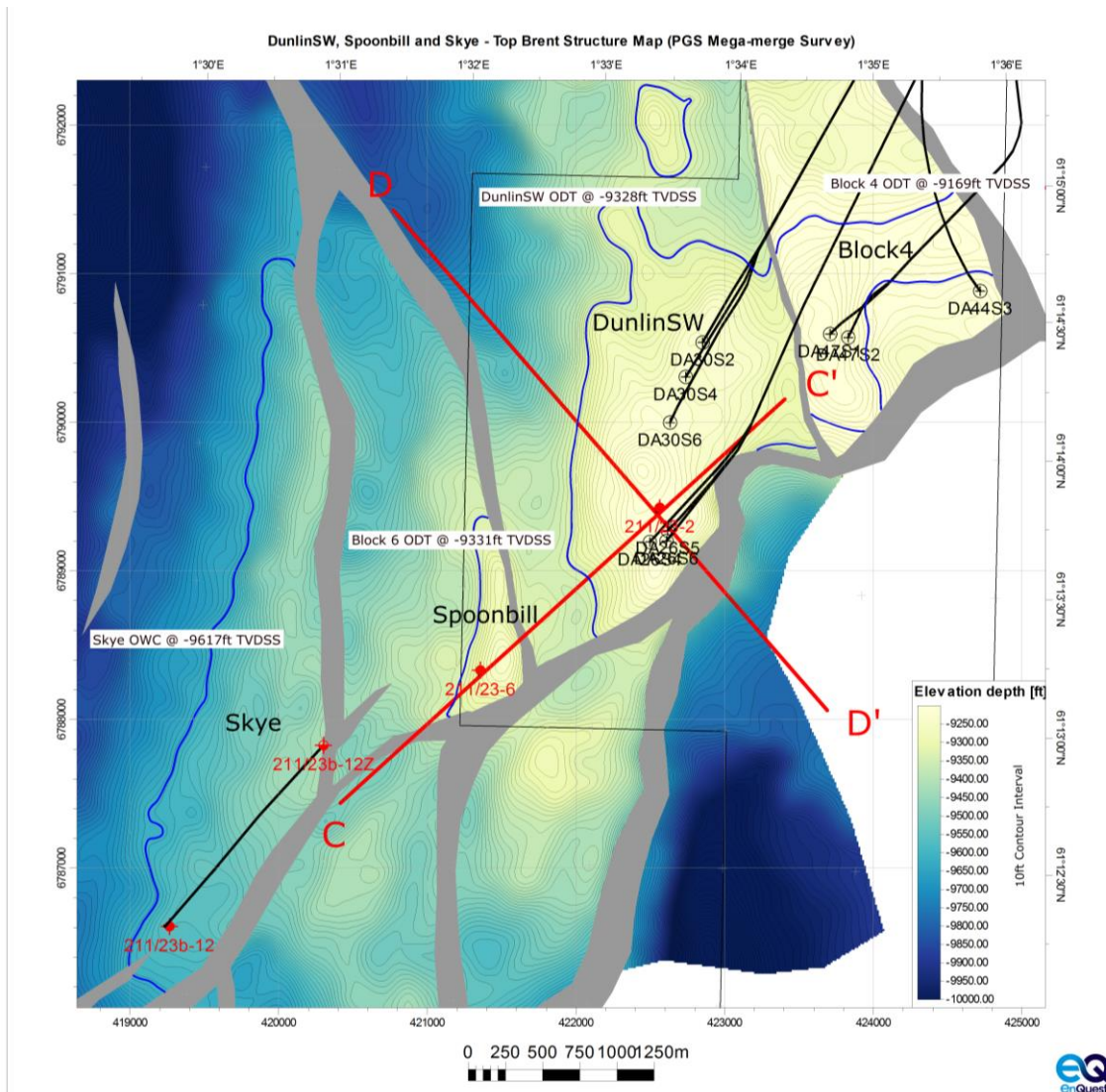


Figure 11: Top Brent Structure Map over Dunlin SW Area (PGS Mega-Merge Survey)

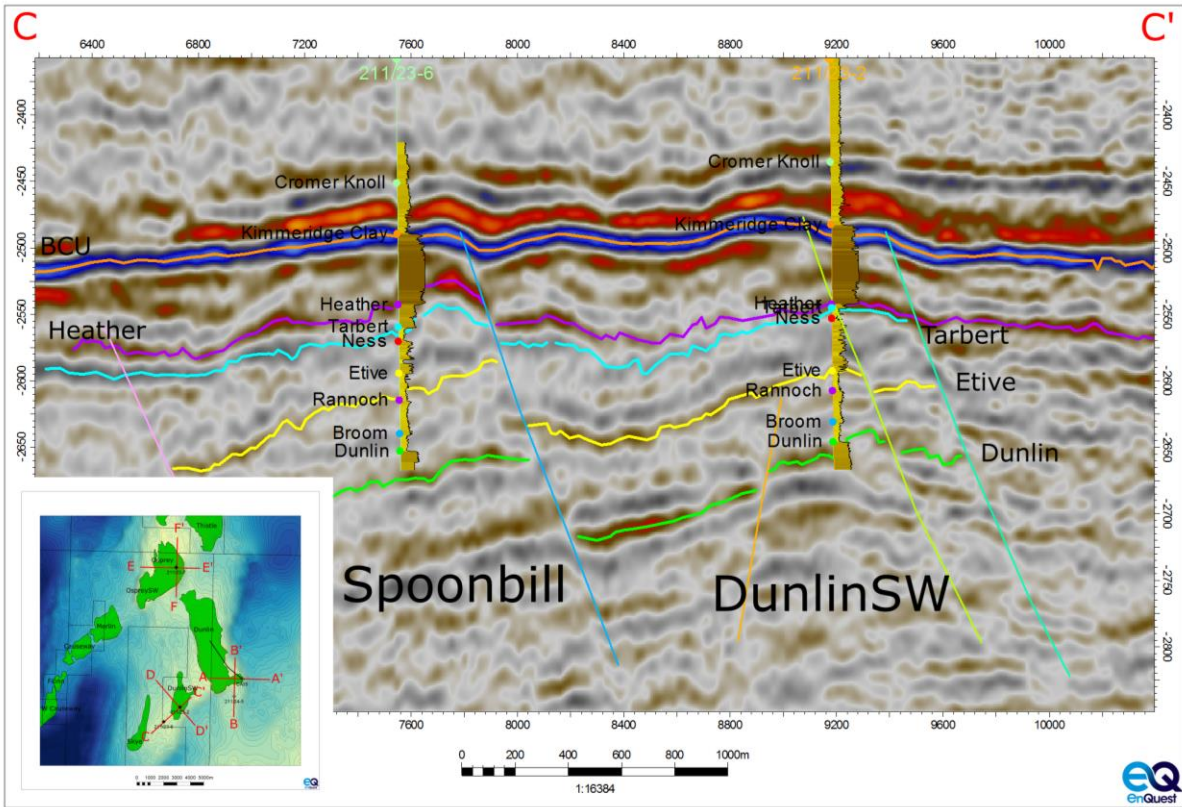


Figure 12: Northeast-Southwest traverse through Dunlin SW

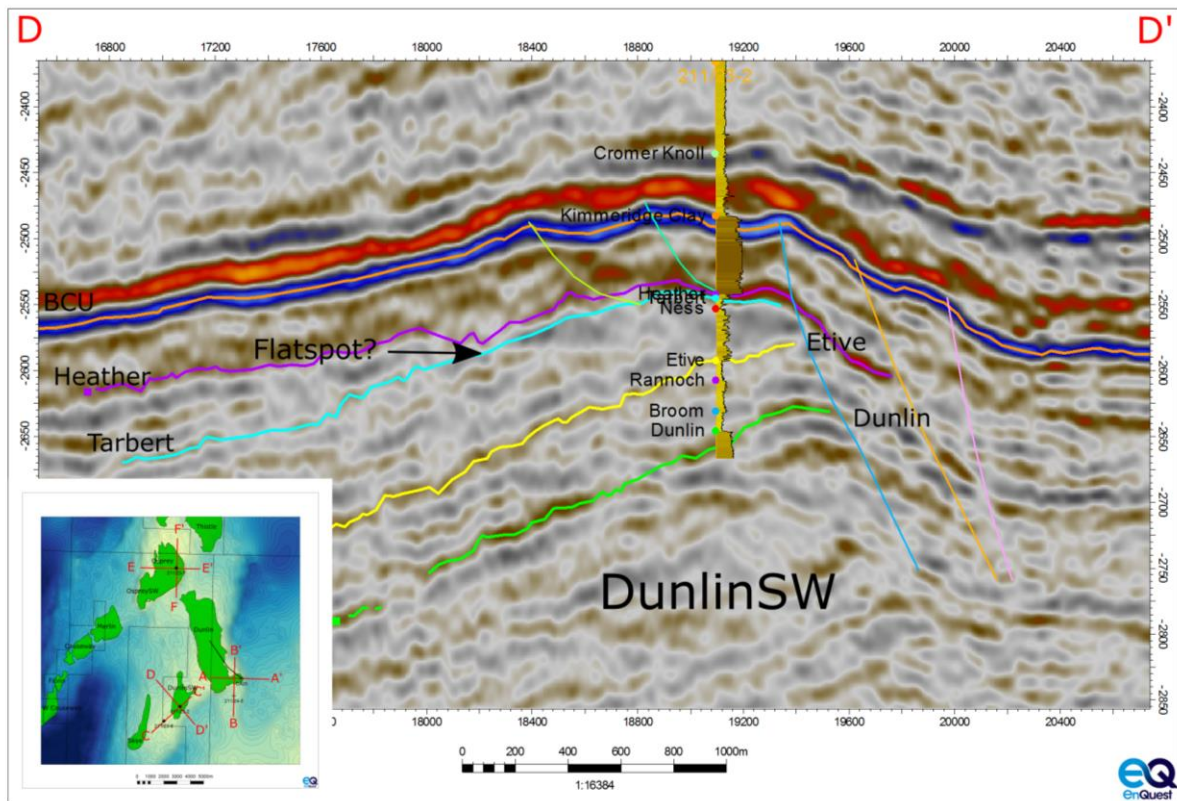


Figure 13: Northwest-Southeast traverse through Dunlin SW

## 5.2.2 Volumetric Resources

GRV Case	Area	Thickness	GRV	Porosity	NTG	Sw	STOIP	Recovery Factor
	MMm2	ft	MMm3	pu		%	MMstb	%
Low	2.36	75	54	0.18	0.84	0.43	25	46
Mid	3.15	75	72	0.19	0.88	0.40	40	29
High	4.11	75	94	0.20	0.92	0.37	60	19

**Table 7: Dunlin SW Volumetrics**

*Note : Assumes a formation volume factor from Dunlin main of 1.13 rb/stb, other properties from 211/23-2*

### 5.2.3 Indicative Development Plan

Dunlin SW is a relatively simple reservoir comprising a single reservoir unit and simple structure, however, as with other Brent reservoirs layer heterogeneity will result in by-passed oil. 11.6 MMstb had been produced when Dunlin SW ceased production in 2015 with a recovery factor of 29% (19-46%). A recovery factor of 38% is believe achievable based on the more complex Deveron field which has been developed with artificial lift but no water injection. Deveron does however benefit from good aquifer support.

Decline curve analysis carried out on the Dunlin SW producers yields from 0.6 to 2.4 MMstb EUR, the latter based on water oil ratio trends. Replacing the original development wells as drilled and completed will not achieve economic volumes due to the low oil rates and high watercuts. Three key subsurface uncertainties drive the re-development potential of Dunlin SW:

- The original oil in place, and therefore remaining oil.
- Identifying a well location that can access the remaining oil.
- The effectiveness of aquifer support.



## 5.3 Dunlin Block 10 & 14

### 5.3.1 Summary

Dunlin Blocks 10 and 14 are downthrown to the south east of the main Dunlin field (Figure 4). Field mapping, FWL and pressure data confirm that these blocks are isolated from the main Dunlin field. Original oil in place is estimated to be in the range 68-85-102 MMstb (Fairfield), of which ca.32 MMstb had been produced to field cessation of production in 2015. This equates to a RF range of 31-37-46%. Dunlin Block 10/14 ceased production in 2015 and the Dunlin cluster of fields are being decommissioned.

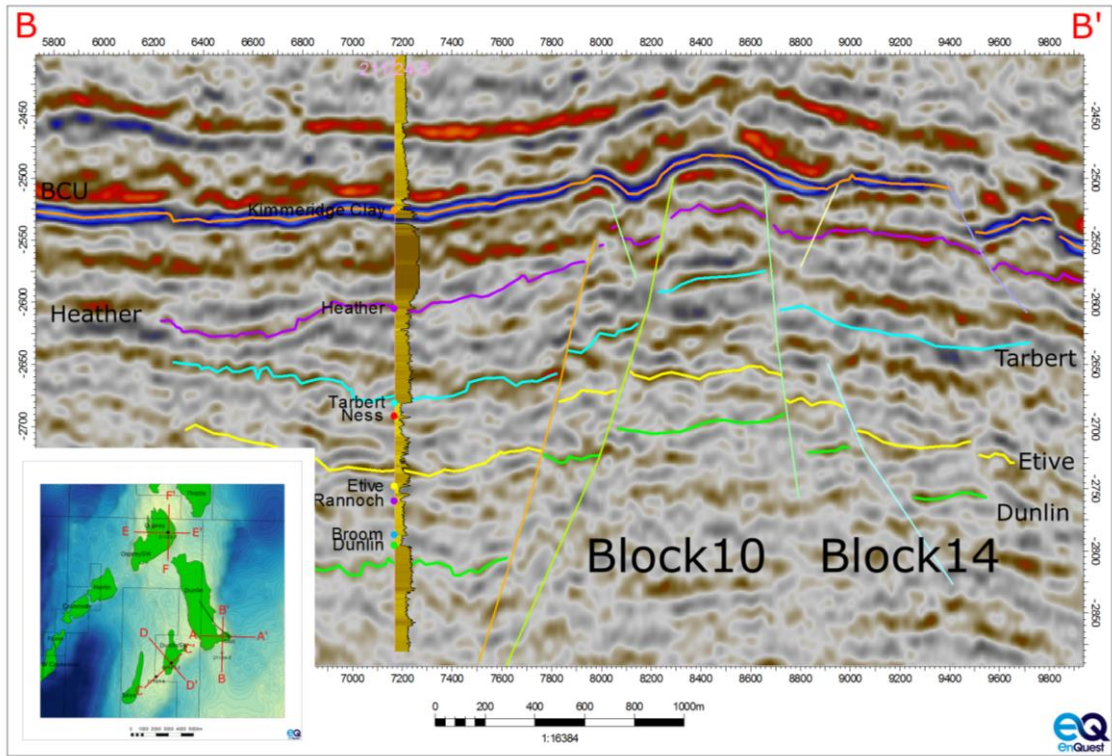


Figure 14: North south traverse through Dunlin Block 10 and Block 14

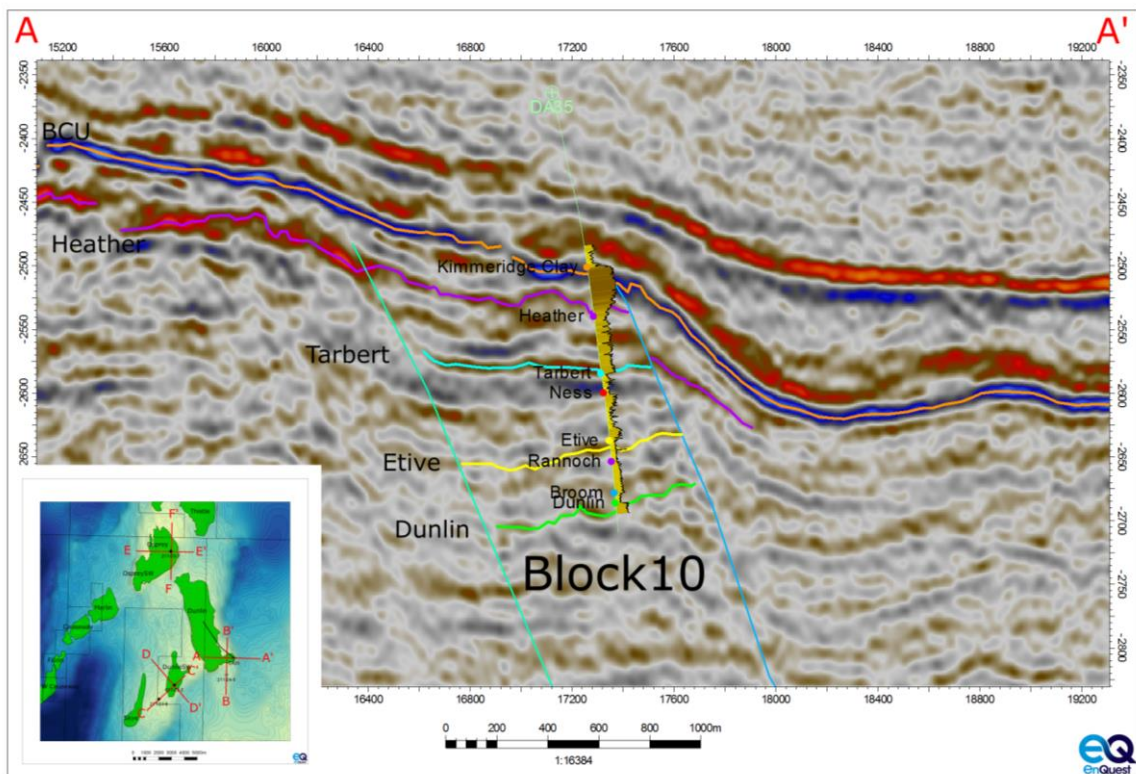


Figure 15: East-west traverse through Dunlin Block 10

### 5.3.2 Volumetric Resources

**Table 8** summarises the key parameters governing STOIP. A range of 68-85-102 MMbbls is assumed though Fairfield quote STOIP estimates calculated from deterministic scenarios. A value of 85 MMbbls is selected to be a mid-case between deterministic low and high cases of 68 and 102 MMbbls. The low and high cases are calculated by assuming a +/- 5% deviation on the GRV and also on porosity, N/G and oil saturation.

GRV Case	Area	Thickness	GRV	Porosity	NTG	Sw	STOIP	Recovery Factor
	MMm2	ft	MMm3	pu		%	MMstb	%
Low	1.336	360	147	0.17	0.67	0.22	68	46
Mid	1.413	360	155	0.18	0.70	0.18	85	37
High	1.482	360	163	0.19	0.74	0.14	102	31

*Note : Assumes a formation volume factor of 1.16 rb/stb*

**Table 8: Block 10/14 Original In Place Volumes**

### 5.3.3 Indicative Development Plan

#### ***Reservoir re-development***

For Block 10/14 reservoirs, most of the remaining oil is considered to reside in Block 14 where estimates of STOIP lie in the range 20-30 MMbbls but only ca. 1 MMbbls has been produced from DA33S1 (211/23-A59) (the only direct offtake from Block 14). However, there is clear evidence of communication across the reservoir and some of the Block 14 oil has already been produced by other wells. A development plan based upon a single P-I pair in Block 14 is deemed to be a potentially attractive future option. This is conceptually shown in Figure 16.

Use of broadband seismic data may better delineate the Block-14 structure, allowing improved definition of STOIP distribution. Simulation modelling, including history matching, would allow a revised field development plan to emerge.

#### ***Well numbers, drilling issues, artificial lift***

Artificial lift will be necessary to sustain required liquid rates at high watercut. Electric submersible pumps (ESP) have been successfully deployed on the Thistle and Deveron fields, and were used selectively in the Dunlin development. However gas lift would also be suitable depending on host facilities. Issues relating to depleted pressure drilling will need consideration.



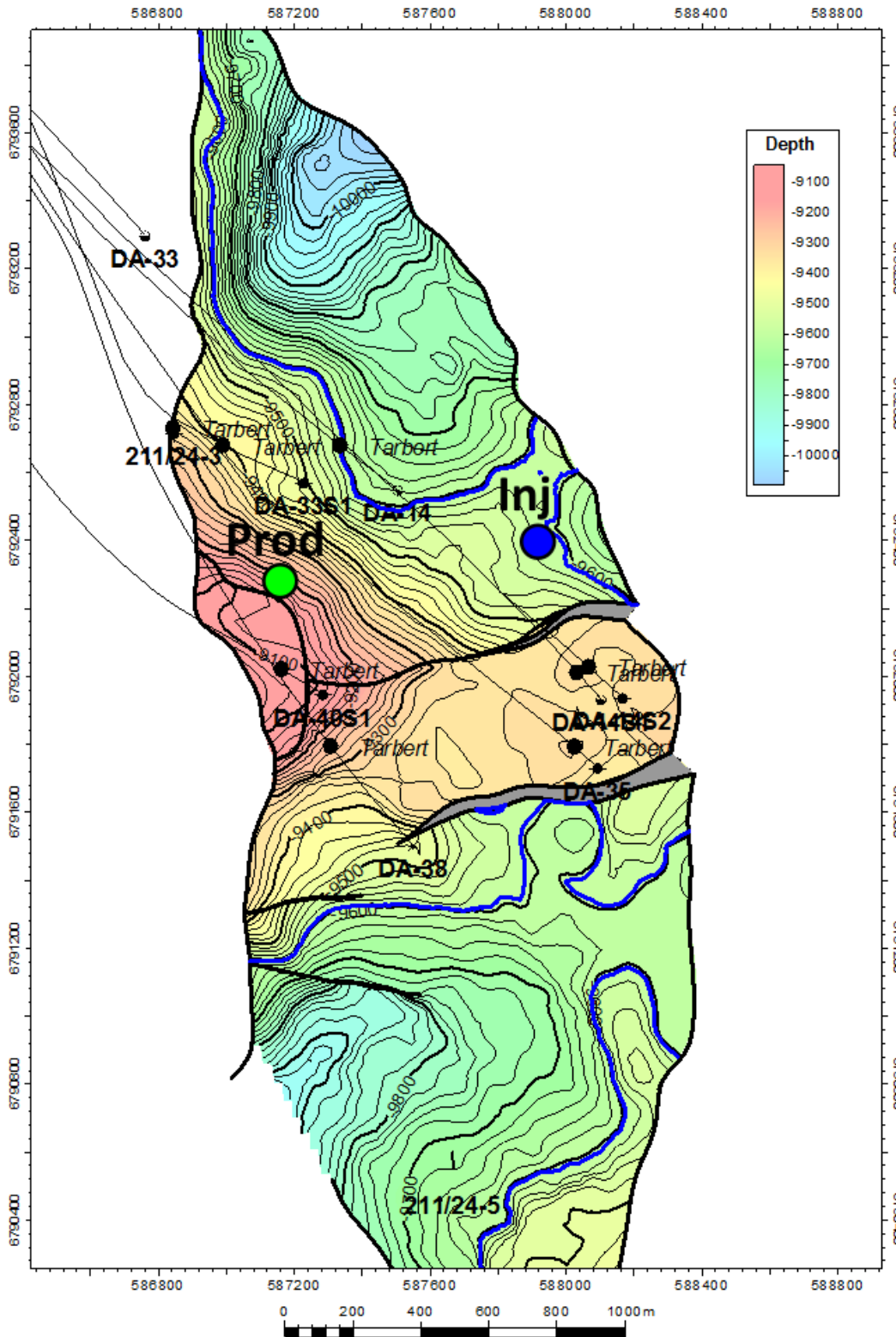


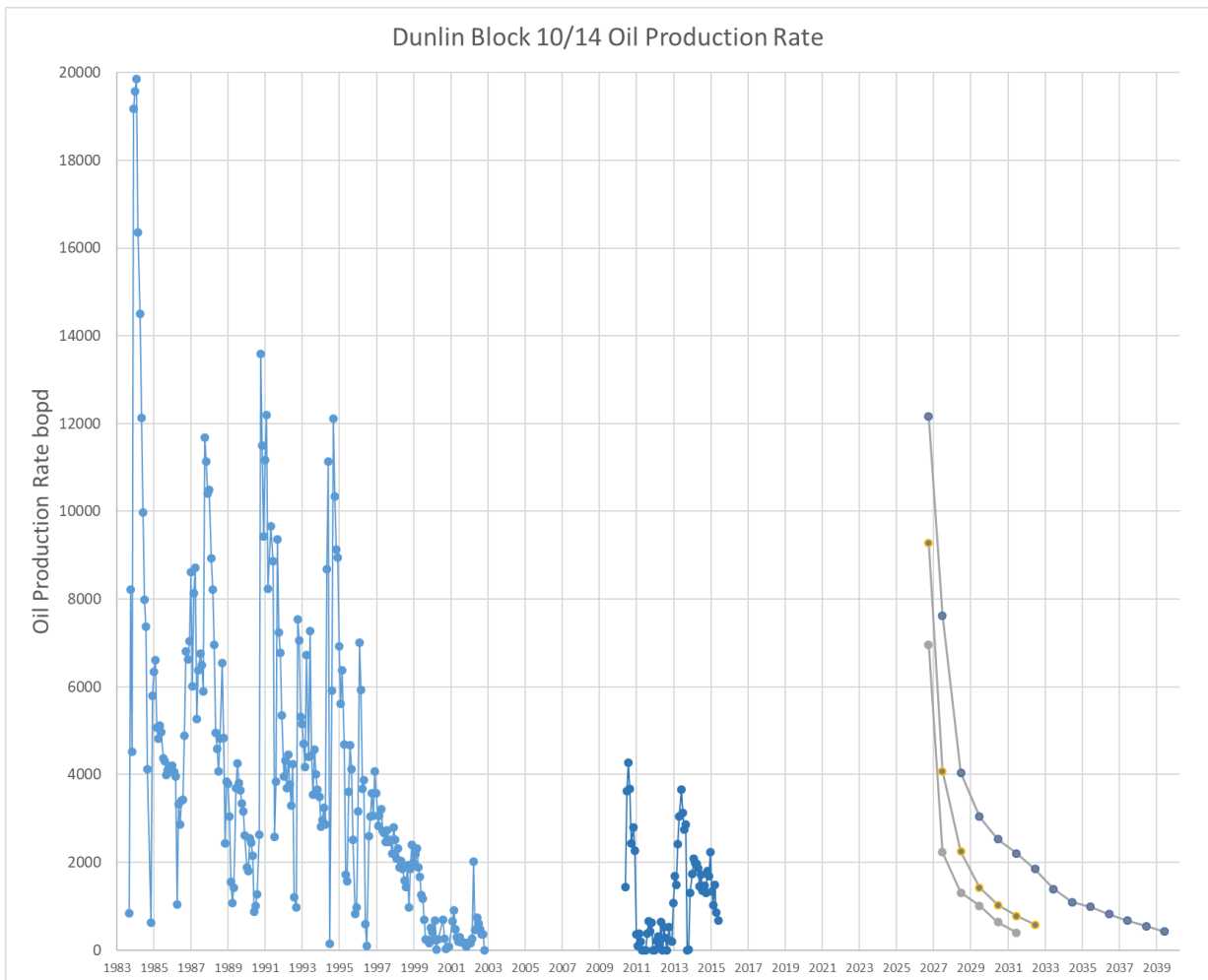
Figure 16: Block 14 Redevelopment Showing Notional P-I Configuration on Top Brent Group Depth Structure  
(SE of main Dunlin Field)

**Resources and Production Profiles**

Brent reservoirs with similar characteristics are capable of achieving recovery factors of 30% (Merlin) to 56% (Thistle), and typically 49%. Most fields were developed with high-volume waterfloods over long production periods.

Screening production profiles and ranges for a single P-I development scenario have been generated by assuming the RF in the low/mid/high STOOIP scenarios can be increased to the range 40%-50% to lie broadly in-line with analogues. Remaining reserves are estimated at 3 – 5 – 10 MMBbls from the partial field waterflood and this recovery by a single producer falls within the range of historical recoveries by Block 10/14 wells.

Indicative production profiles, including historical rates, are depicted below in Figure 17 assuming first oil 4Q-2026.



**Figure 17: Block 14 indicative production profiles, including historical rates**

## 6. Further Work Undertaken

### 6.1 Work Programme Summary

Due to various challenges to the business encountered since the licence award EnQuest was able to screen this licence and confirm it was not economic. We therefore decided not to pursue the opportunities outlined in Appendix B of the P2601 license application. Therefore, no official work programme for licence P2601 was undertaken and EnQuest were unable to commit to obtaining broadband Geostreamer data over the Licence area.

## 7. Resource and Risk Summary

EnQuest has re-evaluated the remaining potential and believes that no economic opportunities exist to re-develop areas of these fields within the limits of the available infrastructure. There is insufficient processing capacity nearby to accommodate the high water cut expected from these wells (Figure 18). The original three opportunities identified were:

1. Osprey Horst re-development
2. Dunlin SW re-development
3. Dunlin Block 10&14 re-development

These former opportunities are detailed in **Table 9** below.

Re-development Opportunity	STOIP	Cumulative Oil	Recovery Factor	Estimated Remaining Reserves	Potential Redevelopment Option
	MMstb	MMstb	%	MMstb	
Osprey	211-234-252	92.3	44-39-36	1.7-3.0-4.2	ERD well from Thistle platform
Dunlin SW	25-40-60	11.6	46-29-19	1.6-3.7-7.2	Single well subsea tie-back
Dunlin (Block 10/14)	68-85-102	31.4	46-37-31	3.0-5.0-10.0	Producer injector pair with subsea tie-back

**Table 9: Former Redevelopment Opportunities**

A map showing the field outlines of the opportunities in the bid, how they relate to one another and the fields/discoveries in the area, together with block boundaries is shown in **Figure 1**.

## Technical Summary for profiles:

- Osprey: redevelopment of the Osprey “Horst”:
  - Single well in the vicinity of well P3S1 (211/23-P4Z). This well was the largest producer in the original development.
  - Estimated reserves ranging from 1.7 to 4.2 MMstb with a P50 of 3 MMstb (after 6 years production)
  - The original proposed development was a single ERW from Thistle platform using ESP (highly deviated well)
  - No water injection assumed (aquifer support)
  - Liquid rate assumption: 10,000 b/d with a PE: 90%
  - Profile generated by reservoir simulation
  
- Dunlin SW:
  - Single conventional subsea production well drilled in the crestal area of the field to the south of 211/23-57W (DA30S6)
  - Resource potential is estimated to be 3.7 MMstb for the mid case STOIP, with low and high cases at 1.6MMstb and 7.2 MMstb, respectively.
  - The original proposed development was based on an ESP deviated subsea well
  - No water injection assumed (aquifer support)
  - Liquid rate assumption: 8,000 b/d, 10% pa decline in gross fluid with a PE: 85%
  - Dunlin SW Profile: Based on DA-30S6 WOR (Poorer of the 2 wells)
  
- Dunlin redevelopment (blocks 10 and 14):
  - Development plan based upon a single P-I pair
  - Remaining reserves are estimated at 3 – 5 – 10 MMbbls from the partial field waterflood.
  - The original proposed development was based on an ESP deviated subsea well with a water injector well
  - Isolated compartment from the main Dunlin field so there is limited aquifer support (water injection required)
  - Liquid rate assumption: 10,000 b/d, 1% pa decline in gross fluid (voidage replacement) with a PE: 85%

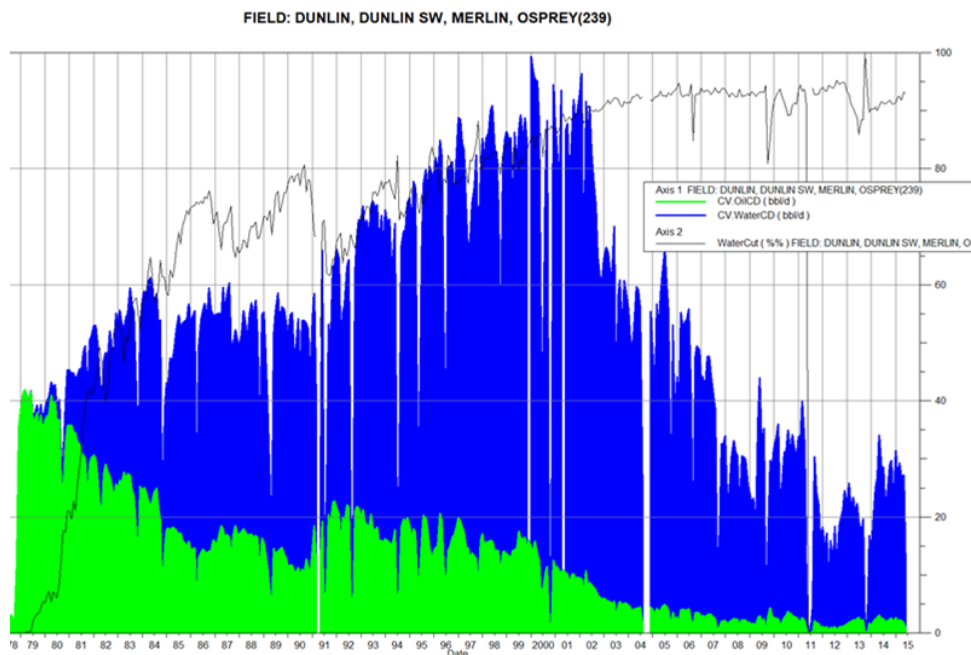


Figure 18. OFM historical production plots for combined fields

## 8. Conclusions

The expectation at the time of the 32nd round was that Thistle could act as a host for a potential redevelopment of the Dunlin area. The development concept was an ERD well from Thistle Alpha to Osprey, followed by a redevelopment of the Dunlin area via a subsea tie back to an existing or new hub. However, the higher operating costs and lower oil volumes on Thistle led to early COP. Therefore, following the award of the licence in December 2020 EnQuest evaluated alternative redevelopment options. These are summarised in the table below.

Dunlin Area Host	Development Plan	Outcome
Thistle	ERD well from Thistle to Osprey with ESP. Future development of Dunlin area could consider Thistle Alpha as host.	Following decision to COP Thistle, this was no longer a viable host for Dunlin area or Osprey ERD well.
Galapagos - Via Ninian	Galapagos development consists of 35km subsea tie back with 4Producers/4 Injectors targeting low risk brownfield panels. Produced by gas lift and WI supplied by the host. Development of higher risk greenfield areas could be considered at a later date. Profiles were considered optimistic given historical well performance.	Economics at best are marginal for a development of Galapagos via Ninian. Therefore, it is not considered a suitable host for Dunlin redevelopment.
Galapagos - Via FPSO ENQuest producer	Galapagos development to FPSO EnQuest Producer with 4Producers/4 Injectors. Same production profiles as used for Galapagos development via	Galapagos development is sub economic mainly due to low oil rates. Therefore, it is not considered a suitable

	Ninian. It should be noted that Galapagos is a very complex reservoir.	host for Dunlin redevelopment.
Magnus	Dunlin single P/I pair ESP well, Dunlin SW single ESP well and Osprey single ESP well, tie back to Magnus. Same production profiles as used in the 32nd round assessment. No allowances for backout of Magnus oil production is accounted for (profile optimistic).	Development marginal/subeconomic at \$70/bbl. Combined option considered with redevelopment of Dons and Thistle, this further eroded value.
Statfjord	Dunlin single P/I pair ESP well, Dunlin SW single ESP well and Osprey single ESP well, tie back to Magnus. Same production profiles as used in the 32nd round assessment. No allowances for backout of Statfjord oil production is accounted for (profile optimistic).	Development marginal/subeconomic at \$70/bbl. Combined option considered with redevelopment of Dons and Thistle, this further eroded value.

Galapagos, a redevelopment of NW Hutton, if proven to be an attractive development could be considered as host for the Dunlin area. Bridge Petroleum originally planned to submit a FID for Galapagos in 2020/2021 but that did not materialise. EnQuest considered Galapagos with a 35km tie-back to Ninian, but economics proved marginal even with optimistic production profiles given the complex reservoir system. A further review of Galapagos in 2021 considered production to the FPSO EnQuest Producer using the same optimistic production profiles. The development was sub economic, primarily driven by low peak oil rates. Given that all considered Galapagos development options were sub economic, this was screened out as a suitable host for the Dunlin redevelopment.

Subsequently, Magnus and Statfjord were evaluated as potential hosts for Dunlin. The Dunlin/Osprey development was the same 3 producer 1 injector well development as proposed in the 32nd round application, however all scenarios were at best marginal or sub-economic. In addition, the production profiles did not account for any backout of the host production, due to the facilities water handling capacity limitations. Given the high-water rates expected from the Dunlin/Osprey development, the production backout would have been considerable. Combining this project with a redevelopment of Dons and/or Thistle further eroded value.

Given the limited associated volumes and complex nature of the Dunlin/Osprey reservoir, the EnQuest development screening work across a series of hosts could not identify an economically viable development. Therefore, it was decided not to pursue the opportunities outlined in Appendix B of the P2601 license application. As such, no official work programme for licence P2601 was undertaken and EnQuest were unable to commit to obtaining broadband Geostreamer data over the Licence area.

## 9. Clearance

The operator, EnQuest, confirm that the OGA is free to publish information documented in this report and that all 3<sup>rd</sup> party ownership rights (on any contained data and/or interpretations) have been considered and appropriately cleared for publication purposes.



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