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**Shell U.K. Limited**

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# **Relinquishment Report**

**for**

**Licence P. 012**

**Part relinquishment of Blocks  
22/29, 29/3a and 29/7**



## **Important Notice**

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## 1. Header

<b>Licence Number:</b>	P. 012	
<b>Licence Round:</b>	1 <sup>st</sup> Round – Awarded 1964	
<b>Licence type:</b>	Traditional	
<b>Block Numbers:</b>	22/29 (part), 29/3a (part) and 29/7 (part)	
<b>Equity Holdings:</b>	<u>Blocks 22/29 &amp; 29/7</u>	
	Shell U.K. Limited	50%
	Esso Exploration and Production UK Limited	50%
	<u>Block 29/3a</u>	
	Shell U.K. Limited	28%
	Esso Exploration and Production UK Limited	72%

## 2. Work Programme Summary

Awarded in 1964, there are no outstanding commitments on the licence.

## 3. Synopsis

Licence P.012 expires in 2010. Prior to relinquishment, Blocks 22/29 and 29/7 outside the producing areas were extensively marketed for divestment several times but without success. BERR subsequently reclassified the Blocks as Fallow B24 (plan required to rescue from relinquishment) and the Blocks were partially relinquished, outside the producing areas, end 2007 (Attachments 1 & 3). Prior to partial relinquishment of Block 29/3a BERR classified the block as Fallow A7 FDP in preparation (Fram), requesting a voluntary partial relinquishment of the areas outside the Starling FDA and Fram area. This partial relinquishment was concluded end 2007 (Attachment 2).

The remaining prospectivity in the relinquished areas includes:

- For Block 22/29: the undeveloped Seagull accumulation (Triassic oil), the Seagull Flank prospect (Triassic gas), the Dumbledore prospect (22/29-C Triassic gas), the Updip Janus prospect (Triassic gas) and an extension of the Fluffy prospect (22/28c-F Triassic gas).
- For Block 29/3a: the Torrance accumulation discovered by 29/3a-5 in 1992 and 29/3a-E lead. Leads 29/3b-D, 29/3b-F, 29/8a-Q and 29/3b-M just clip the edge of the relinquished area.
- For Block 29/7: the undeveloped Curlew A Paleocene discovery, 29/7-M and P (Fulmar oil leads), 29/7-K (Heather mass flow oil lead), 29/7-N (Lower Cretaceous oil lead), 29/7-L (Chalk oil lead) and 29/7-NE (Maersk: Chalk Ekofisk and Tor oil lead).

## 4. Exploration Activities

**29/7-1 (1977); Curlew A discovery well:** encountered 17ft and 26ft of oil-bearing Cromarty and Odin sandstones (Palaeocene), respectively. The well found residual oil in the Chalk, and



the primary objective Jurassic Fulmar sands were found water-bearing likely due to breaching associated with salt movement. The well TD'd at 12152ft and was not tested

**29/7-2 (1979):** dry exploration well, primary Fulmar objective missing due to onlap against salt diapir. The well TD'd at 10902ft.

**29/3a-5 (1983):** encountered 11ft of low saturation hydrocarbons in Eocene Sele sands.

**29/7-3, 3s1 (1987):** dry exploration well, Fulmar objective water-bearing, drilled off structure. Residual oil was found in the middle Jurassic Hugin Formation. The well also tagged tight Ekofisk and water-bearing Pentland and Triassic reservoirs. This well TD'd at 11633ft.

**29/7-4 (1990); Curlew B Fulmar discovery:** Tested 9000 bopd and 3.4 mmscf/d.

**22/29-2 & 22/29-2S1 (1991-1992); Seagull discovery well:** discovered 124ft gross oil bearing Middle Jurassic Pentland sands, and 441ft gross oil bearing Triassic Skagerrak sands. The well produced 42°API oil from both reservoirs at a maximum rate of 4350bopd.

**22/29-3 (1992); Seagull appraisal well:** encountered 148ft gross oil bearing Upper Jurassic Kimmeridge and Middle Jurassic Pentland sands and 239ft gross oil bearing Triassic Skagerrak sands. The well tested 42°API oil from the Kimmeridge and the Skagerrak sands at a maximum rate of 1279 and 841bopd respectively. Reservoir pressure and temperature are 11750psi and 324° F respectively at ca. 12500 ft tvss.

**29/7-5 (1993); Curlew C discovery well:** found Tor and Ekofisk oil-bearing and the primary Jurassic Fulmar target water-bearing. Water-bearing Jurassic may be due to leaky seal/faulting. The well TD'd at 11458ft. The Tor tested at 5200 bopd and the Ekofisk at 2100 bopd, both after acid stimulation.

**29/7-6 (1993); Curlew B appraisal well:** had oil shows only in the Fulmar.

**29/7-7 (1994); Curlew D Fulmar discovery well:** tested 4035 bopd and 10.5 mmscf/d from the Lower Fulmar, 3620 bopd and 10.4 mmscf/d from the Middle Fulmar and 785 bopd and 3.5 mmscf/d from the Upper Fulmar.

**22/29-6, 22/29-6S1, 22/29-6S2 (1995-1996):** Juno dry exploration well encountered oil-stained Fulmar and Pentland reservoirs, probably indicating a blown trap (hydraulic top seal failure).

**22/29-7 (2002):** Janus dry exploration well, found good quality Triassic sands with indications of hydrocarbon charge.

## **5. Prospectivity Analysis**

### **Seagull Discovery (Block 22/29)**

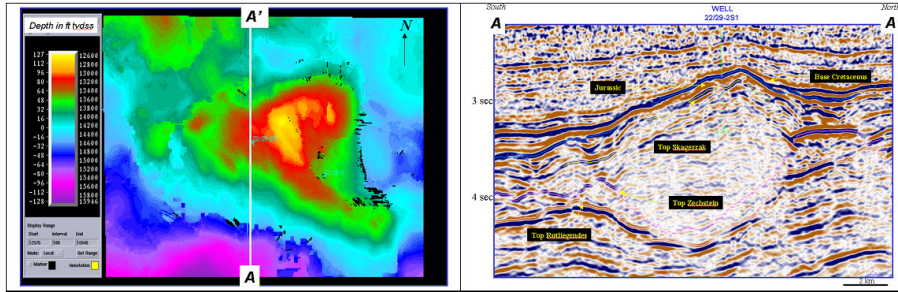
The Seagull oil discovery well 22/29-2 encountered a 441ft oil column in Triassic Skagerrak sands beneath a well-defined faulted anticline at Base Cretaceous level. The reservoir quality of the sands was relatively poor by comparison with the neighbouring Heron and Marnock discoveries, both of which now produce through the ETAP cluster.

An appraisal well 22/29-3 was drilled in late 1992. This second well encountered oil bearing Upper Jurassic mass flow sandstones above oil bearing Skagerrak Sands, also of relatively poor quality. The Triassic section was extensively cored, and found to be highly tectonised, with abundant cemented fractures.

Until 2004, the poor quality reservoirs were attributed to the interpretation of the structure as a highly faulted and fractured salt withdrawal turtle structure, which, by virtue of the complete evacuation of the underlying Zechstein salt, had suffered internal deformation far in excess of



that experienced by neighbouring structures such as the Heron field, whose relatively un-faulted internal structure was considered to be due to the preservation of underlying Zechstein Salt.



**Base Cretaceous Depth Map of the Seagull discovery (well 22/29-2s1) with N-S seismic line.**

#### *Recent studies / evaluations*

In 2004 a new static model was produced, prompted by the interpretation of the poor reservoirs in the 22/29-3 well as Lower Judy sandstone. Furthermore, the poor quality of the 22/29-2 well was interpreted as due to the erosion of the higher quality Skagerrak units more commonly associated with the upper parts of the Judy (Heron) member, as had been demonstrated by numerous ETAP area studies since the drilling and initial interpretations of the Seagull wells.

The 2004 study concluded that the Seagull reservoir would consist of field wide poor quality lower Judy and Bunter members. No fault was recognised in the 22/29-3 well.

In 2006, a re-examination of the data in a play wide review of Triassic reservoir performance, as well as the recognition of a major fault within the Triassic penetration of the 22/29-3 well led to the conclusion that the main reservoir at Seagull is in fact the much higher quality Upper Judy sandstones typical of the ETAP cluster.

A complete re-evaluation of the well test results from the 22/29-3 in the light of the 2006 review has not been conducted. As such, it remains unclear whether the new model can account for the water produced along with hydrocarbons in the DST.

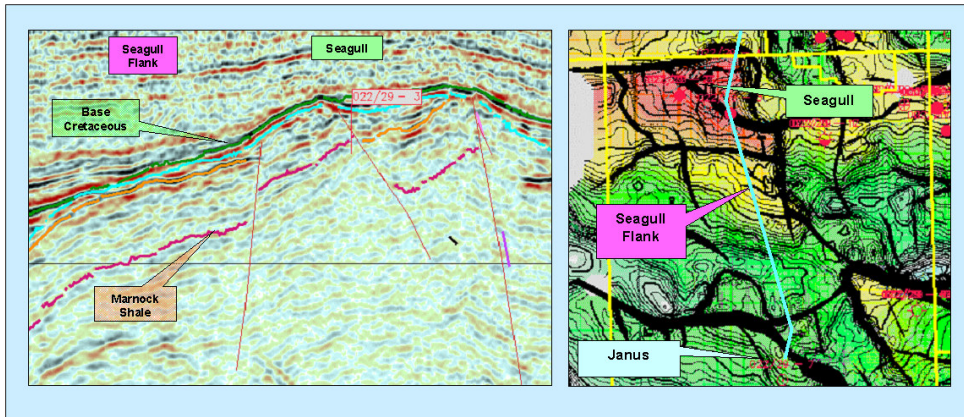
The base case volumes for the Seagull discovery reported in Part 6 are based on the 2004 study (Lower Judy reservoir) whilst the upside volumes are premised on the 2006 model (Upper Judy sandstone).

### **Seagull Flank Prospect (Block 22/29)**

The Seagull Flank opportunity is critically dependent on the sealing capacity of the fault defining the northern limit of the lead and constituting the boundary between the lead and the Seagull discovery to the north.

The fault self-juxtaposes Skagerrak Formation sandstones, and as such, trap integrity is dependent on the sealing capacity of the fault itself. This is a relatively high risk trapping configuration, but is not without precedent. The figure from the Millenium Atlas illustrates an analogous occurrence of sealing faults on the Conoco-Phillips operated Judy Field (UK block 30/7).

The remaining play elements are considered low risk, with the presence of high quality Skagerrak sandstones proven down dip of Seagull by the 22/29-7 Janus well, and ubiquitous hydrocarbon charge along the west-east chain of structures extending from Seagull to Commander. The Seagull flank prospect is likely to be gas-charged.



The Seagull Flank Prospect relies on the sealing capacity of the fault defining the northern limit of the lead and constituting the boundary between the lead and the Seagull discovery to the north

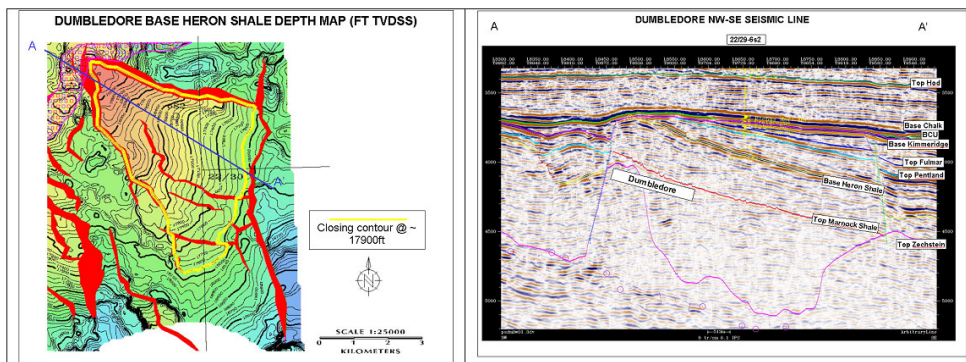
### Dumbledore Prospect (Block 22/29)

Dumbledore is located 10km south of the producing HPHT Heron Field (Skagerrak Formation) and 15 km NW of the Shearwater Field (Fulmar Formation). The prospect consists of a large tilted fault-block, bounded to the north and southwest by major faults and is dip closed to the SE. A major N-S orientated fault bounds the prospect to the east. Gas/condensate fill is predicted

Well 22/29-6S2 (Juno) tested oil-stained Fulmar and Pentland reservoirs, but a possible attic volume may still exist updip. The well terminated short of the Heron Shale and therefore the potential for a protected column within the Skagerrak remains untested.

Both Upper (channel-dominated) and Lower (sheet-flood dominated) units of the Triassic Skagerrak Formation are prognosed in the Dumbledore prospect.

Two main risks are recognised in the Dumbledore prospect; trap integrity and reservoir effectiveness. New mapping of the Dumbledore structure suggests that the crest may be sufficiently deep to protect a hydrocarbon column in the Triassic. Reservoir quality within the Triassic is expected to be of good quality by analogy with the interval encountered in the 22/29-7 Janus well. Sub-seismic faulting associated with main bounding faults in Dumbledore and reservoir compartmentalisation are the key remaining risks.



Base Heron shale depth map with 17900 ft closing contour, and NW-SE seismic line.

An additional play concept could be envisaged to lie on either side of the crestal zone of the Dumbledore structure. The presence of Upper Jurassic Fulmar sands, faulted and juxtaposed against sealing Triassic lithologies of the Dumbledore structure would provide an



effective trapping geometry. To date, no work has been carried out to explore this concept in any detail.

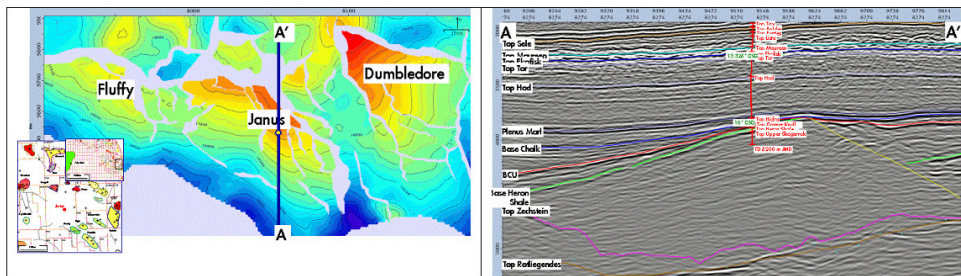
### Updip Janus Prospect (Block 22/29)

The prospect comprises hydrocarbons potentially trapped updip within the tilted fault block tested by the 22/29-7 Janus well. Gas/condensate fill is predicted.

Well 22/29-7 targeted sandstones of the Upper Triassic Skagerrak formation beneath the Base Cretaceous Unconformity. Evaluation of LWD GR-Resistivity and Density-Neutron logs of the uppermost Skagerrak Formation sands indicated that they were water-bearing. The presence of a ~210ft thick Heron Formation claystone was proven, as was a good quality Triassic reservoir (Upper Skagerrak thickness 146 m, net to gross 80 %, average porosity 18.5 %).

MDT pressures indicate that Janus is most likely in the Greater Shearwater pressure cell, which is supported by aquifer salinities. This implies that Janus was likely protected by the Martha structure and is therefore unlikely to have failed due to hydraulic top seal failure. Isotope analysis supports this interpretation, revealing a significant shift in carbon isotope values at the top of the Tor Formation, pointing towards the effectiveness of the K-T boundary as a regional seal. The absence of significant hydrocarbons at the location of the Janus well may be due either to underfill of the structure, or cross-fault leakage.

Evidence for charge is derived from iso-tube analyses of methane carbon isotope composition, and the gas wetness of mud gas which indicate that gases derived from the Skagerrak Formation in well 22/29-7 are similar in composition and maturity with gas in Shearwater. This strongly suggests that the structure has had access to at least some charge from the adjacent Kimmeridge kitchens.

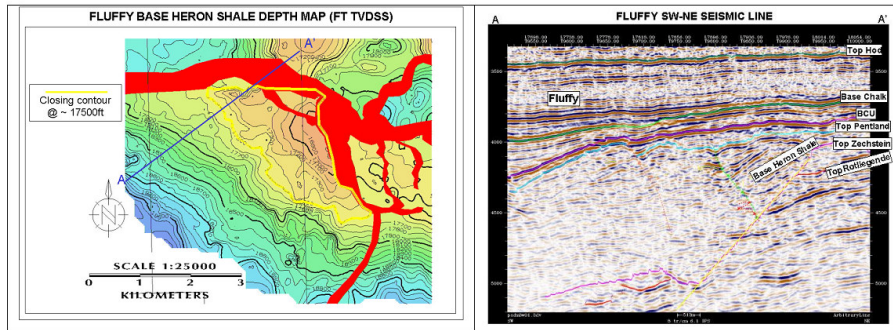


Base Heron shale depth map, and NW-SE seismic line through well 22/29-7.

### Fluffy Prospect (Block 22/29)

The prospect comprises a tilted Triassic fault block, bounded by major faults to the north and east and dip closed to the SW. The structure is similar to Janus and the play consists of Upper Skagerrak sandstones of the Triassic aged Judy Formation, with Upper Jurassic shales and the Triassic Heron Shale providing the seal. Fluffy is separated from the Janus structure by a faulted ‘saddle’ or collapse graben. Gas/condensate fill is predicted.

Both Upper and Lower Skagerrak units are prognosed for the prospect, and by analogy with the nearby Janus well 22/29-7, reservoir quality should be good. Uncertainty in the seismic interpretation suggests that the Skagerrak reservoir may be eroded towards the west

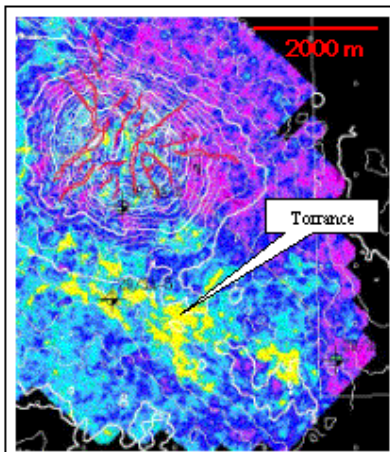


**Base Heron shale depth map with closing contour at 17500 ft, and SW-NE seismic line.**

Two main risks are recognised in the Fluffy prospect; trap integrity and reservoir effectiveness. Pressure cell mapping indicates that Fluffy should be protected from hydraulic top-seal failure. Sub-seismic faulting associated with main bounding faults thus resulting in reservoir compartmentalisation is seen as the key remaining risk.

### **Torrance Discovery (Block 29/3a)**

Torrance was drilled in 1992 targeting Jurassic Fulmar/Pentland and Triassic Skagerrak formations in a faulted dip closure. The well encountered non-hydrocarbon bearing poor quality reservoir over these objective intervals. A small 11ft hydrocarbon column was encountered in the Eocene Sele Formation in good quality sands (porosity ca. 25%) although saturations were low. Identified as an amplitude anomaly, Torrance comprises channelised sand packages of the Sele Formation and is predominantly a stratigraphic trap immediately south of the Starling Field. Despite subsequent re-processing and inversion studies in the area around 2000, Torrance remains a distal and disseminated accumulation with relatively low volumes (ca. 14mmboe).



**Map of maximum hydrocarbon fluid indicator from simultaneous inversion fluid volume in the Sele S2/S3 sands highlighting Torrance.**

### **Leads (Block 29/3a)**

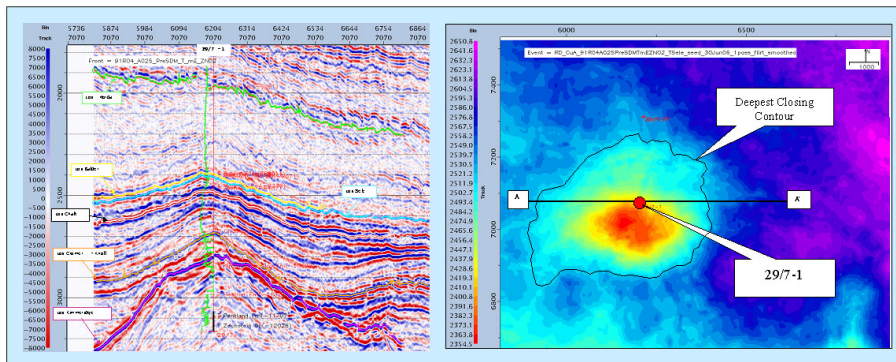
A number of leads have been identified most of which only clip the edge of the relinquished area, although 29/3a-E lies wholly within the area. An Upper/Middle Jurassic prospect significantly downgraded due to reservoir quality issues following the drilling of the Torrance (29/3a-5) well.



## Curlw A Discovery (Block 29/7)

Curlw A was discovered in 1977 by well 29/7-1. Oil-bearing sands were discovered in the Lower Palaeocene section, in the Cromarty and Odin Members of the Sele and Balder Formations respectively.

The trap at Curlw A is a four-way dip closure induced by the underlying Zechstein salt movement. Both reservoir formations are interpreted as thin, sheet-like turbiditic sands, with high porosities but low net sand thicknesses and hydrocarbon saturations. The sands cannot be imaged on seismic, even in the high quality reprocessed 2006 PSDM volume. As Curlw A lies in a distal and marginal position with respect to the fairway axis, these sands are assumed to have a sheet-like geometry, thickening down dip from 29/7-1 in response to the seafloor topography during diapir movement. The sands thin and then pinch out in the direction of well 29/7-3, as they were not encountered in that location.



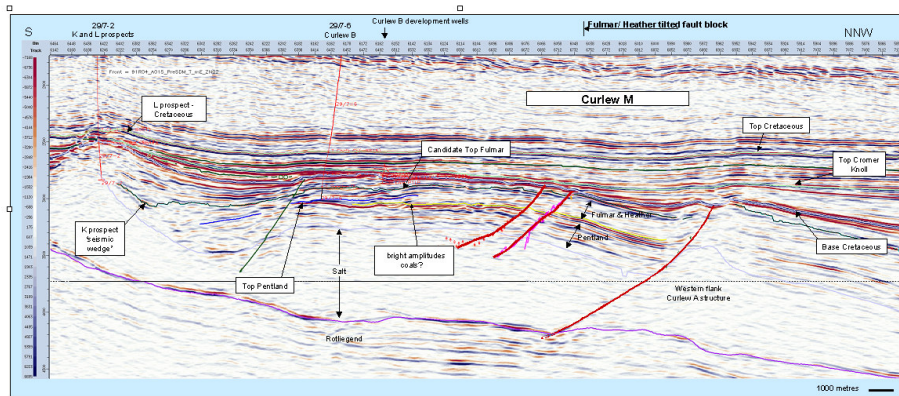
Seismic line across well 29/7-1 with Top Sele (near top Cromarty) time map

## Leads (Block 29/7)

A number of leads have been defined in the block at Jurassic, Lower Cretaceous, and Chalk levels, during a re-evaluation of Block 29/7 in 2006. All of these leads are expected to be normally pressured.

- M and P have Fulmar objectives and are hanging wall traps dependent on fault-sealing
- K and N are onlap traps with conceptual Jurassic/Cretaceous mass flow reservoir objectives (i.e. not penetrated in nearby wells)
- L and NE ("Maersk") have Upper Cretaceous Chalk (Ekofisk and Tor) objectives, the former in a structural closure, and the latter in a stratigraphic trap defined by seismic amplitude anomalies

Lead M has the largest upside and comprises a tilted fault block on the southern margin of the Curlw A salt ridge. The Kimmeridge provides both seal and source rock, and is clearly seen onlapping the top reservoir unit surface. Lateral seal is potentially provided by a fault system to the south and west and onlap onto the salt structure to the north and east.



**N-S Seismic line across Curlew A, Lead M, the Curlew B Field and the K and L leads**

## 6. IN PLACE AND RECOVERABLE VOLUMES

### Block 22/29 IN PLACE AND RECOVERABLE VOLUMES (GROSS)

		GIIP/STOIPP	Recoverable Volumes
Seagull – 22/29 (Triassic oil discovery)	Base Case (L. Judy)	165 mmbo	1.8 mmbo
	Upside Case (U. Judy)	44 mmbo*	13 mmbo + 31bcf solution gas
Seagull Flank – 22/29 (Triassic gas prospect)	Base Case	809 bcf	566 bcf + 20 mmb condensate
	Upside Case	1039 bcf	727 bcf + 28 mmb condensate
Dumbledore – 22/29*** (Triassic gas prospect)	Base Case	21 bcf	15 bcf + 0.6mmb condensate
	Upside Case	32 bcf	23 bcf + 1.2 mmb condensate
Updip Janus – 22/29 (Triassic gas prospect)	Base Case	122 bcf	85 bcf + 3.0 mmb condensate
	Upside Case	177 bcf	124 bcf + 4.4 mmb condensate
Fluffy – 22/29*** (Triassic gas prospect)	Base Case	16 bcf	11 bcf + 0.5 mmb condensate
	Upside Case	272 bcf	191 bcf + 7.7 mmb condensate

\*Upper Judy STOIPP only

\*\*Block 22/29, 30a part only (ca. 85%), remainder in open block 22/30d.

\*\*\*Block 22/29 part only (ca. 35%), remainder in Maersk-operated block 22/28c.

### Block 29/3a RECOVERABLE VOLUMES (GROSS)

	STOIPP	Recoverable Volumes
Torrance – 29/3a* (Eocene oil discovery)	Base Case	14mmbo
	Upside Case	29mmbo
Lead E – 29/3a (Jurassic oil lead)	Base Case	82 bcf + 16mmb condensate
	Upside Case	115bcf + 22mmb condensate

\*Block 29/3a relinquishment area (ca. 55%)

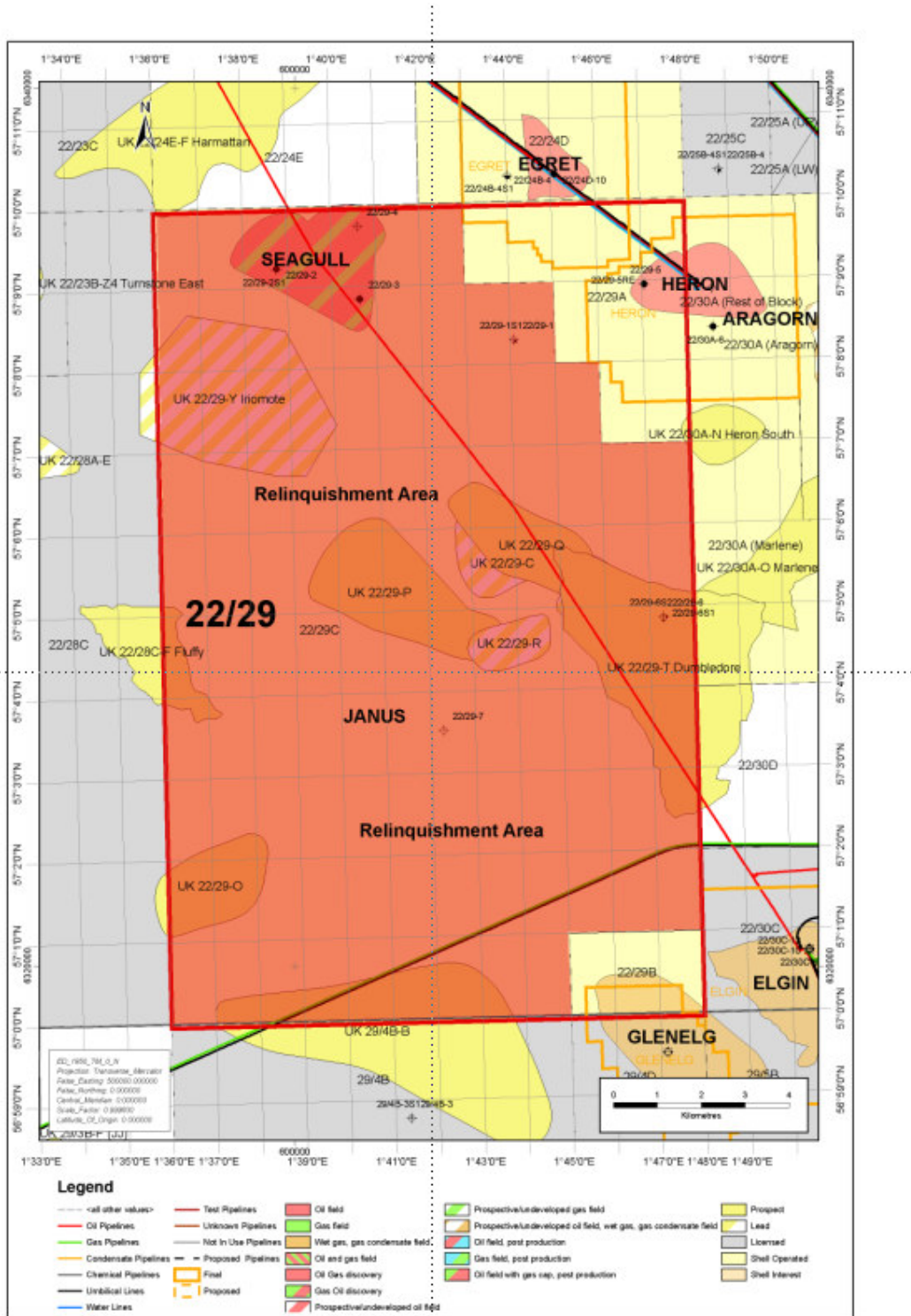


### Block 29/7 IN-PLACE AND RECOVERABLE VOLUMES (GROSS)

	STOIIP		Recoverable Volumes
	Base Case	Upside Case	
Curlew A – 29/7 (Palaeocene oil discovery)	Base Case	24 mmbo	12 mmbo + 7.2 bcf solution gas
	Upside Case	59 mmbo	26 mmbo + 16 bcf solution gas
Lead M – 29/7 (Fulmar oil lead)	Base Case	14 mmbo	4.2 mmbo + 2.5 bcf solution gas
	Upside Case	150 mmbo	18 mmbo + 11 bcf solution gas
Lead P – 29/7 (Fulmar oil lead)	Base Case	58 mmbo	17 mmbo + 10 bcf solution gas
	Upside Case	108 mmbo	32 mmbo + 19 bcf solution gas
Lead K – 29/7 (Heather mass flow oil lead)	Base Case	50 mmbo	15 mmbo + 9.0 bcf solution gas
	Upside Case	88 mmbo	26 mmbo + 16 bcf solution gas
Lead N – 29/7 (Lower Cretaceous oil lead)	Base Case	18 mmbo	5.4 mmbo + 3.3 bcf solution gas
	Upside Case	68 mmbo	20 mmbo + 12 bcf solution gas
Lead L – 29/7 (Chalk oil lead)	Base Case	16 mmbo	4.8 mmbo + 2.8 bcf solution gas
	Upside Case	33 mmbo	9.9 mmbo + 5.8 bcf solution gas
NE (“Maersk”) lead (Chalk Ekofisk and Tor oil lead)	Base Case	81mmbo	24 mmbo + 14 bcf solution gas

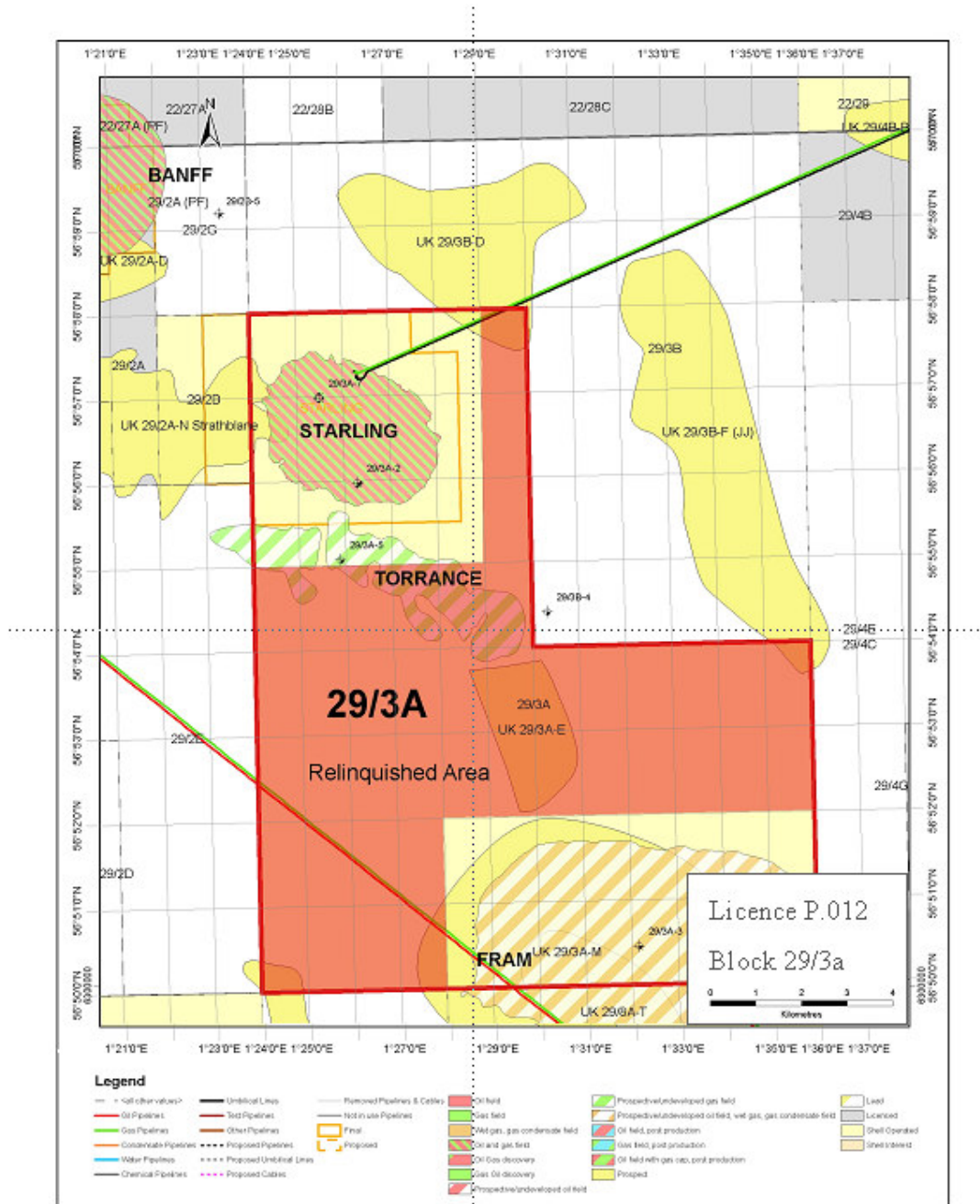


# Attachment 1: Block 22/29 partial relinquishment area outline





## Attachment 2: Block 29/3a partial relinquishment area outline





### Attachment 3: Block 29/7 partial relinquishment area outline

