Disclaimer

No responsibility or liability whatsoever is accepted and no representation, warranty or undertaking, express or implied, is or will be made by Centrica plc, any of Centrica plc's subsidiaries, Shell U.K. Limited ("Shell") or any of Shell's affiliates (the "Companies"), or any of the Companies' respective agents, being their directors, officers, employees, contract staff, advisers, representatives or other agents, for any information, projections or any of the opinions contained in this report or for any errors, omissions or misstatements in this report. Neither the Companies, nor any of their respective agents makes or has authorised to be made any representations or warranties (express or implied) in relation to any of the matters described herein or as to the truth, accuracy or completeness of this report, or any other written or oral statement provided.

This report shall not be deemed to be an offer to sell or invitation to invest in the Companies or any of the Companies' assets and no information set out in this report is intended to form the basis of any contract, investment decision or any decision to purchase or invest in any such assets.

Neither the Companies nor any of the Companies' respective agents undertakes any obligation to provide any recipient with access to any additional information or to update or correct any inaccuracies in or omissions from this report.

This report should not be considered as a recommendation by the Companies or any of the Companies respective agents to invest in any securities (including, without limitation, those issued by the Companies) or any other assets. Recipients should rely solely on their own judgement, review and analysis in evaluating the information set out herein.
# Table of Contents

1. Licence Information .................................................................................................................. 1  
2. Synopsis ..................................................................................................................................... 1  
3. Exploration Activities ............................................................................................................... 2  
   3.1 Seismic .................................................................................................................................... 2  
   3.2 Wells ...................................................................................................................................... 2  
   3.3 Studies ................................................................................................................................... 2  
4. Prospectivity Analysis ............................................................................................................... 3  
   4.1 Bligh discovery ....................................................................................................................... 3  
      4.1.1 Trap type .......................................................................................................................... 4  
      4.1.2 Reservoir ........................................................................................................................ 4  
      4.1.3 Seal ................................................................................................................................... 4  
      4.1.4 Remaining risks/Chance of success ................................................................................. 5  
   4.2 Christian discovery ................................................................................................................ 5  
5. Reserves Summary .................................................................................................................... 5  
6. Maps and Figures ...................................................................................................................... 7  
7. Clearance ................................................................................................................................... 11
## Table of Figures

| Figure 1: Location map showing Bligh P185; outline of block 21/20d in red. | 76 |
| Figure 2: Top Puffin Sandstone in depth (TVDSS). | 87 |
| Figure 3: An example NW-SE seismic section through 21/20d. | 98 |
| Figure 4: An example SW-NE seismic section through 21/20d. | 98 |
| Figure 5: An illustrative NW-SE section through 21/20b. | 109 |
| Figure 6: An illustrative SW-NE section through 21/20b. | 109 |
1. Licence Information

<table>
<thead>
<tr>
<th>Licence Number</th>
<th>P185</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licence Type</td>
<td>Traditional, 4th Round, multi-block. (6+40 year terms; expiry 16th March 2018)</td>
</tr>
<tr>
<td>Block Number</td>
<td>21/20d</td>
</tr>
<tr>
<td>Licensees</td>
<td>Centrica North Sea Oil Ltd 50% (Operator)</td>
</tr>
<tr>
<td></td>
<td>Shell UK Ltd 50%</td>
</tr>
<tr>
<td>Licence Surrendered</td>
<td>1st December 2013 by letter from Secretary of State (part of licence covering 21/20d only)</td>
</tr>
</tbody>
</table>

All permissions to publish this report have been obtained (see section 7 below, “Clearance”).

2. Synopsis

Block 21/20d is part of multi-block licence P185 which was awarded in the 4th Round of licensing in March 1972 and is due to expire on 16th March 2018. At the time of 21/20d relinquishment, P185 comprised 13/16a, 13/21a, 15/22, 21/20a, 21/20d, 21/20f, 30/11b and 30/12b. Many changes have occurred in the structure of the licence-holding partnership on block 21/20, ultimately leading to Centrica and Shell each holding 50% equity at the time of full relinquishment in December 2013. The part-block was mainly focussed on the Bligh HPHT discovery (21/20a-5) but also contained the southern portions of Christian and Christian Deep HPHT prospects (figures 1 & 2).

At the time of relinquishment, the 21/20d licensed area included two wells drilled on the part-block (21/20a-5 and 21/20d-8), and was assigned non-fallow status as a result of drilling well 21/20d-8 in 2012. Well 21/20d-8 has been plugged and abandoned, however 21/20a-5 remains suspended at the time of writing; Centrica plans to permanently abandon the well post-relinquishment (by 31st December 2016). Coordinates of the licence area at the time of relinquishment are provided in Section 6 and illustrated in Figures 1 & 2.

Following evaluation of the results of the 21/20d-8 Bligh appraisal well, the Partnership decided that no economically viable development was possible. Therefore, all work commitments on the licence having been met, the decision was taken to relinquish the licence.
3. Exploration Activities

3.1 Seismic
The Bligh discovery is fully covered by the following datasets licenced by the operator:

- **PGS Megasurvey**
  - Regional dataset purchased after Senergy 2008 work

- **Fugro2005 PSTM 3D – regional coverage**
  - 2005 Greater Kittiwake 3D merge/reprocessing
  - Used as the basis for an AVO inversion carried out by Fugro Jason (now CGG Jason) in 2007/2008. Final products were P-Impedance, S-Impedance, Density, and VpVs, together with bandlimited equivalents.

3.2 Wells
The Bligh discovery well 21/20a-5 was drilled by Enterprise in 1995 and encountered 71’ gross reservoir which tested gas and condensate at rates of 15.4 mmscf/d plus 2766 BCPD. Well 21/20a-5 was suspended as a gas-condensate discovery and remains suspended at the time of writing. A Centrica-operated group retains the on-going licence commitment to fully abandon this well, and plans to fulfil this commitment by 31st December 2016.

Bligh appraisal well 21/20d-8 was drilled by Centrica in 2012 and found 63’ gross hydrocarbon bearing reservoir. The well was tested and flowed gas and condensate to surface, however at extremely low rates. 21/20d-8 was plugged and abandoned following testing.

3.3 Studies
A number of studies have been conducted on Bligh and the target reservoir, these include:

- **Biostratigraphy**

- **Reservoir petrography and quality**

- **Pressure**
  - Geopressure Effective Stress Study 2008

- **Field reviews**
  - Enterprise Oil, 1995
  - Shell, 2006
4. Prospectivity Analysis
Prospectivity in the area has been established in four intervals by drilling:

- Palaeocene Forties Sands (21/20a-1 – Morgan Prospect)
- Kimmeridgian Turbidites (Christian Sands, in 21/20b-4Y – Christian discovery)
- Late Jurassic Ryton Sands (Fulmar Sand equivalent, in 21/20a-2 – Cook Field, and 21/20b-4Y)
- Late Jurassic Puffin sands (21/20a-5 – Bligh discovery, 21/20d-8 – Bligh appraisal).

The drilling of the 21/20b-4Y and 21/20a-5 wells discounted the likelihood of commercial hydrocarbon in Forties and Maureen equivalent sands; thus prospectivity in 21/20d is limited to Late Jurassic sediments – the Kimmeridgian Christian turbidites, Fulmar/Ryton Sands and the deeper Puffin/Pentland Sands. The main target within 21/20d was the Late Jurassic Puffin Sands in the Bligh discovery.

4.1 Bligh discovery
The Bligh gas-condensate discovery is an HPHT accumulation discovered by well 21/20a-5 drilled in 1995. The well encountered 71 ft gross reservoir of Upper Jurassic Oxfordian age shallow marine sandstone, referred to as the Puffin Sands, and Middle Jurassic Pentland Sands. A fault was observed in core, from which it was inferred that the true reservoir thickness might be greater than the thickness encountered. The reservoir was over-pressured by ~6500 psi and tested gas and condensate at rates of 15.4 mmscf/d plus 2766 bcpd. No hydrocarbon water contact was encountered. Reservoir conditions were estimated to be 12,976 psia and 335°F at 14,343 ft TVDSS.

Unproven potential was recognised in the Bligh structure below the 21/20a-5 “gas-down to” (GDT) depth of -14377.5 ft TVDSS, and the possibility of achieving higher production rates was recognised owing to probability of well-kill operations carried out during the test having resulted in formation damage. Further upside was recognised should the Bligh structure connect with the adjacent Christian Deep structure to the NW.

The discovery was appraised by the down-dip well 21/20d-8, located on the NW flank of the structure. 21/20d-8 was drilled at a location that would demonstrate economic viability in the success case and leave only uneconomic reserves up-dip should it fail to prove hydrocarbons. 21/20d-8 encountered the target Puffin/Pentland reservoir and proved a gross interval thickness of 63 ft with moderate reservoir quality on logs as predicted but high water saturation. The well was tested and produced gas and condensate to surface at extremely low rates, and the DST was terminated following an extremely high drawdown. Flow rates were well below the accurate range of meters and no stable flow was achieved. Following the flow periods, a slow reservoir pressure increase over several hours resulted in only partial build-up and no good data was available to allow confident well test analysis.
Data acquired and studies performed have eliminated mechanical reasons and formation damage as possible causes of the poor test results, and analysis of the well kill operation has provided evidence that the zone of low permeability reservoir is extensive (rather than just a local effect around the well). Study of data from 21/20d-8 and known analogues has led to the conclusion that the likely reason for poor test performance is the blockage of reservoir pore throats by quartz overgrowths. The distribution of quartz overgrowths is thought to be related to water saturation and height above free water level, with the earlier charge and higher gas saturations at 21/20a-5 near the crest of the Bligh structure having preserved porosity and permeability at that location relative to the down-dip 21/20d-8. Permeability is degraded in the Sw transition zone, however it is not known how far up the Bligh structure this zone of impaired permeability extends. The most optimistic scenario is that permeability improves immediately up-dip of the 21/20d-8 well penetration and reservoir volumes above 21/20d-8 can be defined as “moveable” reserves for the Bligh discovery.

4.1.1 Trap type
The trapping style is a salt induced structural four-way dip closure spilling to the south. The structure is broadly aligned NW-SE and is approximately 3 km wide and 7 km long (figure 2). A mapped SW-NE trending strike-slip fault with slight vertical throw intersects the middle of structure.

4.1.2 Reservoir
Analysis of logs and core from 21/20a-5 and logs 21/20d-8 show the reservoir at Bligh to be separated into two intervals, the Puffin sands and the Pentland sands.

The main reservoir potential lies in the Puffin Sands. These are shallow marine shoreface sandstones which have a strong diagenetic overprint. The sands are Middle Oxfordian age. In 21/20a-5 they rest discordantly on Middle Jurassic Pentland Formation.

The Puffin Sands are believed to be developed in a confined, elongate north-northwest to south-southeast trending trough coincident with today’s West Central Graben, bounded by the Western Platform to the west and the Forties-Montrose High to the east. Core analysis shows that the Puffin sand is a fine grained, moderately to well sorted sandstone with moderate porosity (14-20%) and variable permeability (<2-73mD). The gross thickness of the Puffin sand is 40-42ft with net reservoir being approximately 32-34ft.

The coal bearing Pentland Formation is assigned to the Middle Jurassic. Sandstones of the Pentland section are generally thin, low NTG deposits of fluvio-deltaic character and are interpreted to be coastal plain deposits. They are fine grained to very fine grained, with root penetrations, and are generally of poor reservoir quality. Porosity averages <13% and permeability is variable <0.5 to 16mD locally. The sandstone unit of the Pentland Fm was encountered only in 21/20a-5 and forms the secondary reservoir for Bligh.

The most significant difference between 21/20a-5 and 21/20d-8 penetrations lies in their calculated water saturations. Average water saturation in well 21/20d-8 (located on the flank of the structure) is calculated as 50%, which is higher than the already high Sw value of 37% calculated for well 21/20a-5 (located near the crest of the structure).

4.1.3 Seal
The seal is inferred to be the overlying Puffin and Heather shale sequences.
4.1.4 Remaining risks/Chance of success

The geological chance of success at Bligh is considered to be 100% as both wells have proven hydrocarbon bearing sands on the Bligh structure. The structure is interpreted to be full to spill but have a significant transition zone which has been detrimentally affected by the high water saturations and therefore has a heavy diagenetic overprint, inferred to be principally related to quartz overgrowths within pore throats. The main risk for the prospect is the presence of an economically viable volume of moveable hydrocarbons updip of the 21/20d-8 penetration. Further appraisal would be required to define the volume of moveable hydrocarbons on structure, however the range of possible volumes calculated post-21/20d-8 do not justify a further appraisal well. Therefore substantial economic risk remains.

4.2 Christian discovery

Block 21/20d also contains part of the Christian discovery, a four-way dip closure tested by well 21/20b-4Y. This was assessed to be uneconomic following the results of Bligh well 21/20d-8, and Christian licence P421, containing the 4Y discovery well, was relinquished in April 2013.

Christian is a HPHT oil accumulation discovered by well 21/20b-4Y in 1990, and is assigned a P50 recoverable volume of 5 mmboe. As mapped, approximately 62% of the prospect volume lies on block 21/20d, however the reservoir sands do not continue over the Bligh structure.

The 21/20b-4Y well encountered 137 ft gross of oil bearing Kimmeridgian turbiditic sands, referred to as the Christian Sand Unit. These are over-pressured and tested 6,200 stb/d of 42° API oil. No oil water contact was encountered. Reservoir conditions are estimated to be 11,220psi and 320°F at 13,475ft TVDSS.

The “Christian Deep” prospect which underlies the proven Christian discovery also extends into block 21/20d (approximately 33% of 9 mmboe). However, this small untested gas-condensate prospect shares the same Puffin Fm reservoir as Bligh and the result of the 21/20d-8 well significantly increases reservoir quality risk.

The potential of the Christian discovery is discussed in the Centrica Relinquishment Report for licence P421 (block 21/20b), dated May 2013 (q.v.).

5. Reserves Summary

Volumes stated below for the Christian discovery and the Christian Deep prospect refer to the entire structure, only part of which lies on block 21/20d. The Bligh discovery lies entirely within 21/20d.

Post-appraisal, the Bligh discovery has the following GIIP and recoverable hydrocarbons figures attributed to it, assuming moveable hydrocarbons all the way down to the 21/20d-8 reservoir penetration:
Estimated recoverable resources for Bligh and Christian prospects, split by hydrocarbon type, are as follows:

<table>
<thead>
<tr>
<th>Prospect Lead Discovery Name</th>
<th>P L D</th>
<th>Stratigraphic level</th>
<th>Oil MMbbls</th>
<th>Gas BCF</th>
<th>Geological Chance of Success %</th>
<th>Risked P50 MMboe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Unrisked recoverable resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>Central</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Bligh</td>
<td>D</td>
<td>Jurassic (Puffin)</td>
<td>0.9</td>
<td>3.2</td>
<td>7.0</td>
<td>6.0</td>
</tr>
<tr>
<td>Christian</td>
<td>D</td>
<td>Jurassic (Kimmeridgian)</td>
<td>3.1</td>
<td>3.9</td>
<td>7.7</td>
<td>5.0</td>
</tr>
<tr>
<td>Christian Deep</td>
<td>P</td>
<td>Jurassic (Puffin)</td>
<td>2.9</td>
<td>4.5</td>
<td>6.2</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Note that the Christian and Christian Deep prospects lie within a 4 way dip closure which straddles blocks 21/20b (P421 Christian) and 21/20d (P185 Bligh). For the Kimmeridgian Christian Sandstone reservoir, approximately 62% of reservoir volume lies within 21/20d, with 38% being in what (before recent relinquishment) was part-block 21/20b. Conversely, approximately 33% of the “Christian Deep” prospective volumes lie on block 21/20d and 67% on 21/20b.
Figure 1: Location map showing Bligh P185; outline of block 21/20d in red. (Centrica acreage in yellow, Shell acreage in blue.)

The 21/20b licence area is defined by the following vertices, numbered starting in the NW corner and proceeding anti-clockwise round the area. ED50 datum latitude/longitude):

1) 57 deg 24 min 0 sec N, 0 deg 51 min 0 sec E
2) 57 deg 24 min 0 sec N, 0 deg 57 min 0 sec E
3) 57 deg 23 min 0 sec N, 0 deg 57 min 0 sec E
4) 57 deg 23 min 0 sec N, 0 deg 58 min 0 sec E
5) 57 deg 22 min 0 sec N, 0 deg 58 min 0 sec E
6) 57 deg 22 min 0 sec N, 1 deg 0 min 0 sec E
7) 57 deg 20 min 0 sec N, 1 deg 0 min 0 sec E
8) 57 deg 20 min 0 sec N, 0 deg 56 min 0 sec E
9) 57 deg 21 min 0 sec N, 0 deg 56 min 0 sec E
10) 57 deg 21 min 0 sec N, 0 deg 55 min 0 sec E
11) 57 deg 22 min 0 sec N, 0 deg 55 min 0 sec E
12) 57 deg 22 min 0 sec N, 0 deg 54 min 0 sec E
13) 57 deg 23 min 0 sec N, 0 deg 54 min 0 sec E
14) 57 deg 23 min 0 sec N, 0 deg 51 min 0 sec E
1) 57 deg 24 min 0 sec N, 0 deg 51 min 0 sec E
Figure 2: Top Puffin Sandstone in depth (TVDSS).
Block outline of 21/20d overlain. Approximate lines of section shown.
Figure 3: An example NW-SE seismic section through 21/20d.
Data Courtesy of Robertson GeoSpec International Limited

Figure 4: An example SW-NE seismic section through 21/20d.
Data Courtesy of Robertson GeoSpec International Limited
Figure 5: An illustrative NW-SE section through 21/20b.

Figure 6: An illustrative SW-NE section through 21/20b.
7. Clearance

Partners have reviewed this document and verified that DECC is free to publish it. All 3rd party ownership rights (on any contained data and/or interpretations) have been considered and appropriately cleared for publication purposes.

Seismic figures are based on TerraCube PSTM data supplied courtesy of Robertson GeoSpec International Limited ("TerraCube" is a registered trademark of Robertson, a CGG company). The publication of all seismic images has been approved by the data owner, CGG.