Brynhild Decommissioning Programme
Final
21488-TEFMC-000-Z-RA-00004

26 May 2020
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Document Control

Approvals

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<td>AS</td>
<td>Aksjeselskap</td>
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<tr>
<td>BAT/BEP</td>
<td>Best Available Techniques / Best Environmental Practices</td>
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<td>CA</td>
<td>Comparative Assessment</td>
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<tr>
<td>C&amp;P</td>
<td>Contracting and Procurement</td>
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<tr>
<td>CNS</td>
<td>Central North Sea</td>
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<tr>
<td>CoP</td>
<td>Cessation of Production</td>
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<td>DP</td>
<td>Decommissioning Programme</td>
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<td>DPN</td>
<td>Disused Pipeline Notice issued by DTI, DECC</td>
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<td>EA</td>
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</tr>
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<td>e.g.</td>
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<td>ENVID</td>
<td>Environmental Impact Identification</td>
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<tr>
<td>EUNIS</td>
<td>European Nature Information System</td>
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<tr>
<td>FEED</td>
<td>Front End Engineering Design</td>
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<tr>
<td>FJSS</td>
<td>Flexible Jumper Support Structures</td>
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<tr>
<td>FPSO</td>
<td>Floating Production Storage Offloading</td>
</tr>
<tr>
<td>GRP</td>
<td>Glass Reinforced Plastic</td>
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<tr>
<td>GMS</td>
<td>Global Marine Systems Limited</td>
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<td>GVI</td>
<td>General Visual Inspection</td>
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<td>ICES</td>
<td>International Council for Exploration of the Sea</td>
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<tr>
<td>IRM</td>
<td>Inspection, Repair, Maintenance</td>
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<tr>
<td>ITS</td>
<td>Integrated Template Structure</td>
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<tr>
<td>JNCC</td>
<td>Joint Nature Conservation Committee</td>
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<tr>
<td>km</td>
<td>Kilometre</td>
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<td>Lundin</td>
<td>Lundin Energy Norway AS</td>
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<tr>
<td>m</td>
<td>Metre</td>
</tr>
<tr>
<td>m²</td>
<td>Square Metres</td>
</tr>
<tr>
<td>m³</td>
<td>Cubic Metres</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetre</td>
</tr>
<tr>
<td>MAT</td>
<td>Master Application Template</td>
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<td>MCZ</td>
<td>Marine Conservation Zone</td>
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<tr>
<td>MDS</td>
<td>Main Drill Site</td>
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<tr>
<td>MSm³</td>
<td>Million Standard Cubic Metres</td>
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<tr>
<td>NCMPA</td>
<td>Nature Conservation Marine Protected Area</td>
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<td>NMPi</td>
<td>National Marine Plan interactive</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>NNW</td>
<td>North North West</td>
</tr>
<tr>
<td>NORM / LSA</td>
<td>Naturally Occurring Radioactive Material / Low Specific Activity</td>
</tr>
<tr>
<td>NCS</td>
<td>Norwegian Continental Shelf</td>
</tr>
<tr>
<td>N/A</td>
<td>Not Applicable</td>
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<td>OD</td>
<td>Outside Diameter</td>
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<td>ODU</td>
<td>Offshore Decommissioning Unit</td>
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<td>OGA</td>
<td>Oil and Gas Authority</td>
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<td>OGUK</td>
<td>Oil and Gas UK</td>
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<tr>
<td>OPRED</td>
<td>Offshore Petroleum Regulator for Environment and Decommissioning</td>
</tr>
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<td>OSPAR</td>
<td>from Oslo/Paris, the Convention for the Protection of the Marine Environment of the North East Atlantic</td>
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<td>OSPAR 2006/5</td>
<td>OSPAR Recommendation on a Management Regime for Offshore Cuttings Piles</td>
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<td>PIP</td>
<td>Pipe in Pipe</td>
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<tr>
<td>PL</td>
<td>Pipeline</td>
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<td>PLET</td>
<td>Pipeline End Termination</td>
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<tr>
<td>PFM</td>
<td>Priority Marine Feature</td>
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<td>PVA</td>
<td>Particularly Valuable Area</td>
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<td>PWA</td>
<td>Pipeline Works Authorisation</td>
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<td>P&amp;A</td>
<td>Plug and Abandon</td>
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<td>Q</td>
<td>Quarter</td>
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<tr>
<td>RBM</td>
<td>Riser Base Manifold</td>
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<td>RBS</td>
<td>Riser Base Structure</td>
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<tr>
<td>ROV</td>
<td>Remotely Operated Vehicle</td>
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<td>SAC</td>
<td>Special Area of Conservation</td>
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<td>SEPA</td>
<td>Scottish Environmental Protection Agency</td>
</tr>
<tr>
<td>SFF</td>
<td>Scottish Fishermen’s Federation</td>
</tr>
<tr>
<td>SIMOP</td>
<td>Simultaneous Operations</td>
</tr>
<tr>
<td>SNH</td>
<td>Scottish Natural Heritage</td>
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<tr>
<td>SOPEP</td>
<td>Shipboard Oil Pollution Emergency Plan</td>
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<td>SPS</td>
<td>Subsea Production System</td>
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<tr>
<td>SSS</td>
<td>Side Scanner Sonar</td>
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<tr>
<td>SW</td>
<td>South West</td>
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<td>S29</td>
<td>Section 29</td>
</tr>
<tr>
<td>Te</td>
<td>Tonnes</td>
</tr>
<tr>
<td>TFSW</td>
<td>Trans Frontier Shipment of Waste</td>
</tr>
<tr>
<td>UKCS</td>
<td>United Kingdom Continental Shelf</td>
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<td>WI</td>
<td>Water Injection</td>
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1 EXECUTIVE SUMMARY

1.1 Decommissioning Programme

This document contains the Decommissioning Programme (DP) for the two pipelines and one umbilical that make up the Brynhild Field that tie back to the Haewene Brim Floating Production, Storage and Offloading (FPSO) vessel serving the Pierce Field. The Brynhild pipelines are operated by Lundin Energy Norway AS (herein after referred to as Lundin). Bluewater (Haewene Brim) N.V. is the Operator and Duty Holder of the Haewene Brim FPSO, whilst Shell and partners (see below) are the Pierce Field licence holder.

Pierce Field Licence Holders:
- Shell EP Offshore Ventures Limited
- Shell Upstream Overseas Services (I) Limited
- Enterprise Oil Limited
- Ithaca Energy (UK) Limited

The DP covers the Brynhild infrastructure in the United Kingdom Continental Shelf (UKCS) only as the infrastructure in the Norwegian Sector is covered by a separate Disposal Plan already submitted to the Norwegian Regulators.

A summary of the pipelines and umbilical is provided and detailed in the Tables in Section 1.4.2 below.

1.2 Requirement for Decommissioning Programme

Installations
There are no surface installations covered by this DP, the Brynhild development consists of a subsea tie-back to the Haewene Brim FPSO located in the Pierce field. The FPSO will continue to operate after decommissioning of the Brynhild Field and the DP for the FPSO will be the responsibility of the FPSO licence holders at the appropriate time (See also Section 8 - Partner Letters of Support).

Pipelines
In accordance with the Petroleum Act 1998, the S29 notice holders of the Brynhild Field pipelines (see Table 1.5) are applying to OPRED to obtain approval for decommissioning the pipelines, umbilical and associated subsea structures detailed in Section 2.3 of this programme.

In conjunction with public, stakeholder and regulatory consultations, the DP is submitted in compliance with national and international regulations and OPRED guidelines. The schedule outlined in this document is for a decommissioning project of some two years covering selection and definition of options and execution, due to begin in Quarter 2 2020.

1.3 Introduction

Brynhild is an oil field located in the southern part of the Norwegian sector in the North Sea, in block 7/7, bridging the border between blocks 7/7 and 7/4. It is located 10 kilometres from the UK sector boundary and approximately 246 kilometres from the Aberdeen coast.

Whilst Brynhild is in the Norwegian Sector, the production pipeline, water injection (WI) pipeline and control umbilical cross over into the UKCS at block 23/22b and connect to Haewene Brim FPSO in block 23/27a which is 12km from the median line crossing (only 12km of each line and the umbilical is within the UKCS). Water depths along the pipeline route varies from 80 m at the Brynhild drill centre to 86.5 m at the FPSO location.

See Figure 1-1 for field location and pipeline route.
Brynhild was developed as a subsea tie-back to the Haewene Brim FPSO. The FPSO is operated by Bluewater (Haewene Brim) N.V. and will continue in operation after the Brynhild tie-back has been decommissioned. The FPSO therefore, does not form part of this DP.

Brynhild consists of four wells (two production wells and two water injection wells), drilled from a single location. The production well stream was transported in a single 6” OD Pipe in Pipe (PIP) pipeline, with 10” OD carrier pipe, to Pierce 38 km from the drill centre. A 6” OD water injection pipeline from Pierce was brought onstream in December 2014 to maintain the pressure in the field. Control and chemical injection at the field was provided remotely from the Haewene Brim FPSO via a 127mm OD umbilical.

Production commenced in December 2014; with peak production of 0.254927 MSm³ oil in 2015 and total recovery of 0.491876 MSm³ oil during field life. Cessation of Production (CoP) occurred on 21 January 2018. The last barrier test of all four wells was conducted 16 June 2018 as the status of the wells was redefined to “Temporarily abandoned without monitoring”.

A Service Agreement with the Pierce Operator is in place that provides for monitoring of the wells, the pipeline and the template but the well status is independent of continuous monitoring capability.

Due to capacity challenges on the FPSO, i.e. being unable to process the increased produced water rates being experienced, and when the operator of the FPSO could not present plans for realizing the revised operational conditions for the continued operation of Brynhild, the Brynhild partnership concluded that it was not commercially viable, and that ongoing operation would entail an unacceptable high risk to continuing the production agreement.

As there is no alternative infrastructure in the area that is appropriate to receive and process the remaining Brynhild reserves, the decision to terminate the production agreement was taken; the agreement with the FPSO/Pierce operator and field licence holder was subsequently terminated on 8th May 2018.

Studies have been carried out for possible reuse of Brynhild pipelines and umbilical. These studies have highlighted no reuse options in their current location. Re-use of recovered equipment has also been studied, however, there is uncertainty regarding material integrity, for example technical status after recovery and quality of welding. In addition, there is major uncertainty regarding the costs of excavation work on the seabed and recovery of pipelines onto vessel (i.e. Reel-lay vessel).

A feasibility study on the reuse of Brynhild facilities on the Norwegian shelf is positive for the reuse of the subsea template, manifold and valve trees (i.e. re-use after recovery). However, no re-use options for infrastructure in the UKCS has been identified.

As a result, the Brynhild field is currently scheduled for decommissioning between 2019 – 2021. Plugging and abandonment of wells will commence in Q2 2020 and is scheduled for completion by Q3 2020.

The DP explains the proposed decommissioning activities and these proposals are supported by a Comparative Assessment (CA) [Ref: 1] for the pipelines and umbilical and an Environmental Appraisal (EA) [Ref: 2]. The stabilisation features are predominantly rock cover and will be decommissioned in situ; the few mattresses that are exposed in the field will be removed and returned onshore for treatment in line with the waster hierarchy, recycle and disposal.
1.4 Overview of Pipeline Systems Being Decommissioned

1.4.1 Installations

There are no surface installations associated with Brynhild. Tables below illustrate subsea structures which are part of the pipeline systems in the UK sector (Table 1.1). Subsea structures in the Norwegian sector (Table 1.2) are provided here for reference only as only subsea structures in the UK sector are covered by this DP.

There are no wells in the UK Sector.

Table 1.1: Pipeline Systems Being Decommissioned (UK Sector)

<table>
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<th>Brynhild</th>
<th>Production Type</th>
<th>Oil</th>
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<tr>
<td>Water Depth (m)</td>
<td>86.5 m</td>
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**Surface Installations**

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<th>Number</th>
<th>Type</th>
<th>Topsides Weight (Te)</th>
<th>Jacket Weight (Te)</th>
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**Pipeline Systems and associated materials**

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<th>Platform</th>
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<td>Pipeline End Termination (PLET)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>PLET Support Frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PLET Protection Covers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Flexible Jumper Support Structures (FJSS)²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Riser Base Manifold (RBM) Protection Covers²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pipeline Systems and associated materials**

<table>
<thead>
<tr>
<th>Distance to median</th>
<th>Distance from nearest UK coastline</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 km up to 2.4 km</td>
<td>246km</td>
</tr>
</tbody>
</table>

**Drill Cuttings pile**

<table>
<thead>
<tr>
<th>Number of Piles</th>
<th>Total Estimated volume (m³)</th>
<th>km</th>
<th>km</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>N/A³</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:

1. *Haewene Brim FPSO and the Pierce Field remain operational after Brynhild decommissioning is completed, The FPSO and Pierce subsea infrastructure will therefore be the subject of a separate DP at the appropriate time.*

2. *The RBM remains operational after decommissioning of Brynhild as part of the Pierce Field infrastructure, the RBM will therefore be the subject of a separate DP at the appropriate time. The protection covers associated with Brynhild tie-ins adjacent to the RBM and infrastructure below the GRP covers are currently within the scope of this DP. i.e. the FJSS associated with the Brynhild pipelines will be removed as part of this DP. The GRP covers will be reinstated, to protect a remaining Pierce field tie-in and will be decommissioned at a later date as part of the Pierce Field DP.*
There are no wells in the UKCS as the drill centre is in Norwegian Sector.

### Table 1.2: Infrastructure being decommissioned (Norwegian Sector)

<table>
<thead>
<tr>
<th>Field:</th>
<th>Brynhild</th>
<th>Production Type</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Depth (m)</td>
<td>80 m</td>
<td>NCS block</td>
<td>7/7 and 7/4</td>
</tr>
</tbody>
</table>

#### Surface Installations

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Topsides Weight (Te)</th>
<th>Jacket Weight (Te) (Note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Pipeline Systems and associated materials

<table>
<thead>
<tr>
<th>Number</th>
<th>Type</th>
<th>Platform</th>
<th>Subsea</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Integrated Template Structure (ITS)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Subsea Production System (SPS) Template Protection Covers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Manifold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pipeline End Termination (PLET)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PLET Support Frames</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PLET Protection Covers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Flexible Jumper Support Structures (FJSS)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Infrastructure in the Norwegian sector is provided for reference only and are not covered by this DP. Wells are in the Norwegian sector and are provided for reference only and not covered by this DP.

### Table 1.3: Installations Section 29 Notice Holders Details

<table>
<thead>
<tr>
<th>Section 29 Notice Holders</th>
<th>Registration Number</th>
<th>Equity Interest (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are no installations associated with this DP.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.4.2 Pipelines and Umbilicals

Table 1.4: Pipelines and Umbilicals Being Decommissioned

<table>
<thead>
<tr>
<th></th>
<th>Number of Pipelines</th>
<th>Number of Umbilicals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>(See Table 2.3)</td>
<td></td>
<td>(See Table 2.3)</td>
</tr>
</tbody>
</table>

Table 1.5: Pipelines and Umbilicals Section 29 Notice Holders Details

<table>
<thead>
<tr>
<th>Section 29 Notice Holders</th>
<th>Registration Number</th>
<th>Equity Interest (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL3083 (production), PL3084 (Water Injection)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lundin Energy Norway AS</td>
<td>986 209 409</td>
<td>51%</td>
</tr>
<tr>
<td>CapeOmega AS</td>
<td>995 152 142</td>
<td>49%</td>
</tr>
<tr>
<td>Repsol Norge AS</td>
<td>993 787 787</td>
<td>0%</td>
</tr>
<tr>
<td>PLU3085 (umbilical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lundin Energy Norway AS</td>
<td>986 209 409</td>
<td>51%</td>
</tr>
<tr>
<td>CapeOmega AS</td>
<td>995 152 142</td>
<td>49%</td>
</tr>
<tr>
<td>Repsol Norge AS</td>
<td>993 787 787</td>
<td>0%</td>
</tr>
</tbody>
</table>
1.5 Summary of Proposed Decommissioning Programme

<table>
<thead>
<tr>
<th>Table 1.6: Summary of Decommissioning Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selected Option</strong></td>
</tr>
<tr>
<td>1. Topsides</td>
</tr>
<tr>
<td>2. Jacket(s) / Floating Facility (FPSO etc)</td>
</tr>
<tr>
<td>3. Subsea Installations</td>
</tr>
<tr>
<td>4. Pipelines, Flowlines &amp; Umbilical’s and Associated Materials</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5. Wells</td>
</tr>
<tr>
<td>6. Drill Cuttings</td>
</tr>
<tr>
<td>7. Interdependencies</td>
</tr>
</tbody>
</table>

\(^1\) The RBM is part of the Pierce field infrastructure and is not within the Brynhild DP responsibility.

1. Any permit applications required for any work associated with the proposed decommissioning solutions will be submitted as appropriate.
1.6 Field Location Including Field Layout and Adjacent Facilities

Figure 1-1: Field Location

Legend
- UKCS sub-blocks transected by proposed operations
- Norwegian Blocks 7/7 and 7/4
- Brynhild
- Brynhild to Pierce (PLU3083)
- FPSO
- Platform
- License Blocks Infrastructure (Norway)
- Surface
- Subsurface
- Wells
- Existing pipelines
- Median line
- Condensate Field
- Gas Field
- Oil Field
- Depth
  - 50 - 100
  - 100 - 250

Brynhild located in Norwegian Block 7/7
Figure 1-2: Field Layout
Table 1.7: Adjacent Facilities

<table>
<thead>
<tr>
<th>Owner</th>
<th>Name/Block</th>
<th>Type</th>
<th>Distance/Direction</th>
<th>Information</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Oil Limited</td>
<td>Pierce 23/27</td>
<td>FPSO</td>
<td>0 – used as ref point</td>
<td></td>
<td>Operational</td>
</tr>
<tr>
<td>BP Exploration Operating Company Limited</td>
<td>Machar 23/26a</td>
<td>Subsea wells</td>
<td>15.5km SW</td>
<td>Subsea development with 35km tie-back to ETAP</td>
<td>Operational</td>
</tr>
<tr>
<td>Chrysaor Limited</td>
<td>Lomond 23/21a</td>
<td>Platform</td>
<td>15.5km NNW</td>
<td>Fixed steel jacket, manned platform processing Lomond and Erskine Fields</td>
<td>Operational</td>
</tr>
<tr>
<td>Ithaca Oil and Gas Limited</td>
<td>PL1257</td>
<td>Pipelines</td>
<td>Running South to North and parallel to the Brynhild lines. 7.5km west of the Brynhild line</td>
<td>24” condensate pipeline Erskine to Lomond</td>
<td>Operational</td>
</tr>
<tr>
<td>Ithaca Oil and Gas Limited</td>
<td>Erskine 23/26A</td>
<td>Platform</td>
<td>19km SW</td>
<td>Fixed steel jacket, normally un-manned platform.</td>
<td>Operational</td>
</tr>
</tbody>
</table>

Impacts of Decommissioning Proposals

No Impact is anticipated on Machar, Lomond and Erskine infrastructure and PL1257, either during execution of the decommissioning project or upon completion of the decommissioning.

There are interfaces to be managed with the Operator of the Pierce field as most of the decommissioning work is to be carried out within the Pierce 500m exclusion zone. The interfaces are being managed between Lundin and the Pierce Operators by regular interface meetings. Responsibility for decommissioning of shared facilities (e.g. GRP covers) has been decided. See Table 1.6, section 7 for more detail.

There are pipeline/cable crossings associated with a CNS fibre optic cable and a Newbigging–Marsbrand cable inside the UKCS, both cables cross underneath both Brynhild pipelines and umbilical see Figure 1.2. The cables are trenched and buried and at the point where the crossings occur are rock covered and are intended to be decommissioned in-situ. There is therefore no impact to the existing cables at these crossings.

There is an existing 6” production line and control umbilical associated with the Pierce Field that are trenched and buried and cross below PL3084 (WI Pipeline) see Figure 1.2. The point where the crossings occur are rock covered and PL3084 is intended to be decommissioned in-situ. There is therefore no impact to the Pierce pipeline and umbilical at these crossings.
Figure 1-3: Field Nearby Developments

Brynhild located in Norwegian Block 7/7
The closest operative field is the Lomond Gas field, located approximately 5 km to the West of the Brynhild pipelines/umbilical. On the UKCS the Brynhild pipelines/umbilical crosses blocks 23/22a and 23/27a, both operated by Shell (the Pierce operator). In block 23/22a there is one abandoned well close to the pipeline routes, the well location has been observed on the surveys and is 3 kilometres northwest of the Brynhild field.

1.7 Industrial Implications

It is Lundin’s intention to develop a contract strategy that will result in an efficient and cost-effective execution of the decommissioning works. Lundin will also try to combine Brynhild decommissioning activities with other developments or decommissioning activities to reduce mobilisation and demobilisation costs should the opportunity arise. Geographic locations of potential disposal yard options may require the consideration of Trans Frontier Shipment of Waste (TFSW), including hazardous materials. Where this is the case, the relevant permits/licences will be sought. The decommissioning schedule is extended to allow flexibility for when decommissioning operations are carried out and completed. Lundin will demonstrate this intention by:

- Publishing information on the decommissioning project and timelines on its decommissioning website;
- Working closely with the OGA and other industry bodies in engagement sessions with the decommissioning supply chain on issues relating to the DP and timelines, including engaging directly with disposal yards that serve the North Sea;
- Competitively tendering all removal scopes, including the onshore disposal scope;
- Aligning supply chain and decommissioning activity, wherever possible, with Operators of adjacent infrastructure to optimise efficiencies and cost reduction.

2 DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

2.1 Installations: Surface Facilities (Topsides/Jackets)

<table>
<thead>
<tr>
<th>Name</th>
<th>Facility Type</th>
<th>Location</th>
<th>Topsides/Facilities</th>
<th>Weight (Te)</th>
<th>No of modules</th>
<th>Jacket (if applicable)</th>
<th>Weight (Te)</th>
<th>Number of legs</th>
<th>Number of piles</th>
<th>Weight of piles (Te)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 Installations: Subsea including Stabilisation Features

<table>
<thead>
<tr>
<th>Subsea installations including Stabilisation Features</th>
<th>Number</th>
<th>Dimensions (m)/ Total Weight (Te)</th>
<th>Location</th>
<th>Comments/Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.3 Pipelines Including Stabilisation and other Features

The Tables below have been split into Pipelines/ Umbilicals and stabilisation features. Only Tables 2.3 and 2.5 are covered by this DP. Tables 2.4 and 2.6 covers infrastructure in the Norwegian Sector and is provided for reference only.

<table>
<thead>
<tr>
<th>Description</th>
<th>Pipeline Number (as per PWA)</th>
<th>Diameter (inches)</th>
<th>Length (km)</th>
<th>Description of Component Parts</th>
<th>Product Conveyed</th>
<th>From – To End Points</th>
<th>Burial Status²</th>
<th>Pipeline Status</th>
<th>Current Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Pipeline</td>
<td>PL3083</td>
<td>6” OD/ 10” OD PiP</td>
<td>11.970</td>
<td>6” production pipeline (DNV 13%Cr2.5Mo FPD) in a 10” Carbon steel Carrier pipe (DNV415PD)</td>
<td>Oil</td>
<td>From UK Median Line to Pierce production Pipeline PLET</td>
<td>Trenched and buried with some areas of rock cover</td>
<td>Out of use</td>
<td>Treated Freshwater</td>
</tr>
<tr>
<td>Production Flexible Jumper</td>
<td>PL3083</td>
<td>6” ID</td>
<td>0.138</td>
<td>6” ID flexible with Cofoam MO01 insulation</td>
<td>Oil</td>
<td>From PLET structure to RBM</td>
<td>Rock covered</td>
<td>Out of use</td>
<td>Treated Freshwater</td>
</tr>
<tr>
<td>Water injection line</td>
<td>PL3084</td>
<td>6” OD</td>
<td>12.280</td>
<td>6” OD x 11mm w.t. pipeline (DNV450FPD) with 3mm 3LPP insulation</td>
<td>Water</td>
<td>WI Line tie-in flange to UK Median Line</td>
<td>Trenched and buried plus mattress covered with some areas of rock cover</td>
<td>Out of use</td>
<td>Inhibited seawater</td>
</tr>
<tr>
<td>Control Umbilical</td>
<td>PLU3085</td>
<td>127mm OD</td>
<td>12.063</td>
<td>Plastics &amp; misc. coatings/Carbon Steel/ Corrosion Resistant Alloy/ Copper</td>
<td>Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua</td>
<td>From UK Median Line to RBM</td>
<td>Trenched and buried with some areas of rock cover</td>
<td>Out of Use</td>
<td>Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua</td>
</tr>
<tr>
<td>Description</td>
<td>Norwegian Pipeline Number</td>
<td>Diameter (inches)</td>
<td>Length (km)</td>
<td>Description of Component Parts</td>
<td>Product Conveyed</td>
<td>From – To End Points</td>
<td>Burial Status(^2)</td>
<td>Pipeline Status</td>
<td>Current Content</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------</td>
<td>-------------------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------------------</td>
<td>---------------------</td>
<td>-----------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Production Pipeline</td>
<td>PL148(^1)</td>
<td>6” OD/10” OD PiP</td>
<td>25.027</td>
<td>6” production pipeline (DNV 13%Cr2.5Mo FPD) in a 10” Carbon steel Carrier pipe (DNV415PD)</td>
<td>Oil</td>
<td>From Brynhild SPS Manifold to UK median line</td>
<td>Trenched and buried</td>
<td>Out of use</td>
<td>Treated Freshwater</td>
</tr>
<tr>
<td>Water injection line</td>
<td>PL148(^1)</td>
<td>6” OD</td>
<td>24.968</td>
<td>6” OD x 11mm w.t. pipeline (DNV450FPD) with 3mm 3LPP insulation</td>
<td>Water</td>
<td>From UK median line to Brynhild SPS Manifold</td>
<td>Trenched and buried</td>
<td>Out of use</td>
<td>Inhibited seawater</td>
</tr>
<tr>
<td>Control Umbilical</td>
<td>PL148(^1)</td>
<td>127mm OD</td>
<td>25.285</td>
<td>Plastics &amp; misc. coatings/Carbon Steel/Corrosion Resistant Alloy/Copper</td>
<td>Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua</td>
<td>From UK median line to Brynhild SPS Manifold</td>
<td>Trenched and buried</td>
<td>Out of Use</td>
<td>Methanol, FX2443 (scale inhibitor), Flotron, Emulsotron, Transaqua</td>
</tr>
</tbody>
</table>

1. All Brynhild pipelines are listed under production licence number PL148 in the Norwegian sector, no individual pipeline numbers are available.
2. Burial Depth information provided in Appendix A.
### Table 2.5: Pipeline systems associated materials and stabilisation features (UK sector)

<table>
<thead>
<tr>
<th>Stabilisation Feature</th>
<th>Total Number</th>
<th>Weight (Te)</th>
<th>Geographical Location(s)</th>
<th>Exposed/Buried/Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLET including:</td>
<td>1</td>
<td>6.38</td>
<td>57° 09' 49.923&quot; N 2° 17' 28.597&quot; E</td>
<td>Exposed</td>
</tr>
<tr>
<td>PLET support frames</td>
<td>2</td>
<td>37</td>
<td>below PLET</td>
<td>below PLET</td>
</tr>
<tr>
<td>FJSS at PLET</td>
<td>2</td>
<td>2.72</td>
<td>within PLET boundary</td>
<td>Under GRP cover</td>
</tr>
<tr>
<td>GRP cover at PLET</td>
<td>3</td>
<td>30.81</td>
<td>covering tie-ins at PLET</td>
<td>Plastic – 11.64 Te</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concrete – 19.17 Te</td>
</tr>
<tr>
<td>Rock Cover on GRP Covers at PLET</td>
<td>-</td>
<td>2100</td>
<td>At PLET</td>
<td>Rock cover skirt located around GRP Cover base</td>
</tr>
<tr>
<td>FJSS at RBM</td>
<td>1</td>
<td>2.75</td>
<td>Supporting pipeline tie-in at RBM</td>
<td>beneath GRP cover at RBM</td>
</tr>
<tr>
<td>GRP covers at RBM</td>
<td>2</td>
<td>32.88</td>
<td>immediately adjacent to RBM</td>
<td>Plastic – 13.63 Te</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Concrete – 19.25 Te</td>
</tr>
<tr>
<td>Rock Cover on GRP Covers at RBM</td>
<td>-</td>
<td>2000</td>
<td>at RBM</td>
<td>Rock cover skirt located around GRP Cover base</td>
</tr>
<tr>
<td>Mattresses</td>
<td>31</td>
<td>197</td>
<td>Stabilisation under PL3083/ PL3084/ PLU3085</td>
<td>Buried below rock cover</td>
</tr>
<tr>
<td>Mattresses</td>
<td>5</td>
<td>42</td>
<td>PL3084 protection</td>
<td>Exposed above pipeline, and in good condition</td>
</tr>
<tr>
<td>Grout bags</td>
<td>432</td>
<td>11</td>
<td>Under PL3083/ PL3084/ PLU3085</td>
<td>Buried below rock cover</td>
</tr>
<tr>
<td>Rock cover</td>
<td>-</td>
<td>40,255</td>
<td>PL3083/ PL3084/ PLU3085 Protection</td>
<td>Exposed</td>
</tr>
</tbody>
</table>

1. All structures in this table are located within the Haewene Brim FPSO 500 m exclusion zone.
2. There are no structures associated with the Water Injection Pipeline or Umbilical in the UKCS.
3. The Brynhild pipeline installations have utilised mattresses and rock cover for protection within the Pierce 500m exclusion zone and to alleviate possible upheaval buckling, additionally rock cover was used on the CNS cable crossing to protect the pipeline/umbilical crossing and ensure ability to over-trawl. Additionally, GRP protection covers were installed at both the PLET and RBM. All rock cover was restricted to <1.5m height and rock used graded between 1” – 5”; non-corrosive, non-magnetic and clear and free from cohesive material.

<table>
<thead>
<tr>
<th>Stabilisation Feature</th>
<th>Total Number</th>
<th>Weight (Te)</th>
<th>Location(s)</th>
<th>Exposed/Buried/Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mattresses</td>
<td>19</td>
<td>147.5</td>
<td>Under Production / WI Pipelines and umbilical Plus WI pipeline protection</td>
<td>Various</td>
</tr>
<tr>
<td>Grout bags</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rock cover</td>
<td>12233</td>
<td>12233</td>
<td>Production / WI Pipelines and umbilical protection</td>
<td>Exposed</td>
</tr>
</tbody>
</table>

1. All Brynhild pipelines are listed under production licence number PL148 in the Norwegian sector, no individual pipeline numbers are available.
a. **Wells**

<table>
<thead>
<tr>
<th>Platform Wells</th>
<th>Designation</th>
<th>Status</th>
<th>Category of Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subsea Wells</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7/7-A-1 AH</td>
<td>Oil Production</td>
<td>Shut-In</td>
<td>N/A</td>
</tr>
<tr>
<td>7/7-A-3 AH</td>
<td>Oil Production</td>
<td>Shut-In</td>
<td>N/A</td>
</tr>
<tr>
<td>7/7-A-2 HT4(^1)</td>
<td>Water Injection</td>
<td>Shut-In</td>
<td>N/A</td>
</tr>
<tr>
<td>7/7-A-4 H</td>
<td>Water Injection</td>
<td>Shut-In</td>
<td>N/A</td>
</tr>
</tbody>
</table>

\(^1\) Originally Oil producer, converted to Water injector March 2016

All Wells are in the Norwegian sector and are identified here for reference only. They are not covered by this DP.

### 2.5 Drill Cuttings

<table>
<thead>
<tr>
<th>Location of Pile Centre (Latitude/Longitude)</th>
<th>Seabed Area (m(^2))</th>
<th>Estimated volume of cuttings (m(^3))</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.6 Inventory Estimates

The pie charts (Figure 2.1 and Figure 2.2) show the inventory estimates for different elements of the DP contained in this document.

**Figure 2-1: Materials Inventory Summary (UK Sector)**

- **Carbon Steel**: 61.0% (1570te)
- **Copper**: 12.6% (324te)
- **Aluminium Alloy**: 14.1% (362te)
- **Corrosion Resistant Alloy**: 9.3% (239te)
- **Plastics and Misc. Pipe Coatings**: 1.5% (39te)
- **Concrete**: 0.4% (10te)
- **Mattresses**: (3te) 0.1%
- **Grout Bags**: (3te) 0.1%

Total Weight of Inventory = 2,571Te, excludes rock cover
NORM and other hazardous materials is not expected to be present.
Figure 2-2: Materials Inventory Summary (Norwegian Sector)

Total Weight of Inventory = 5,219.3Te, excludes rock cover
NORM and other hazardous materials is not expected to be present.
3 REMOVAL AND DISPOSAL METHODS

In line with the waste hierarchy, Lundin have considered other reuse options for the facilities, and this was a key consideration leading to a final decision on the nature and timing of field decommissioning.

Further field life extension options were also investigated; all were found to be sub-economic and consequently the facilities are to be decommissioned. Lundin will ensure the principles of the waste hierarchy in accordance with the Waste Framework Directive and will ensure segregation by type and transport to shore in an auditable manner through licensed waste contractors. It is anticipated that the chosen waste management provider’s/disposal yards shall follow the waste management hierarchy in the handling of materials from Brynhild Decommissioning to maximize the amount of material from the projects which is reused or recovered/recycled.

Lundin and the selected removal contractor(s) will monitor and review the disposal route of all materials and waste to the point of final reuse, recycling or disposal. It is anticipated that there will be relatively small quantities of equipment and materials returned onshore (<170 Tonnes).

Preparation/Cleaning:

<table>
<thead>
<tr>
<th>Table 3.1: Cleaning of Topsides for Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Type</td>
</tr>
<tr>
<td>-------------</td>
</tr>
<tr>
<td>N/A as no surface installations are associated with this DP</td>
</tr>
</tbody>
</table>

Removal Methods:

<table>
<thead>
<tr>
<th>Table 3.2: Topsides Removal Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>N/A as no surface installations are associated with this DP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3.3: Jacket Decommissioning Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>N/A as no Jackets are associated with this DP</td>
</tr>
</tbody>
</table>
### 3.3 Subsea Installations, Stabilisation and Other Features

<table>
<thead>
<tr>
<th>Subsea installations and stabilisation features</th>
<th>Number</th>
<th>Option</th>
<th>Disposal Route (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A no subsea installations associated with this DP</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.4 Pipelines

**Decommissioning Options:**

*Key to Options:

1) Total removal – by reverse reeling

2a) Remediation in-situ – exposed sections rock covered

2b) Remediation in-situ – exposed sections trenched and buried

2c) Remediation in-situ – exposed sections cut and removed

3) Leave in-situ

<table>
<thead>
<tr>
<th>Pipeline or Group (as per PWA)</th>
<th>Condition of line/group</th>
<th>Whole or part of pipeline/group</th>
<th>Decommissioning Options considered</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL3083</td>
<td>Offshore:</td>
<td>All</td>
<td>1, 2a, 2b, 2c, 3</td>
</tr>
<tr>
<td>PL3084</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLU3085</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Rigid pipeline/ Umbilical</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stainless Steel, Carbon Steel, Plastics, Copper, Corrosion Resistant Alloy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Trenched and buried and spot rock cover berms at crossings and transitions, no spanning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comparative Assessment Method:**

A comparative assessment was carried out for both pipelines and the umbilical in line with the recommendations in OPRED Guidance Notes. The comparative assessment considered Technical, Environmental, Safety, Societal and Economic Impacts. The assessments closely followed the Guidelines on Comparative Assessments in DPs published by Oil and Gas UK.

A workshop was held by Lundin (representatives from the environmental and subsea decommissioning teams were present) using established terms of reference, detailed data on field facilities and recorded results approved by participants.
Outcome of Comparative Assessment:

<table>
<thead>
<tr>
<th>Pipeline or Group</th>
<th>Recommended Option</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL3083</td>
<td>Option 2c: Decommission by leaving trenched and buried and already rock covered</td>
<td>Total removal options were discounted for the already trenched and buried and rock covered sections of pipeline as excessive seabed disturbance in uncovering the pipeline would occur, also more risk exposure time to project personnel both offshore and onshore in having to handle large pipelines lengths was a concern.</td>
</tr>
<tr>
<td></td>
<td>sections in-situ. Decommission exposed sections at tie-in-ends by cut and lift and return onshore for recycle. ¹</td>
<td>Technically full removal of the lines would be difficult.</td>
</tr>
<tr>
<td>PL3084</td>
<td></td>
<td>There will be minimum legacy risk to other users of the seas in leaving the pipelines in-situ as the trenched and buried and already rock covered sections of the pipeline will remain so. The rock cover berms have been designed and specified to be over trawled.</td>
</tr>
<tr>
<td>PLU3085</td>
<td></td>
<td>Exposed ends will be remediated by cut and lift¹ as the residual safety risk to other users of the seas if left exposed on the seabed and potential deterioration was deemed unacceptable.</td>
</tr>
</tbody>
</table>

¹Option 2c Remediation pipeline/ umbilical in-situ – with exposed sections cut and removed is the proposed decommissioning option for both pipelines and the umbilical. However, the conclusion of the CA was that there is no significant differentiator on each of the three remediate in-situ sub-options for the exposed sections of pipeline or umbilical. i.e.:

- 2a) Remediation pipeline/ umbilical in-situ – with exposed sections rock covered;
- 2b) Remediation pipeline/ umbilical in-situ – with exposed sections trenched and buried;
- 2c) Remediation pipeline/ umbilical in-situ – with exposed sections cut and removed.

As such Lundin intend to carry out a Contracting and Procurement (C&P) engagement exercise and tendering process on all three sub-options and note that any change in preference from the proposed decommissioning option (2c), will require discussion with OPRED and prior agreement to any change.
3.5 Pipeline Stabilisation and Other Features

<table>
<thead>
<tr>
<th>Stabilisation features</th>
<th>Number</th>
<th>Option</th>
<th>Disposal Route (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLET</td>
<td>1</td>
<td>Full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td>PLET support frames</td>
<td>2</td>
<td>Full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td>Flowline Jumper Support Structures (FJSS)</td>
<td>2</td>
<td>Full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td>GRP Protective Covers (3 x PLET and 2 x RBM)</td>
<td>5</td>
<td>Base case full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td>Prefabricated Concrete Mattresses, providing stabilisation under PL3083/PL3084/PLU3085</td>
<td>31</td>
<td>Remain In-situ (below existing rock cover)</td>
<td>N/A</td>
</tr>
<tr>
<td>Prefabricated Concrete Mattresses, protecting the exposed section of PL3084</td>
<td>5</td>
<td>Full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td>Flexible concrete mattresses</td>
<td>5</td>
<td>Full removal</td>
<td>Return to shore for reuse/recycling/disposal</td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>To remain in situ as already rock covered</td>
<td>N/A</td>
</tr>
<tr>
<td>Grout bags</td>
<td>432</td>
<td>To remain in situ as already rock covered</td>
<td>N/A</td>
</tr>
<tr>
<td>Rock Cover (Berms)</td>
<td>44,355Te</td>
<td>Remain In-Situ</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Mattresses and grout bags providing stabilisation beneath crossings are already rock covered and as such will be decommissioned in-situ.

The exposed mattresses above PL3084 (5 off) were installed in 2011 and are expected to be in good condition and will therefore be recovered and returned onshore for re-use/recycle or disposal.

OPRED expectation is full removal of any surface laid / exposed mattresses. In the event of practical difficulties removing the mattresses to shore Lundin will be required to discuss and agree an appropriate course of action with OPRED.
3.6 Wells

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Removal and Disposal method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk liquids</td>
<td>The production pipeline (including the flexible jumper) is currently filled with treated freshwater containing oxygen scavenger and is expected to contain limited volumes of hydrocarbons.</td>
</tr>
<tr>
<td></td>
<td>The water injection pipeline is currently filled with inhibited seawater. No further flushing or cleaning is proposed for the both pipelines.</td>
</tr>
<tr>
<td></td>
<td>The umbilical cores will be round trip flushed from a vessel located at the well location (i.e. in Norwegian waters). Contents of the cores will be collected in the vessel and shipped to shore. The cores will be left filled with freshwater</td>
</tr>
<tr>
<td>Marine growth</td>
<td>Marine growth is not anticipated to be present on the materials to be recovered. However, if found to be present it will be cleaned from the materials immediately recovered on site and before the materials are transported onshore.</td>
</tr>
<tr>
<td>NORM/LSA Scale</td>
<td>NORM is not anticipated to be present. However, tests for NORM will be undertaken and work will be carried out in full compliance with all relevant regulations and under the appropriate permit, where required.</td>
</tr>
<tr>
<td>Asbestos</td>
<td>N/A</td>
</tr>
<tr>
<td>Other hazardous wastes</td>
<td>N/A</td>
</tr>
<tr>
<td>Onshore Dismantling sites</td>
<td>Appropriate licensed sites will be selected. Only dismantling sites that can demonstrate waste stream management throughout the deconstruction process will be considered.</td>
</tr>
</tbody>
</table>

3.7 Drill Cuttings

N/A

3.8 Waste Streams

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Removal and Disposal method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk liquids</td>
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<td></td>
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<tr>
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</tr>
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<tr>
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</tr>
<tr>
<td>Other hazardous wastes</td>
<td>N/A</td>
</tr>
<tr>
<td>Onshore Dismantling sites</td>
<td>Appropriate licensed sites will be selected. Only dismantling sites that can demonstrate waste stream management throughout the deconstruction process will be considered.</td>
</tr>
</tbody>
</table>

As part of the Contracting Strategy, Lundin will ensure the selection of waste competent Contractor(s), experienced in the handling of all wastes associated with the Decommissioning of Oil and Gas pipelines. The waste management provider’s/disposal yards shall follow the waste management hierarchy in the handling of materials from Brynhild Decommissioning to maximize the amount of material from the projects which is reused or recovered/recycled. Lundin and the selected removal contractor(s) will, monitor and review the disposal route of all materials and waste to the point of final reuse, recycling or disposal and reserves the right to audit to fulfil any Duty of Care responsibilities. It is anticipated that up to 67% of the returned material will be reused or recovered/recycled.

<table>
<thead>
<tr>
<th>Waste Stream</th>
<th>Removal and Disposal method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk liquids</td>
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</tr>
<tr>
<td>Asbestos</td>
<td>N/A</td>
</tr>
<tr>
<td>Other hazardous wastes</td>
<td>N/A</td>
</tr>
<tr>
<td>Onshore Dismantling sites</td>
<td>Appropriate licensed sites will be selected. Only dismantling sites that can demonstrate waste stream management throughout the deconstruction process will be considered.</td>
</tr>
</tbody>
</table>

As part of the Contracting Strategy, Lundin will ensure the selection of waste competent Contractor(s), experienced in the handling of all wastes associated with the Decommissioning of Oil and Gas pipelines. The waste management provider’s/disposal yards shall follow the waste management hierarchy in the handling of materials from Brynhild Decommissioning to maximize the amount of material from the projects which is reused or recovered/recycled. Lundin and the selected removal contractor(s) will, monitor and review the disposal route of all materials and waste to the point of final reuse, recycling or disposal and reserves the right to audit to fulfil any Duty of Care responsibilities. It is anticipated that up to 67% of the returned material will be reused or recovered/recycled.

Table 3.10: Inventory Disposition (UK Sector)

<table>
<thead>
<tr>
<th></th>
<th>Total Inventory Te</th>
<th>Planned tonnage to shore</th>
<th>Planned left in situ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installations</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
4 ENVIRONMENTAL APPRAISAL OVERVIEW

The Environmental Appraisal Report has been issued separately for OPRED review and feedback, when received, will be incorporated for next issue and before the publication of the 3rd pre-draft DP.

4.1 Environmental Sensitivities (Summary)

Table 4.1: Environmental Sensitivities

<table>
<thead>
<tr>
<th>Environmental Receptor</th>
<th>Main Features</th>
</tr>
</thead>
</table>
| Conservation interests | The closest designated area in UK waters is the East of Gannet and Montrose Fields Nature Conservation Marine Protected Area, located c. 48 km west of the Haewene Brim FPSO. This site has been designated for the presence of Arctica islandica (ocean quahog) aggregations (including sands and gravels as their supporting habitat), and offshore deep-sea muds. At this distance none of the proposed activities are expected to impact on this area or any other designated areas in the UKCS.

The Brynhild infrastructure located within Norwegian waters occurs within an area considered valuable for its mackerel spawning grounds and is therefore considered a Particularly Valuable Areas (PVA). None of the proposed decommissioning activities (either in UK or Norwegian waters) are expected to have a significant impact on spawning mackerel in the area. |
| Seabed | Two broad habitat types occurred along the pipeline route: Circalittoral Muddy Sand (EUNIS Code A5.26) and Circalittoral Mixed Sediment (EUNIS Code A5.44), whilst at the Pierce Field a single habitat ‘Deep Circalittoral Sand’ (EUNIS Code A5.27) has been found to be present. No Annex I habitats have been identified near the Brynhild infrastructure. Further details are provided in the EA. |
| Fish | Several fish species are known to use the area as a spawning and/or nursery ground. Species known to use the area for spawning include lemon sole, sandeel, cod, Norway pout, plaice mackerel. Apart from lemon sole, each of these species also have recognised nursery grounds in the area. In addition, haddock, ling, whiting, herring, anglerfish, blue whiting, hake, spurdog, and spotted ray are among the species known to have nursery grounds in the area.

Of the fish species identified in the area, anglerfish, herring, mackerel, ling, blue whiting, cod, sandeels and whiting have been assessed by SNH and JNCC as Priority Marine Features (PMFs) in Scotland. |
| Fisheries | The Brynhild infrastructure within the UKCS occurs within ICES (International Council for Exploration of the Sea) rectangle 43F2. A review of the information collated by the Scottish Government suggests that fishing effort in the area is relatively low in comparison to the surrounding area. Landings reported by... |
**Table 4.1: Environmental Sensitivities**

<table>
<thead>
<tr>
<th>Category</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scottish Government</td>
<td>Scottish Government indicate that demersal species make up the majority of the landings that are reported. Further details are provided in the EA.</td>
</tr>
<tr>
<td>Marine Mammals</td>
<td>Distribution maps based on telemetry data (1991 - 2012) and count data (1988 – 2012) indicate that neither grey seals or harbour seals occur near the Brynhild infrastructure. Dependent on the time of year, harbour porpoise, white-beaked dolphin, minke whale, and <em>Lagenorhynchus</em> sp. (which refers to white-beaked and Atlantic white-sided dolphin combined where it was not possible to distinguish between the two species) have been sighted in the area. Further information from the Small Cetacean Abundance in the North Sea (SCANS-III) reports is provided in the EA.</td>
</tr>
<tr>
<td>Birds</td>
<td>Bird species known to occur in the area include the northern gannet, northern fulmar, black-legged kittiwake, little auk, herring gull, black-headed gull, common guillemot and the Atlantic puffin. Based on several factors which are considered to contribute to the sensitivity of seabirds to oil pollution (e.g. annual productivity, adult survival rate, habitat flexibility etc), sensitivity of birds to hydrocarbon pollution near the Brynhild infrastructure is considered low. Further details are provided in the EA.</td>
</tr>
<tr>
<td>Onshore Communities</td>
<td>Waste generated during decommissioning will be transported to shore in an auditable manner through licensed waste contractors. The waste management hierarchy of ‘reduce, re-use, recycle’ will be followed. Lundin intends to engage approved waste management contractors to handle, store and dispose of all waste generated by the decommissioning activities.</td>
</tr>
<tr>
<td>Other Users of the Sea</td>
<td>Based on available data shipping activity around the Brynhild infrastructure is considered low. In addition, there are no telecommunications cables, aggregate extraction areas, military exercise areas or renewable energy developments within the vicinity of the proposed decommissioning activities.</td>
</tr>
<tr>
<td>Atmosphere</td>
<td>Emissions to atmosphere offshore will arise from the vessels used to decommission the Brynhild infrastructure. Onshore emissions will result from the yard activities including recycling of the steel etc. associated with the structures returned to shore. Further details are provided in the EA.</td>
</tr>
</tbody>
</table>
4.2 Potential Environmental Impacts and their Management

Environmental Impact Appraisal Summary:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Main Impacts</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topsides Removal</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Jacket Removal</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Decommissioning Pipelines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Decommissioning of the pipelines in situ will require cutting and removal of exposed pipeline ends.

The principal environmental and societal impacts include:
- Physical presence of vessels;
- Energy use and atmospheric emissions;
- Underwater noise from vessels;
- Discharges to sea from vessels;
- Disturbance to the seabed from cutting, trenching and burying activities;
- Production of waste materials.

Potential impacts resulting from accidental events include discharges to sea as a result of hydrocarbon releases (e.g. a loss of diesel inventory due to vessel collision).

Following the mitigations summarised in this table (detailed in the EA Report) the environmental and societal significance of the planned activities are considered low.

During decommissioning of the pipelines, a number of mitigation measures will be adhered to, in order to minimise the environmental and socio-economic impacts. These are detailed in the EA Report and are summarised here:
- Notice to mariners will be circulated.
- Lundin will carry out a detailed assurance process on all vessels prior to contract award and all contractors will originate from countries signed up to the International Maritime Organisation and will adhere to their guidelines.
- Vessel use will be optimised.
- Work procedures will be in place to minimise duration of activities and minimise likelihood of dropped objects.
- A waste management plan will be developed which will describe and quantify waste.
- Waste management options will take account of the waste management hierarchy.
- SIMOPS (simultaneous operations) will be managed through bridging documents and communications.
- Emergency response plans in place including SOPEP’s (Shipboard Oil Pollution Emergency Plan).
### Decommissioning Stabilisation Features

| **Decommissioning Stabilisation Features** | The base case is to leave the rock cover and those mattresses associated with crossing and already rock covered in situ. All other stabilisation features (e.g. GRP covers, and the five exposed mattresses will be recovered. The principal environmental and societal impacts include:  
- Physical presence of vessels;  
- Energy use and atmospheric emissions;  
- Underwater noise from vessels;  
- Discharges to sea from vessels;  
- Disturbance to the seabed from recovery activities;  
- Production of waste materials.  
Potential impacts resulting from accidental events include:  
- Discharges to sea as a result of hydrocarbon releases (e.g. a loss of diesel inventory due to vessel collision).  
Following the mitigations summarised in this table (detailed in the EA Report) the environmental and societal significance of the planned activities are considered to be low. | During decommissioning of the stabilisation features a number of mitigation measures will be adhered to, in order to minimise the environmental and socio-economic impacts. These are detailed in the EA Report and are summarised here:  
- Notice to mariners will be circulated.  
- Lundin will carry out a detailed assurance process on all vessels prior to contract award and all contractors will originate from countries signed up to the International Maritime Organisation and will adhere to their guidelines.  
- Vessel use will be optimised  
- Work procedures will be in place to minimise duration of activities and minimise likelihood of dropped objects.  
- A waste management plan will be developed which will describe and quantify waste  
- Waste management options will take account of the waste management hierarchy.  
- SIMOPS (simultaneous operations) will be managed through bridging documents and communications.  
- Emergency response plans in place including SOPEPs (shipboard oil pollution emergency plan).  
- Vessels carrying out these activities will use dynamic positioning thus minimising impact on the seabed. |
- Verification of seabed clearance will be provided.
- If any stabilisation features cannot be recovered Lundin will consult with OPRED to discuss alternative approaches.
- A survey strategy will be agreed with OPRED for monitoring any stabilisation features that will be decommissioned *in situ*.

| Decommissioning Drill Cuttings | N/A | N/A |
5 INTERESTED PARTY CONSULTATIONS

Consultations Summary:

On 12th March 2019, as part of the informal stakeholder engagement process Lundin issued the Environmental Scoping Report to the statutory stakeholders identified in Table 5.1 below and as advised by OPRED.

The Scoping Report provided an overview of the Brynhild Field, the proposed decommissioning activities and an overview of the impacts to be assessed in the EA. Statutory Stakeholders were invited to comment on the Scoping Report with respect to any concerns they may have. Those that responded provided no opposing comments on the strategies proposed.

Table 5-1 captures feedback following formal consultation.

<table>
<thead>
<tr>
<th>Who</th>
<th>Comment</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Statutory Consultations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scottish Fishermen's Federation (SFF)</td>
<td>Advisory comments were received. SFF confirmed that they are aligned with the proposed decommissioning plan for the project. They request that should any rock cover be deployed, that the size and profile of the rock aligns with industry standards. SFF also advised that any rock cover berms are incorporated into the post decommissioning debris clearance trawls sweeps to verify that they do not pose a risk to fishing.</td>
<td>Noted. Any rock cover laid will align with industry standard and any debris clearance survey will include any rock berms associated with the project.</td>
</tr>
<tr>
<td>The National Federation of Fishermen's Organisations (NFFO)</td>
<td>No response received following formal consultation</td>
<td></td>
</tr>
<tr>
<td>Northern Ireland Fish Producers Organisation Ltd (NIFPO)</td>
<td>No response received following formal consultation</td>
<td></td>
</tr>
<tr>
<td>Global Marine Systems Limited (GMS)</td>
<td>No response received following formal consultation</td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>No comments were received</td>
<td></td>
</tr>
<tr>
<td><strong>Informal Consultations prior to Public Consultation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OGA</td>
<td>EA Scoping Report issued, no response received.</td>
<td></td>
</tr>
<tr>
<td>Stakeholder</td>
<td>Comments</td>
<td>Relevance</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)</td>
<td>EA Scoping Report issued, no response received.</td>
<td></td>
</tr>
<tr>
<td>Marine Scotland</td>
<td>Scoping Report issued, response received 05/04/19, no opposing comments on the proposed strategy, advice provided on availability on new features in NMPI available only.</td>
<td>Latest NMPI data has been used to support the EA where relevant.</td>
</tr>
<tr>
<td>Joint Nature Conservation Committee (JNCC)</td>
<td>Scoping Report issued, response received 10/04/19. Providing advice on survey data to be used and recommended minimising the introduction of new hard substrate materials to the seabed.</td>
<td>The recommended option for exposed sections of pipelines (See Table 3.6) aligns with this recommendation.</td>
</tr>
<tr>
<td>Scottish Environmental Protection Agency (SEPA)</td>
<td>Scoping Report issued, response received 10/04/19, no opposing comments on the proposed strategy, advice provided on Duty of Care with respect to Wastes and requirements for Trans-Frontier Shipment of wastes only.</td>
<td>See Section 3.8.</td>
</tr>
<tr>
<td>Scottish Fisherman’s Federation (SFF)</td>
<td>EA Scoping Report issued, no response received.</td>
<td></td>
</tr>
</tbody>
</table>
6 PROGRAMME MANAGEMENT

6.1 Project Management and Verification

Lundin has established a multi-disciplinary team lead by a Project Manager responsible for the implementation of activities and co-ordination of all services. An execution plan will align with established Lundin Health, Safety and Environment policies and meet all relevant legislative requirements. A contracting strategy will be based on Lundin procurement and contracts policies, including competitive tendering for all contractor services. Where possible, activities will be co-ordinated with other decommissioning operations and take account of any initiatives promoted by the OGA. Lundin will report regularly on the execution of the DP to OPRED and discuss any changes in plans in advance.

6.2 Post-Decommissioning Debris Clearance and Verification

As built installation data combined with IRM (GVI) 2015 & 2017 were utilised to identify debris within the installations’ 500 m zones and within the 100 m pipeline corridors. Excluding the FPSO 500m zone, a post decommissioning site survey will be carried out along a 100 m corridor of the pipeline (50m) along each existing pipeline route to identify and remove any debris related to offshore oil and gas activities which will be recovered for onshore recycling or disposal in line with existing waste management policies. Debris removal will form part of the subsea decommissioning execution scope of work. The clear seabed will be validated by a verification survey, over the installation sites and pipeline corridors, non-over-trawl techniques such as Side Scan Sonar (SSS)/ ROV, or by the post decommissioning survey; the methods used will be discussed and agreed with the OPRED. The post decommissioning survey will provide further verification.

6.3 Costs

<table>
<thead>
<tr>
<th>Item</th>
<th>Estimated Cost (£m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platforms /Jackets - Preparation / Removal and Disposal</td>
<td>N/A</td>
</tr>
<tr>
<td>Pipelines Decommissioning</td>
<td>Confidential¹</td>
</tr>
<tr>
<td>Subsea Pipeline associated materials and stabilisation Features</td>
<td>Confidential¹</td>
</tr>
<tr>
<td>Well Abandonment</td>
<td>N/A</td>
</tr>
<tr>
<td>Continuing Liability – Future Pipeline and Environmental Survey Requirements</td>
<td>Confidential¹</td>
</tr>
<tr>
<td>TOTAL</td>
<td>Confidential¹</td>
</tr>
</tbody>
</table>

¹ Estimated Costs are confidential and have therefore been provided separately to OPRED.
6.4 Schedule

The main milestones for the Brynhild DP are:

- CoP: 2018 Q2
- Wells P&A: To commence on 1st April 2020, at the earliest.
- Facilities Removal: To be completed during 2021
- Close-out report: 2022, Q2

Note: The offshore execution schedule for the subsea facilities is not time-critical and therefore not fixed, except that the Drilling rig P&A activities shall be planned to commence by 1st April 2020 and the overall project execution will be completed in 2021.

The Facilities execution contractor will be offered schedule flexibility during 2020/2021 to reduce risk and cost.
6.5 Close Out

A close out report will be submitted to OPRED within 12 months of the completion of decommissioning activities, including debris clearance and post-decommissioning surveys. Any material changes to the DP will need to be discussed and agreed by OPRED prior to any change.

6.6 Post-Decommissioning Monitoring and Evaluation

A post decommissioning environmental seabed survey, covering pipeline routes and infrastructure, will be carried out when decommissioning activity has been concluded. The survey will focus on chemical and physical disturbances due to the decommissioning. Results of the survey will be forwarded to OPRED and a risk-based post decommissioning pipeline monitoring regime will be discussed and agreed with OPRED.

6.7 Management of Residual Liability

This information will be included in the project Close Out Report (COR) when it is submitted for review and circulated to consultees for comment.
7 SUPPORTING DOCUMENTS

<table>
<thead>
<tr>
<th>Document Number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>J74927A-A-RT-00006</td>
<td>Comparative Assessment Report</td>
</tr>
<tr>
<td>J74927A-Y-RT-24003</td>
<td>Environmental Appraisal Report</td>
</tr>
</tbody>
</table>

Web link for all stakeholder / interested parties

https://lundin-norway.no/2020/01/03/public-notice/?lang=en
8 PARTNER LETTERS OF SUPPORT

Signed and dated Partner Letters will be included with the final version of the Brynhild DP.
Offshore Petroleum Regulator for Environment and Decommissioning  
Department for Business, Energy & Industrial Strategy  
3rd Floor, Wing C  
AB1 Building  
Crimon Place  
Aberdeen  
AB10 1BJ

27.05.2020

Dear Sir or Madam

BRYNHILD DECOMMISSIONING PROGRAMME PETROLEUM ACT 1998

We acknowledge receipt of your letter dated 26.05.20.

We, CapeOmega AS confirm that we authorise Lundin Energy Norway AS to submit on our behalf an abandonment programme relating to the Brynhild facilities as directed by the Secretary of State on 26.05.2020.

We confirm that we support the proposals detailed in the Brynhild Decommissioning Programme dated 26.05.2020, which is to be submitted by Lundin Energy Norway AS in so far as they relate to those facilities in respect of which we are required to submit an abandonment programme under section 29 of the Petroleum Act 1998.

Yours faithfully

Frode Losnedal  
SVP Projects

For and on behalf of CapeOmega AS
Offshore Petroleum Regulator for
Environment & Decommissioning
Department for Business, Energy &
Industrial Strategy
AB1 Building (Wing C) 3rd Floor
Crimon Place
Aberdeen. AB10 1BJ
Attn.: Kim Wood

Your ref.: Our ref.: Date: 3 June 2020

BRYNHILD DECOMMISSIONING PROGRAMME PETROLEUM ACT 1998

We acknowledge receipt of your letter dated 26.05.2020.

We, Repsol Norge AS confirm that we authorise Lundin Energy Norway AS to submit on our behalf an abandonment programme relating to the Brynhild facilities as directed by the Secretary of State on 26.05.2020.

We confirm that we support the proposals detailed in the Brynhild Decommissioning Programme dated 26.05.2020, which is to be submitted by Lundin Energy Norway AS in so far as they relate to those facilities in respect of which we are required to submit an abandonment programme under section 29 of the Petroleum Act 1998.

Yours sincerely,
for Repsol Norge AS

VIDAR NEDREBØ
Managing Director
9 APPENDIX A: PIPELINE BURIAL DEPTH INFORMATION

The graphs below show the measured depth of cover along the full length of each pipeline and umbilical, below seabed (0 being seabed level) from two separate surveys, a) an As-laid survey completed at the end of the pipelines installation in 2013 and b) an inspection survey carried out in July 2015.

Note PL3083 and PLU3085 share a common trench until they exit the trench near to Pierce, at this point the pipeline and umbilical diverge but are fully rock covered on the surface and up to the tie-ins at Pierce RBM.

Figure 9-1: Production Pipeline / Umbilical (PL3083/ PLU3085) Burial Depth
Figure 9-2: Water Injection Pipeline (PL3084) Burial Depth

Graph vertical axis is in metres and horizontal axis is in kilometres.

2013 As Laid survey data excludes rock cover.
2015 Inspection Survey includes rock cover.
PUBLIC NOTICE
The Petroleum Act 1998

BRYNHILD PIPELINES AND UMBILICAL

Lundin Norway AS has submitted, for the consideration of the Secretary of State for Business Energy and Industrial Strategy, a draft Decommissioning Programme for the Brynhild pipelines and umbilical in accordance with the provisions of the Petroleum Act 1998. It is a requirement of the Act that interested parties be consulted on such decommissioning proposals.

The items/facilities covered by the Decommissioning Programme are the: Brynhild infrastructure in the United Kingdom Continental Shelf (UKCS) comprising a production pipeline, a water injection pipeline and a control umbilical tied back to the Haewene Brim Floating Production, Storage and Offloading (FPSO) vessel serving the Pierce field (the FPSO is not part of the decommissioning programme).

The Brynhild field is located in the southern part of the Norwegian Continental Shelf (NCS), approximately 246 km east of Aberdeen. The pipelines and the umbilical cross over to UKCS at block 23/22b and connect to the Pierce field infrastructure in block 23/27a.

Lundin Norway AS hereby gives notice that a summary of the Brynhild Decommissioning Programme can be viewed at the internet address:

https://lundin-norway.no/2020/01/03/public-notice/?lang=en

Alternatively, a hard copy of the Programme can be inspected at the following locations during office hours:

Genesis Oil & Gas Consultants Limited (Contact: Adnan Hossain / John Wilson)
Aspect 32, Pavilion 3, Prospect Road, Arnheil Business Park
Westhill, AB32 6FE

Representations regarding the Brynhild Decommissioning Programme should be submitted in writing to the nominated contact below, by closing date 18.02.2020 and should state the grounds upon which any representations are being made.

Date: 20.01.2020

Lundin Norway AS
Strandveien 4
1366 Lysaker
Norway

Linda Hanken
Brynhild Decommissioning Project Manager
11 APPENDIX C: STATUTORY CONSULTEE CORRESPONDENCE
Dear Linda,

**Brynhild Field Decommissioning Programme (UKCS infrastructure– Statutory Consultation Draft)**

I refer to the Consultation on Draft Decommissioning Programme (DP) and key supporting documentation provided by email link on 20 January 2020.

The Scottish Fishermen’s Federation (SFF) appreciates the clearly laid out and detailed explanation of Lundin Norway AS’ proposals for the decommissioning of the elements of the Brynhild field infrastructure that are installed on the United Kingdom Continental Shelf (UKCS) and place on record our appreciation of the information provided and discussions held at earlier briefing sessions.

As highlighted to your colleagues previously, the concerns of fishermen remain primarily that of safety and the physical impact on the fishing grounds of the long term presence of oil industry infrastructure on the seabed.

It is noted that there are no surface installations in the UKCS associated with the Brynhild Field and that this particular DP covers the production pipeline, water injection pipeline and control umbilical that cross over into the UKCS (12 km of each line and umbilical are within the UKCS). It is further noted that final decommissioning of the GRP covers at the Riser Base Manifold will become the responsibility of the Pierce Field operator at the time of Pierce decommissioning.

In relation to the offshore pipelines and umbilical, given that these are trenched and mostly buried along their length, we accept the reasoning behind the recommendation (based on the outcome of the comparative assessment of feasible options) of leaving these in situ with minimum intervention in order to minimise seabed disturbance. We are pleased to note that the five identified exposed flexible concrete mattresses will be recovered and returned onshore for treatment.

Linda Hanken
Brynhild Decommissioning Project Manager
Lundin Norway AS
Strandveien 4
1366 Lysaker
Norway

6 February 2020
As you will be aware, any pipelines left on the seabed represent a legacy issue and will require on going monitoring. Where rock cover is deployed, we would look for the size and profile of the rock to follow normal industry standards and would recommend that such rock dump berms are incorporated into the post decommissioning debris clearance trawl sweeps to verify that, at the time of deposit, they did not pose a risk to fishing.

We would highlight to Lundin that the Federation’s decommissioning preference(s) with regard to pipelines and flowlines can be summarised as follows:

- **Pipelines & flowlines (including trunk lines, pipeline bundles and umbilicals): total removal to shore.**
  Failing that; trenching and burial with a proactive monitoring programme put in place. With regard to pipeline ends, where a trenched and buried pipeline is cut and removed at the point where it previously emerged from the trench to tie-in to a subsea installation, preference is for burial along with an element of rock dump returning to mean seabed level.

* The SFF’s Oil and Gas Decommissioning Policy and accompanying Key Principles document can be viewed via the SFF’s website using the following link: [https://www.sff.co.uk/sff-offshore-oil-gas-decommissioning-policy/](https://www.sff.co.uk/sff-offshore-oil-gas-decommissioning-policy/).

Yours sincerely,

[Signature]

Steven Alexander
Offshore Liaison