

Shell U.K. Limited



Brent Field Pipeline PLU6294 Decommissioning Programme

Submitted to the Offshore Petroleum Regulator for Environment and Decommissioning

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Abbreviations and Glossary	
ALARP	As Low As Reasonably Practicable
DP	Decommissioning Programme
MFE	Mass Flow Excavator
MPA	Marine Protected Area
NLGP	Northern Leg Gas Pipeline
NL-WL	Northern Leg - Western Leg
NORM	Naturally Occurring Radioactive Material
NSTA	North Sea Transition Authority
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
PLEM	Pipeline End Manifold
PPA	Pipeline Proximity Agreement
PWA	Pipeline Works Authorisation
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SCI	Site of Community Importance
SSIV	SubSea Isolation Valve
VO	Variation Order
WLGP	Western Leg Gas Pipeline



1 EXECUTIVE SUMMARY

1.1 Decommissioning Programme

This document contains the single Decommissioning Programme (DP) for the umbilical PLU6294 (Shell number N5854, previously referred to as C0815¹, Table 1-1). PLU6294 is a 3" diameter control umbilical that runs approximately 1.2km from the Brent Alpha splitter box to the Northern Leg Gas Pipeline (NLGP) SubSea Isolation Valve (SSIV).

1.2 Requirement for Decommissioning Programme

In accordance with the Petroleum Act 1998, the Section 29 notice holders of PLU6294 (Table 1-2) are applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for decommissioning the umbilical PLU6294, which is described fully in Section 2.1 of this programme (see also Section 8 – Partner Letter of Support).

In conjunction with stakeholder and regulatory consultation, the decommissioning programme is submitted in compliance with national and international regulations and OPRED guidelines. The schedule outlined in this document is for a multi-year decommissioning project starting in 2023. A multi-year programme is necessary because PLU6294 is crossed by two live pipelines - PL4492 a 16" pipeline transporting gas from the Penguins Field and PL4101 - a 20" pipeline transporting gas from the Magnus Field. Production from these fields is currently expected to continue until 2039 and 2036 respectively. As a minimum, a section of PLU6294 will have to remain in situ under both of these live lines until they are taken out of use.

However, vessels are currently in-field executing scopes of work approved within the Brent Field Pipelines DP and, if possible, Shell would like to maximise synergies of vessel use and undertake some work on PLU6294, away from the live pipeline crossings, in Q3 2023.

1.3 Introduction

Since the approval of the Brent Field Pipelines Decommissioning Programme [1] in 2020, ownership of the control umbilical from the Brent Alpha splitter box to the NLGP SSIV has been transferred to Shell U.K. Limited and Esso Exploration and Production UK Limited. Accordingly, a Section 29 Notice has been raised and the umbilical has been assigned the number PLU6294.

PLU6294 is essentially a continuation of the control umbilical PLU4562 which connected the Brent Alpha jacket to the Brent Alpha splitter box. At the splitter box the control umbilical is split into two lengths - PLU4562 to the Western Leg Gas Pipeline (WLGP) SSIV located near the Alpha jacket, and PLU6294 which connects the Brent Alpha splitter box to the NLGP SSIV located on pipeline PL164.

PLU6294 is predominantly trenched and buried with surface laid sections on the approach to the NLGP SSIV and at the mattressed crossing with PL49. The crossings at PL4104 and PL4492 are rock dumped over trenched and buried sections of PLU6294.

¹ NSTA pipeline number PLU6294. Umbilical previously owned by BP with the internal pipeline reference of C0815. Shell internal pipeline reference number N5854



During the Brent Bypass project, a solvent chemical was used to flush the hydraulic fluid within the umbilical into waste tanks on Brent Alpha and returned to shore for disposal, under permit (CP/1234). The umbilical was left filled with raw seawater. To allow the decommissioning of the Brent Alpha splitter box, PLU6294 has been flushed and taken out of use and is ready for decommissioning.

1.4 Overview of Pipeline Being Decommissioned

Table 1-1: Pipeline Being Decommissioned			
Field(s)	Brent Field	Production Type (Oil/Gas/Condensate)	Control umbilical
Water Depth (m)	140 m – 142 m	UKCS block	211/29
Distance to median (km)	11 (Norway)	Distance from nearest UK coastline (km)	136 (Shetland)
Number and total length (km) of Pipeline Full details given in Table 2-1		One umbilical approximately 1.2km long	

Table 1-2: Pipeline Section 29 Notice Holders' Details		
Section 29 Notice Holders	Registration Number	Equity Interest (%)
Shell U. K. Limited (Operator)	00140141	50
Esso Exploration and Production UK Limited	00207426	50



1.5 Summary of Proposed Decommissioning Programme

Table 1-3: Summary of Decommissioning Programme	
1. Pipelines, Flowlines & Umbilicals	
Selected Option: Leave in Place with Remediation	
Reason for Selection	Proposed Decommissioning Solution
<p>Surface laid section must be disconnected from the Brent Alpha splitter box to allow the removal of the splitter box during the 2023 offshore campaign, and the matted crossing with PL49 must be removed to allow the future decommissioning of PL49 in accordance with the Brent Field Pipelines DP [1].</p> <p>To maximise efficient vessel time, the surface-laid section connected to the NLGP SSIV will also be disconnected and recovered at this time. The removal of the surface-laid sections to the trench transition and at crossings will remove legacy snagging risks.</p> <p>Main length of umbilical is trenched and buried. The whole buried length of line would have to be excavated to permit removal, and this would result in significant seabed disturbance.</p> <p>During the 2023 campaign, a depth-of-cover survey will be carried out to confirm that the trenched section is sufficiently buried and can be left in place.</p>	<p>Surface laid section (approximately 200 m long) at NLGP SSIV, including the associated mattresses (estimated 43 mattresses) and the matted crossing with PL49 will be removed (2 mattresses). PLU6294 will be disconnected from Brent Alpha splitter box to allow the splitter box to be removed.</p> <p>All recovered pipeline material and protective structures would be taken to shore for reuse, recycling or disposal as appropriate.</p> <p>The trenched and buried sections will be left <i>in situ</i>.</p> <p>Degradation of the trenched and buried section will occur over an extended period of time and degradation products are expected to remain largely within the seabed.</p> <p>The trenched and buried section is not expected to present a hazard to other users of the sea.</p>
Contingency Option: Complete Removal by Reverse Reeling without Excavation	
Reason for Selection	Contingency Decommissioning Solution ¹
<p>Should the planned depth of cover survey indicate that the umbilical is buried to a shallower depth, it may be possible to remove this umbilical by reverse reeling, without the need for excavating the umbilical.</p> <p>If this were possible, the recommended decommissioning solution would become complete removal.</p>	<p>With the exception of the section of umbilical under the live pipeline crossings, the whole line would be removed by reverse reeling. Decommissioning of the live crossings would be postponed until these lines were taken out of use.</p> <p>All pipeline material and protective structures would be taken to shore for reuse, recycling or disposal as appropriate.</p>
2. Interdependencies	



The umbilical PLU6294 must be disconnected from the Brent Alpha splitter box to allow the removal of this subsea structure. Removing the matted crossing with PL49 will allow the future decommissioning of this line as described in the Brent Field Pipelines DP [1].



1.6 Field Location Including Field Layout and Adjacent Facilities

Figure 1-1: Location of the Brent Field

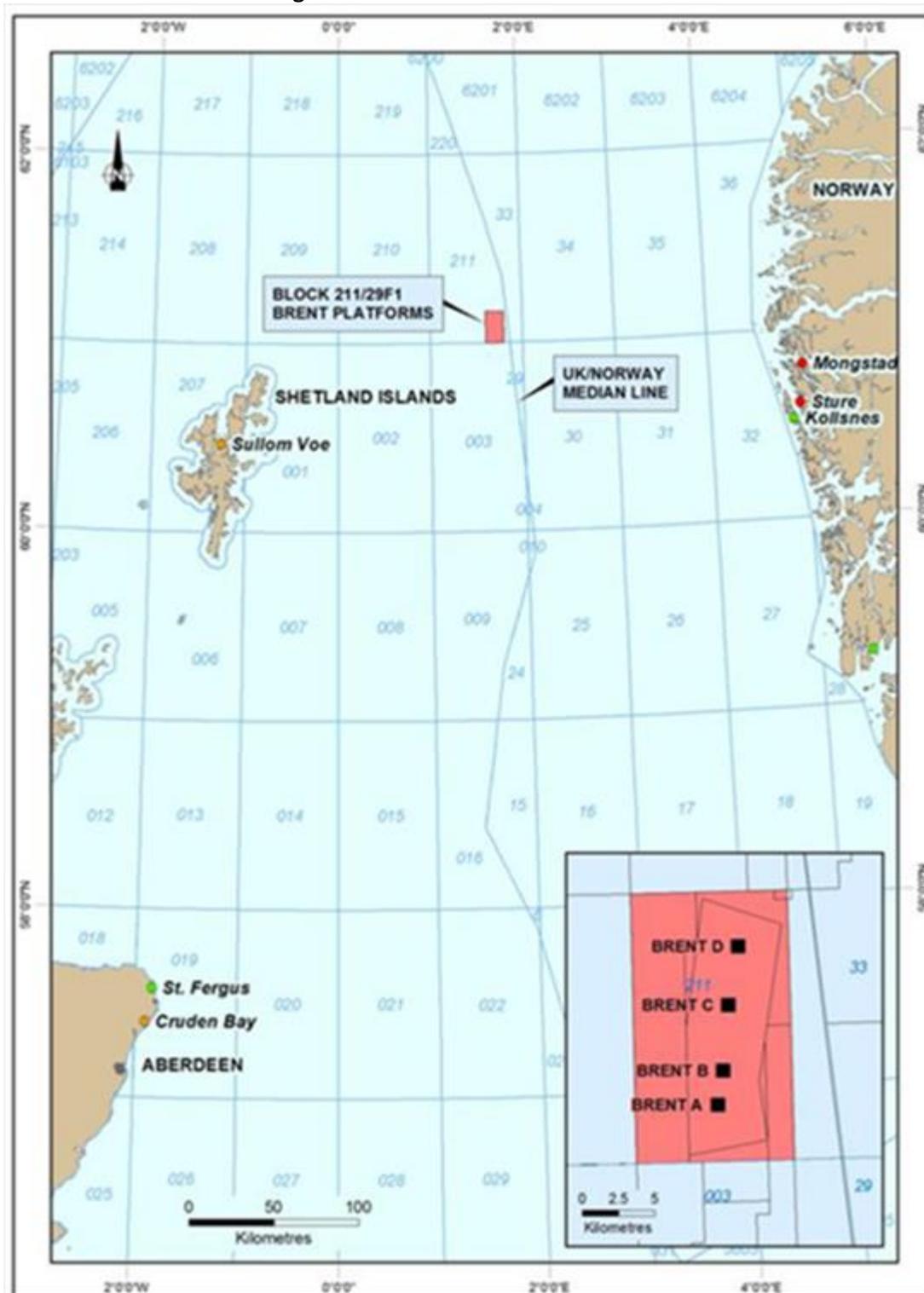




Table 1-4: Adjacent Facilities					
Owner	Name	Type	Distance/Direction	Information	Status
EnQuest Heather Limited	NLGP SSIV	Subsea structure	Connected	Gas	Operational
EnQuest Heather Limited	PL164 (C0603)	20" pipeline	<5 m north at closest point	From Magnus to NLGP SSIV	Operational
EnQuest Heather Limited	PL164A (C0603A)	20" pipeline	<20 m north at closest point	From NLGP SSIV to Brent Alpha (disconnected at both ends)	Out of use
EnQuest Heather Limited	PLU4168 (C0801)	Umbilical	Crossed by PLU6294	From NLGP SSIV to Brent Alpha (disconnected at Brent Alpha)	Out of use
Shell U.K. Limited	PL4104 (N0614)	20" pipeline	Crosses PLU6294	Gas from NLGP SSIV to NL-WL PLEM	Operational
Shell U.K. Limited	PL4492 (N0610)	16" pipeline	Crosses PLU6294	Gas from Brent Charlie GEP SSIV to NL-WL PLEM	Operational
Shell U.K. Limited	PL49 (N0301)	16" pipeline	Crosses PLU6294	Ex-drains line from Brent Spar PLEM to Brent Alpha	Out of use
Shell U.K. Limited	PLU4562 (N0830)	6" umbilical	Approx. 45 m south at closest point	Brent Alpha splitter box to WLGP SSIV umbilical	Out of use
Shell U.K. Limited	PL17A-D	16" gas pipeline	Approx. 25 m south at closest point	Brent Alpha to WLGP SSIV	Out of use
Shell U.K. Limited	WLGP SSIV	Subsea structure	Approx. 60 m south	Gas	Operational



Table 1-4: Adjacent Facilities					
Owner	Name	Type	Distance/Direction	Information	Status
Shell U.K. Limited	Brent Alpha jacket footings	Derogated installation	Approx. 45 m south-east at closest point	N/A	Decommissioned
Shell U.K. Limited	NL-WL PLEM	Subsea structure	Approx. 100 m south at closest point	Gas	Operational

Impacts of Decommissioning Proposals

The majority of nearby or associated infrastructure is operated by Shell U.K. Limited and forms part of the Brent Field Pipelines DP. PPAs are in place with third parties (EnQuest and CNR) to allow the proposed decommissioning works.

The surface crossing with PL49 is to be dismantled which will allow the future decommissioning of PL49. The trenched and buried and rock-dumped crossings with PL4104 and PL4492 will remain in place until these lines are taken out of use.

Figure 1-2: PLU6294 near Brent Alpha

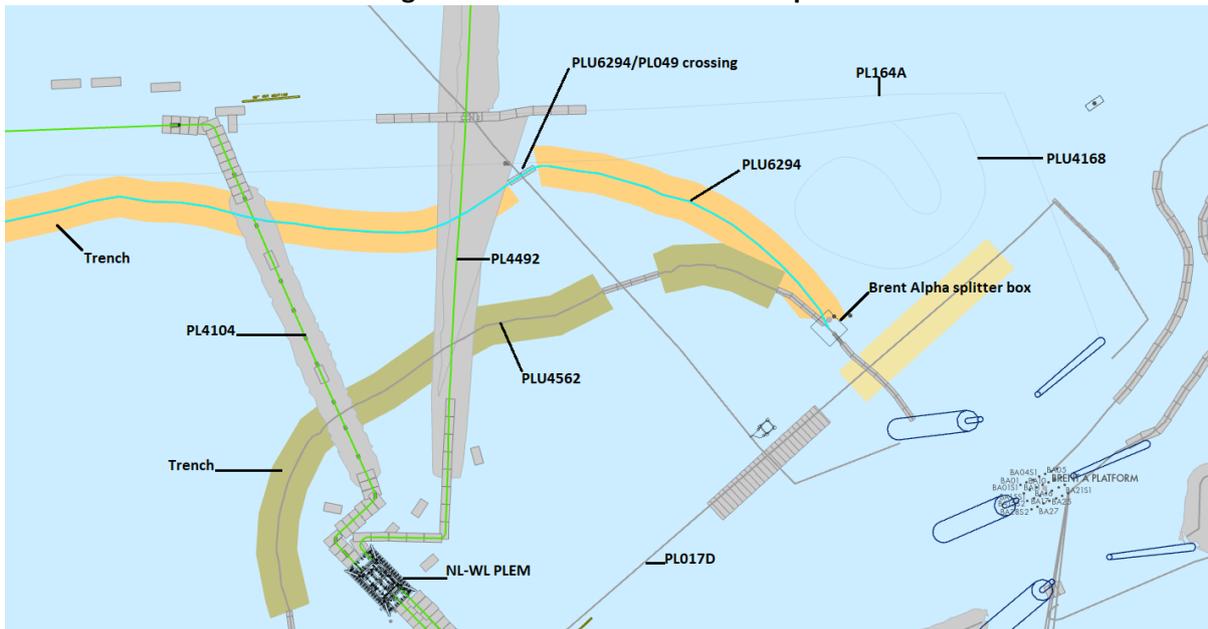
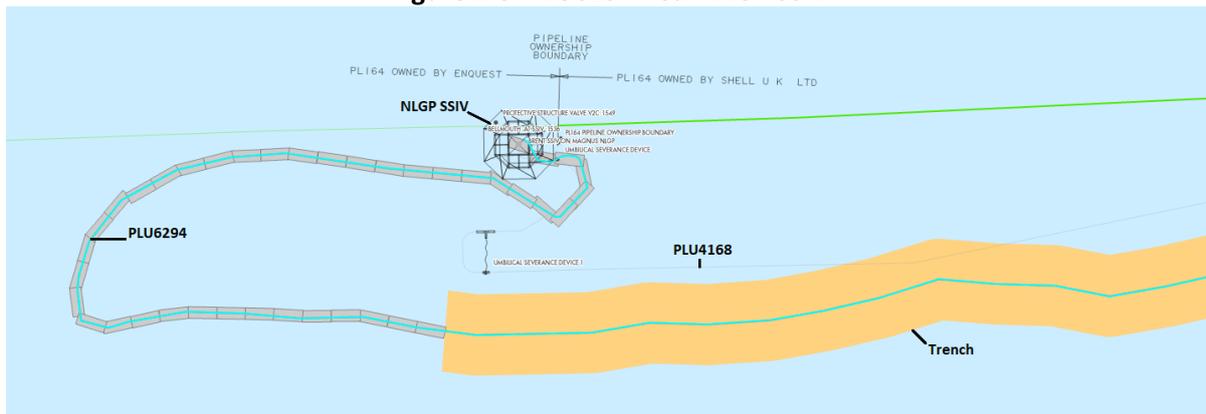




Figure 1-3: PLU6294 near NLGP SSIV



1.7 Industrial Implications

The programme of work for the Brent Field Pipelines DP [1] is being carried out in several phases. Under the Subsea Infrastructure Decommissioning (SID) sub-project, the subsea structures and some pipelines are to be removed in accordance with the approved DP [1]. In addition, some pipelines will be prepared for future trenching by removing end spool pieces to create the space required for the trenching equipment. In 2020, a single contract was awarded for the execution of this work, and it has now commenced under the appropriate permits and consents.

When the change in ownership of the umbilical PLU6294 was identified, a Variation Order to the 2023 workscope was raised with the contractor to add (i) the removal of the surface-laid sections of PLU6294 and (ii) a survey of the trenched and buried sections of PLU6294 to confirm depth of burial.

PLU6294 must at least be disconnected from the Brent Alpha splitter box to allow the recovery of that structure. An existing decommissioning campaign at Brent is utilising vessels which carry the equipment required to remove the surface-laid sections of PLU6294 and associated mattresses. Therefore, to optimise vessel time, it is intended that the PLU6294 scope will be amalgamated into the existing campaign.



2 DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

2.1 Umbilical Including Stabilisation Features

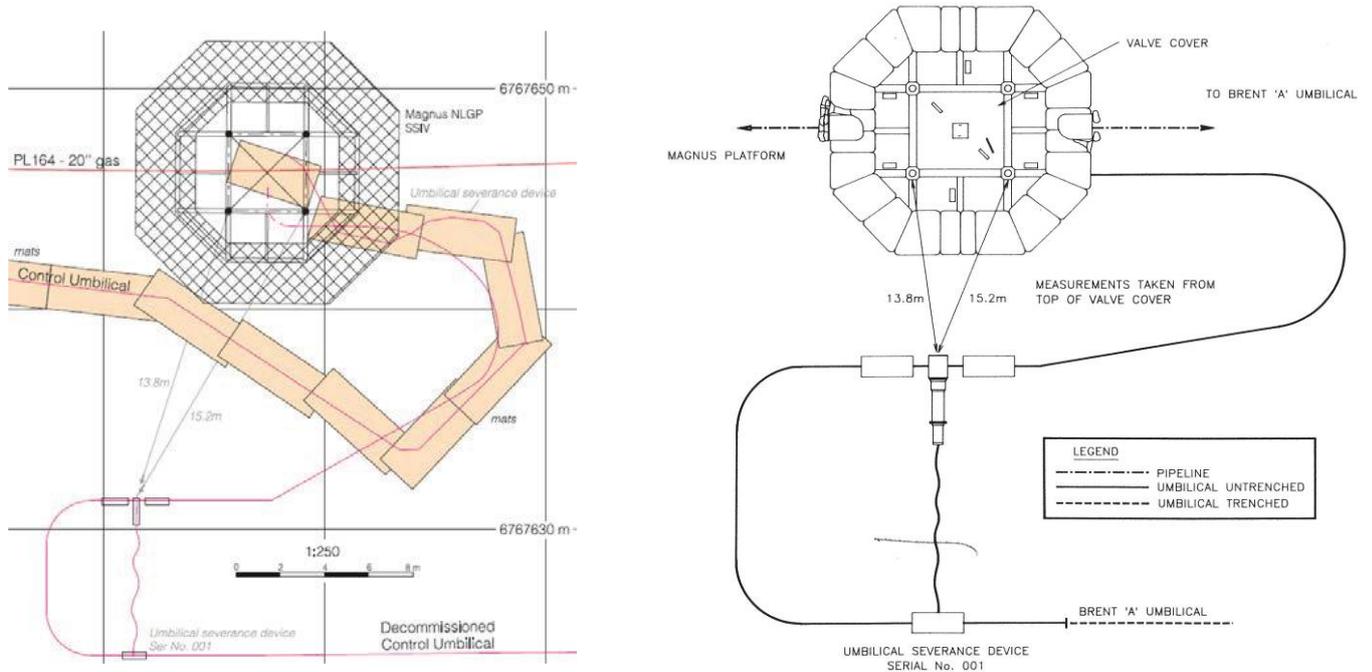
Details of PLU6294 and the associated stabilisation materials are provided in Table 2-1 and Table 2-2.

In 1990 the original umbilical between the NLGP SSIV and Brent Alpha (C0801/PLU4168) was taken out of use and replaced with PLU6294.

PLU4168 was disconnected from Brent Alpha and left on the seabed; it is owned by Enquest Heather Limited who are responsible for decommissioning this line. PLU4168 has an explosive umbilical severance device installed onto it at the NLGP SSIV end (Figure 2-1); it is likely that this severance device will have been left unarmed but this has not been confirmed.

PLU6294 also has an umbilical severance device, installed at the NLGP SSIV end (Figure 2-1), and we have assumed that this device is armed. These two explosive devices are less than 25 m apart.

Figure 2-1: Umbilical severance device



**Table 2-1: Pipeline/Flowline/Umbilical Information²**

Description	Pipeline Number	Diameter (inches)	Length (km)	Description of Component Parts	Product Conveyed	From – To End Points	Burial Status	Pipeline Status	Current Contents
Control umbilical	PLU6294	3	1.2	Steel, plastics, other materials	Hydraulic fluid and electrical signal	Umbilical splitter box – NLGP SSIV (located on PL164)	Trenched and buried with approx. 200 m section exposed	Out of use	Seawater

Note: Brent Alpha splitter box will be removed under Brent Field Pipelines DP [1]
NLGP SSIV owned by EnQuest and outwith scope

Table 2-2: Subsea Stabilisation Features

Stabilisation Feature	Total Number	Weight (Te)	Location(s)	Exposed/Buried/Condition
Concrete mattresses	Approx. 45	6 tonnes each	At NLGP SSIV and PL49 crossing point.	Exposed

² Information taken from final EnQuest PWA submission



2.2 Wells

Not applicable.

2.3 Inventory Estimates

Data on the composition of PLU6294 is not available. The unit weight of the umbilical is assumed to be the same as the sister umbilical, PLU4562, of 25kg/m, and this has been used to calculate the total weight. Table 2-3 presents the proportions of material that would be returned to shore for reuse/recycling/disposal as appropriate under the recommended option (Option 3, Section 3.3.3).

Table 2-3: Material Inventory ¹			
Item	Total weight (tonnes)	Weight to be recovered (tonnes)	Weight to be left in situ (tonnes)
PLU6294	30.1	5.5	24.6
Associated mattresses	270	270	0

Note 1: Includes a 10% contingency in terms of surface laid section length and number of mattresses at NLGP SSIV.

Should our ongoing studies indicate that the contingency option, Option 3 can be executed (Section 3.3.4), then the entire length of the umbilical, with the exception of the short section under the currently live pipelines and the associated stabilisation materials will be returned to shore. Once the live pipelines are taken out of use, we would then intend to remove the section of PLU6294 from under the crossings in a future campaign.



3 PIPELINES

3.1 Decommissioning Options

3.1.1 Introduction

Considering the characteristics and status of the line, two removal options and one leave in place option were subject to Comparative Assessment.

3.1.2 Option 1 Complete Removal by Reverse Reeling with Excavation

According to available installation data, PLU6294 was installed in a 0.75 m deep trench for the majority of its length and backfilled. Mattresses were then placed on the surface laid section at the approach to NLGP SSIV and at the crossing with PL49. (It should be noted that the mattresses at the Brent Alpha splitter box are associated with PLU4562, which is covered by the Brent Field Pipelines DP [1]). The umbilical has an outer diameter of 3" (77.6 mm, 0.0776 m). With no record of any historic interactions with other users of the sea, it is presumed that the trenched and buried section remains stable and without spans.

The actual depth of cover will be confirmed by a survey during the 2023 campaign. Small diameter, flexible lines such as PLU6294 are usually candidates for removal by reverse-reeling. With a combined length of approximately 860 m, the trenched lengths of PLU6294 are significantly longer than the two trenched sections of the sister umbilical PLU4562 (40 m and 180 m long, trenched and buried to a depth of 0.75 m). Therefore, if the depth of cover of PLU6294 is confirmed to be 0.75 m along its length, it is likely that the over-burden of soil would have to be excavated from the trench using a Mass Flow Excavator (MFE) or similar, to make reverse-reeling a feasible option. Accordingly, Option 1 considered for this umbilical is "reverse-reeling with excavation".

Due to the presence of the live lines PL4104 and PL4492, the decommissioning of the trenched section of PLU6294 under these lines would have to be postponed until PL4104 and PL4492 are taken out of use, which is currently estimated to be 2039 and 2036 respectively. The location of the proposed cuts near the live pipelines is illustrated in Figure 3-1.

Note that the surface-laid sections and associated mattresses are presumed to be removed in this option.

The programme of work for this option would be as follows:

- Recover mattresses at NLGP SSIV section.
- Remove surface laid section at NLGP SSIV by cut and lift or include this section in the reverse reeling operation.
- Remove mattresses at crossing with PL49.
- Remove the 12 m section at the PL49 crossing (2 cuts); as with other pipelines, assume recovery with basket or skid.
- Disconnect/cut at Brent Alpha splitter box.
- Excavate trenched sections of the umbilical with MFE or similar (approximately 860 m, noting that the section between Cut C2 and Cut C3 in Figure 3-1 will not be excavated or removed due to the presence of the live lines).
- Remove the two excavated sections of line by reverse reeling.
- If necessary, ensure any berms or spoil will not affect other users of the sea.



- Transport to licensed onshore site for dismantling, reuse or recycling of all retrieved material.

3.1.3 Option 2 Complete Removal by Reverse Reeling without Excavation

If the backfill over the trenched sections is less than 0.6 m deep, it is likely that the umbilical would be strong enough to be pulled from the trench without excavation. The feasibility of extracting the line without excavation will be determined based on the 2023 survey findings and detailed assessment of the physical and mechanical properties of the trenched sections.

Due to the presence of the live lines PL4104 and PL4492, the decommissioning of the trenched section of PLU6294 under these lines would have to be deferred until PL4104 and PL4492 are taken out of use, which is currently estimated to be 2039 and 2036 respectively. The location of the proposed cuts near the live pipelines is illustrated in Figure 3-1.

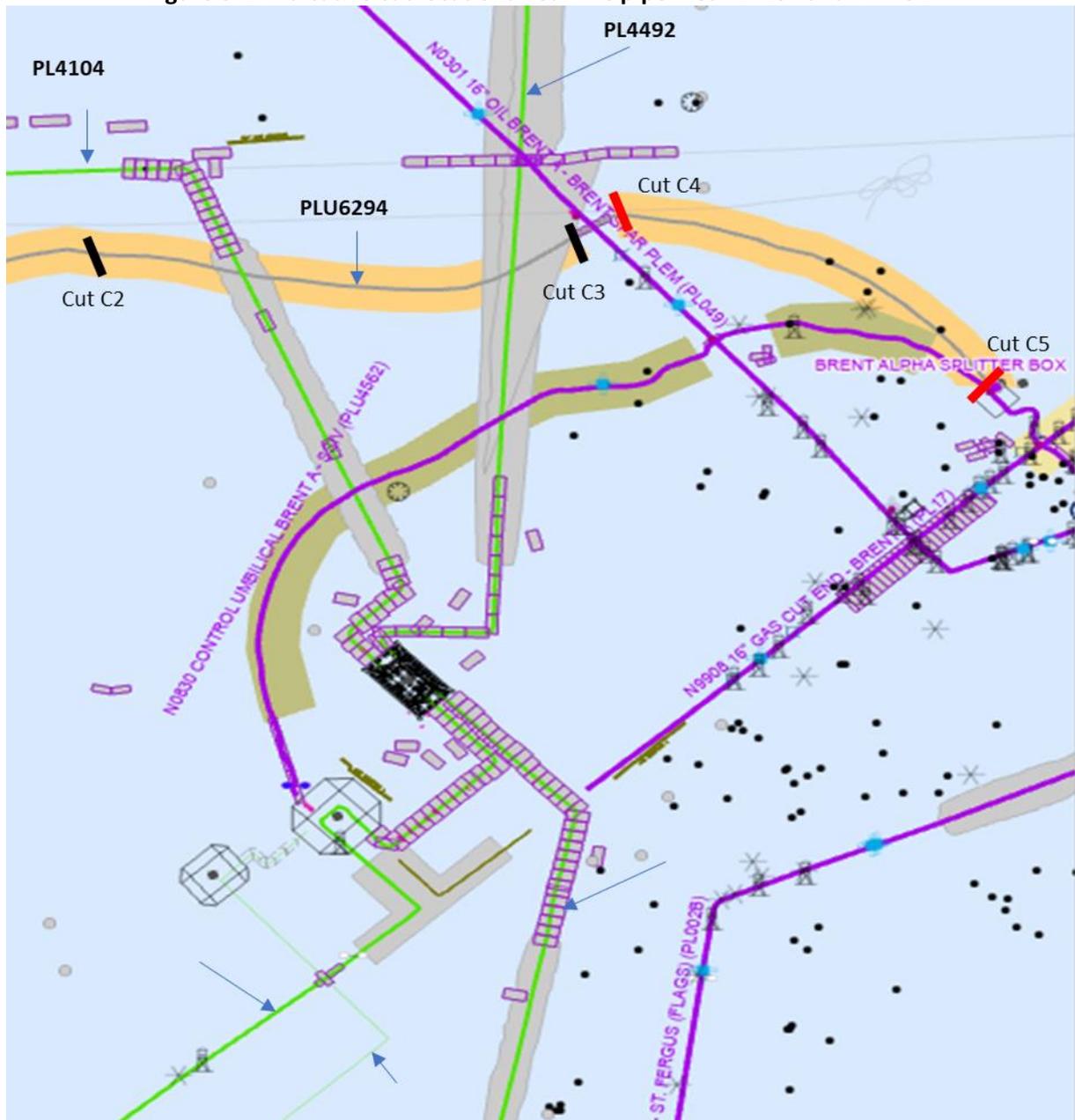
Again, the surface-laid sections and mattresses are presumed to be removed in this option.

The programme of work for this option would be as follows:

- Recover mattresses at NLGP SSIV section.
- Remove surface-laid section at NLGP SSIV by cut and lift or include this section in the reverse reeling operation.
- Remove mattresses at crossing with PL49.
- Remove the 12 m section at the PL49 crossing (2 cuts); as with other pipelines, assume recovery with basket or skid.
- Disconnect/cut at Brent Alpha splitter box.
- Remove the two trenched and buried sections of the line by reverse reeling (noting that the section between Cut C2 and Cut C3 in Figure 3 2 will be left in situ until a later date).
- Transport to licensed onshore site for dismantling, reuse or recycling of all retrieved material.



Figure 3-1: Indicative cut locations near live pipelines PL4104 and PL4492





3.1.4 Option 3 Leave in Place with Remediation

The final option considered for PLU6294 is leave in situ with remediation of the pipeline ends. The majority of PLU6294 is stable within a trench of sufficient depth to reduce risk to fishing activities. It is therefore a candidate to leave in situ with minor remediation of the umbilical ends which are lying on the seabed. The surface-laid sections and mattresses would be removed, the cut ends locally dredged to beneath mean seabed level and the trenched and buried section of the umbilical would be left in situ. The programme of work for this option would be as follows:

- Recover mattresses at NLGP SSIV section.
- Remove surface laid section at NLGP SSIV, approximately 200 m.
- Remove mattresses at crossing with PL49.
- Remove the 12 m section at the PL49 crossing; as with other pipelines, assume recovery with basket or skid.
- Disconnect/cut at Brent Alpha splitter box.
- Ensure cut ends are sufficiently buried to 0.6 m or more; localised dredging may be required.

Table 3-1 shows the range of possible options for pipelines and the options selected for the CA of PLU6294.

Table 3-1: Pipeline or Pipeline Groups Decommissioning Options			
Pipeline or Group (as per PWA)	Condition of line/group (Surface laid/trenched/buried/spanning)	Whole or part of pipeline/group	Decommissioning options* considered
PLU6294	Predominantly trenched and buried	Whole of umbilical	1, 7

*Key to Options:

- | | | |
|-----------------------------|---------------------------|--------------------|
| 1) Remove - reverse reeling | 2) Remove - Reverse S lay | 3) Trench and bury |
| 4) Remedial removal | 5) Remedial trenching | 6) Partial Removal |
| 7) Leave in situ | | |

3.2 Comparative Assessment

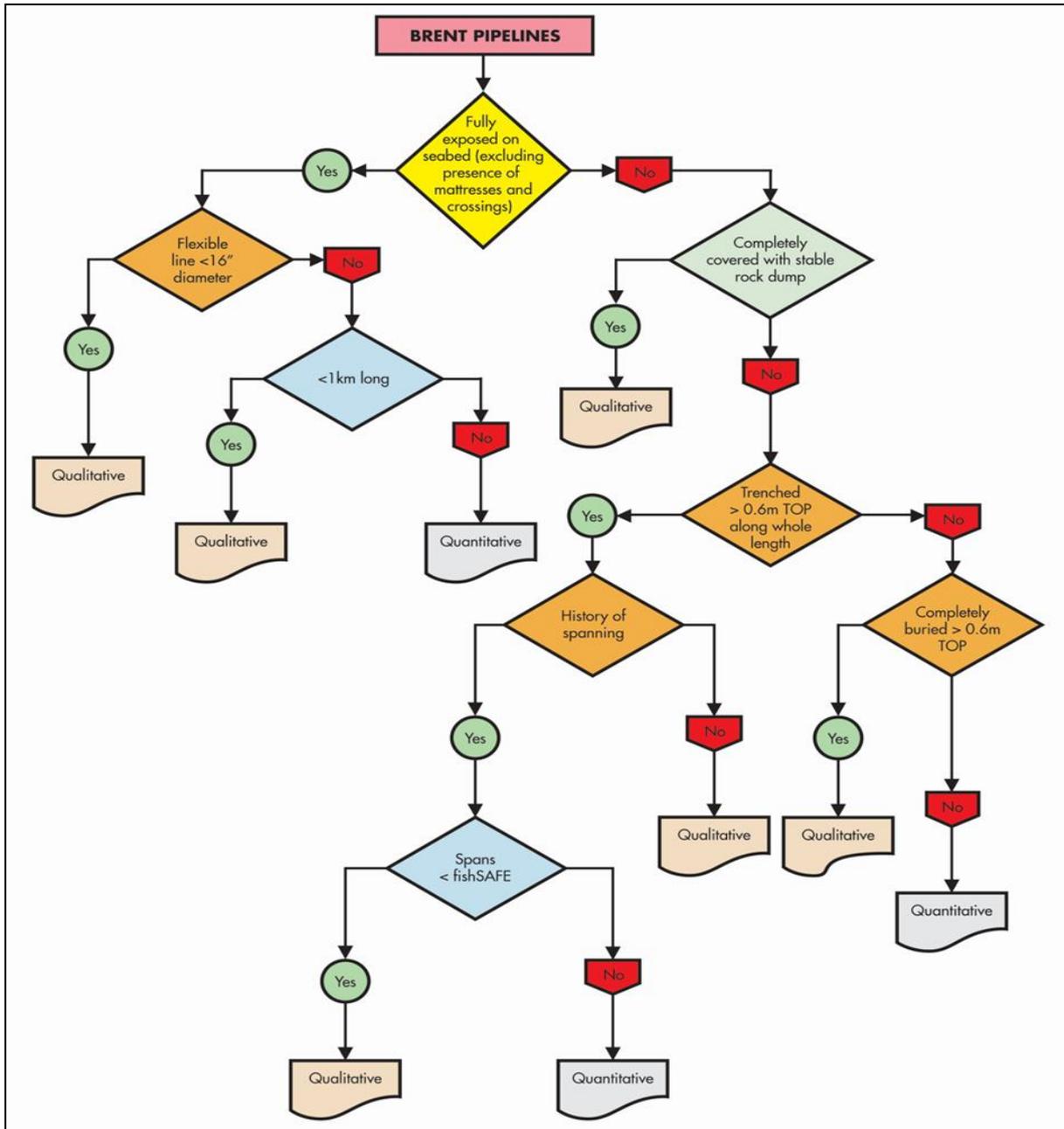
3.2.1 Introduction

The decommissioning of PLU6294 was considered against a decision tree, based on the OPRED guidance, to determine whether a qualitative or quantitative Comparative Assessment process should be applied (Figure 3-2).

If it is assumed that the depth of cover over the buried umbilical is 0.6 m or more and given that the surface-laid sections of the umbilical would at least have to be disconnected from the associated subsea structures, PLU6294 has been assessed as requiring a qualitative assessment, and this has been completed from the presumption of full removal.



Figure 3-2: Decision Tree for the Division of the Pipelines Subject to Qualitative and Quantitative Comparative Assessment





3.2.2 Comparative Assessment Method

A simple ranking assessment was performed, using expert judgment to place these three options in order of preference in each of 12 sub-criteria – the same sub-criteria that were assessed in the Brent Field Pipelines DP [1]. In such a RAG assessment, the least preferred option in any sub-criterion is marked RED, the most preferred GREEN, and the intermediate AMBER. This method requires that the options must be accorded a unique assessment, however close their performances might be. The RAG assessment ranks the options relative to each other; the colours do not indicate absolute acceptability.

3.3 Results of Comparative Assessment

3.3.1 Summary

The qualitative Comparative Assessment indicated that the recommended option for the decommissioning of PLU6294 is Option 3 “Leave in place with Remediation”. The results of the Assessment are presented in Table 3-2 and the performance in each of the sub criteria examined is described in the narratives below.

Table 3-2: Assessment of Options in Sub-Criteria			
Sub-criterion	Reverse reel with excavation	Reverse reel without excavation	Leave in place with remediation
Safety risk to offshore project personnel	Red	Yellow	Green
Safety risk to other users of the sea	Yellow	Green	Red
Safety risk to onshore project personnel	Red	Yellow	Green
Operational environmental impacts	Red	Yellow	Green
Legacy environmental impacts	Yellow	Green	Red
Energy use	Red	Yellow	Green
Emissions	Red	Yellow	Green
Technical feasibility	Red	Yellow	Green
Effects on commercial fisheries	Yellow	Green	Red
Employment	Green	Yellow	Red
Impact on communities	Red	Yellow	Green
Cost	Red	Yellow	Green

3.3.2 Performance in Sub-Criteria

Safety risk to offshore project personnel

Safety risk to project personnel is a function of the types and durations of the activities required to complete the scope of work. As the most complex operation, Option 1 has been assessed to have the greatest cumulative risk to offshore personnel, albeit in real terms the activities would be managed to an ALARP level. In contrast, Option 3 would be a shorter programme of work and would require the minimum amount of handling of recovered sections, and therefore has been assessed as having the lowest safety risk for offshore personnel.



Safety risk to other users of the sea

Although Option 3 is assessed as poorest when compared with the other options, in reality the umbilical is trenched and buried and there have been no reported interactions with bottom-towed fishing gear. It has therefore been assessed as the least preferred option only on the basis that the main length of umbilical would remain in situ and may pose a risk in the future, should it become unburied. In both Option 1 and Option 2, the umbilical would be completely removed, and the only differentiator is the potential in Option 1 for spoil to be created during the excavation of the umbilical from the trench. In reality, it would be standard practice to ensure no berms that might affect other users of the sea remained at the end of the activities.

Safety risk to onshore project personnel

With the greatest amount of material returned to shore for processing, recycling and/or disposal, Option 1 is ranked as the option with the greatest safety risk to onshore project personnel. There is very little difference in the amounts of material that would be returned to shore in Options 1 and 2, and the amounts are less than that in Option 3.

Operational environmental impacts

The most significant operational environmental impact would be the disturbance to the seabed caused by the excavation operations in Option 1; a large proportion of the over-burden would have to be removed to permit the umbilical to be pulled through the remaining cover without breaking. In Option 1, the requirement to excavate about 1 km of umbilical to a depth of about 0.75 m would disturb a considerable volume of seabed sediment, perhaps 1,000 m³ or more. This material would be resuspended and then resettle over an area adjacent to the route, smothering and otherwise impacting established local benthic fauna. Although the seabed and associated fauna in the vicinity of the umbilical would be expected to recover fully from this disturbance, the impacts of Option 1 would be greater than those in either Option 2 or Option 3.

If it is determined that the depth of cover and strength of the umbilical are such that full recovery could be successfully undertaken without excavation, less seabed disturbance would occur. In these circumstances the seabed sediments in the trench would resettle and, given the small diameter of the umbilical, it is unlikely that a significant depression would be left on the seabed. In Option 3, minimal disturbances would occur at isolated locations at each end of the umbilical during the cut and lift operations. Option 3 has been assessed to have the least operational environmental impact.

Legacy environmental impacts

Option 2 performs best, because no large-scale disturbance of the seabed would be required; small amounts of resuspended sediment would resettle on the adjacent seabed and a natural benthic fauna quickly become established. This option would also remove all the umbilical and thus eliminate any potential legacy impacts from degrading materials.

In Option 1, a much larger volume of material would be displaced and settle over a larger area, smothering the local benthos. Although, the seabed would in time recover from these impacts and disturbances, it would take time.

In Option 3, most of the umbilical would remain in situ and would ultimately degrade. Although the degradation products are likely to be contained within the trench and thus limit the long-term impact, relative to Option 1 and 2, Option 3 is the least preferred option in terms of legacy environmental impacts.



Energy use and Emissions generated

Options 1 and 2 would both result in the same large amount of material being removed and taken to shore for reuse, recycling or disposal, with the same associated level of energy saving. Option 1 performs worse than Option 2, however, because the lengthy and extensive excavation required in Option 1 would use more energy; indeed, in Option 1 the energy use and emissions from offshore vessels might exceed any savings derived from the recovery and recycling of the umbilical materials. In contrast, although Option 3 would return less material for recycling than Options 1 or 2, it would require a much shorter offshore operation.

Technical feasibility

By definition, all three options are technically feasible.

Option 1 has been assessed as the most technically challenging due to the requirement to excavate about 1km of umbilical, which is not a standard operation undertaken by the industry. In Option 2, the programme of work to pull the umbilical through a shallow over-burden of sediment is a standard offshore operation, but still requires some additional work offshore. In contrast, Option 3 is assessed as the least complex of the options, requiring only a small number of cut and lift operations.

Effects on commercial fisheries

Option 2 was assessed to have the best performance because the whole line would be removed and seabed disturbance kept to a minimum, hence reducing the likelihood that sediment “berms” would be created. Option 1 would be somewhat poorer because, although the surface laid sections of umbilical and the associated mattresses would be removed, the extensive excavation required might result in the creation of sediment berms which could pose a snagging risk to bottom-towed fishing gear, though any such berms would be assessed for potential risk and remediated at the end of activities. In Option 3 the whole umbilical would remain in the trench, where it would degrade over the very long term. Although there have been no reported effects on commercial fisheries to date, it is possible that parts of the umbilical or its constituent materials could become exposed on the seabed and thus pose a snagging risk which might impede commercial fishing operations in the immediate area.

Employment

The amount of employment supported by each of the options is directly correlated with the cost of each option. As the most expensive option, Option 1 would support more onshore and offshore jobs than Option 2, which in turn would support more jobs than Option 3.

Impacts on communities

Under Options 1 and 2, the greatest amount of material would be returned and would require transport, processing and recycling and/or disposal. Options 1 and 2 therefore have the greatest potential to impact onshore communities whereas Option 3 has the least potential to do so. In terms of impacts arising from onshore processing, Options 1 and 2 are identical; Option 1 has been assessed as the least preferred due to the mobilisation of extra equipment to the vessels but in reality, it is acknowledged that this is a small, incremental increase to onshore impacts.

Cost

Option 1 has been assessed to be the most expensive option since it would require the longest offshore programme and the use of an MFE. Option 2 would be somewhat cheaper since no excavation at all would be needed. Option 3, with the least amount of vessel time and minimal onshore disposal cost, is expected to be the least expensive of the options.



3.3.3 Conclusion

Excavation of the umbilical is technically feasible though it would require an extended duration with the commensurate increase in risk of equipment failure and/or waiting on weather delays.

Although the seabed and associated fauna in the vicinity of the umbilical would be expected to recover rapidly and fully from the reverse-reel of the umbilical, as described for PLU4562 in [1], the requirement to excavate the umbilical would disturb a greater volume of seabed sediment (i.e. to a depth of at least 0.75 m) and over a larger area due to the longer length of PLU6294. This increase in disturbance to both the surface and deeper sediments would result in greater impact than the impact arising from the long term and contained degradation of the umbilical in situ. The operational environmental impacts of Option 1 are therefore assessed to be disproportionate to the small potential environmental legacy effects in Option 3 if the line is fully buried under stable backfill. The excavation and removal of this line would also require the use of a larger vessel spread and the operations would be more complex and hence take longer, thereby increasing the gaseous emissions from the operations. As a result, Option 1 is the least preferred of the considered options.

In the leave in place option, Option 3, the disturbance to the seabed would be minimal and would affect only the upper layers of the seabed sediment. The offshore operations to remove the surface laid sections would be short and therefore emissions to the atmosphere would be limited. Some new manufacture would, theoretically, be required to replace the recyclable material left in situ. However, this is balanced against the large degree of disturbance to the seabed that would result if the umbilical had to be excavated prior to removal. Option 3 therefore represents the best balance between minimizing a potential but low safety risk to fishermen, minimizing risk to project personnel, and minimizing operational environmental impacts.

3.3.4 Contingency recommendation

This DP includes a contingency recommendation because the burial status of the umbilical PLU6294 is not known with certainty. Further information is expected very soon. If it were available now, we would perform a RAG assessment on the same three options presented in this DP. This contingency recommendation therefore anticipates this and attempts to reduce uncertainty and avoid the need to re-present this DP and repeat the consultation process on what would be essentially an identical DP.

Should our ongoing investigations indicate that the umbilical can be removed without excavation, the recommended option would be Option 2, complete removal without excavation. In such circumstances, the majority of the umbilical could be removed in a single operation, with minimal operational and legacy environmental impacts, thus eliminating all long-term safety and legacy concerns, and our long-term responsibility for monitoring and remediating this umbilical.



3.3.5 Outcome of Comparative Assessment

Pipeline or Group: PLU6294	
Recommended Option	Justification
OPRED Guidance Notes Option 7, Leave in situ	<p>Umbilical is already trenched and buried and is stable. No snagging hazards have been identified and the hydraulic fluids have been displaced from the hydraulic cores, disposed of onshore and replaced with seawater. Degradation products will therefore be limited to the umbilical components and predominantly remain within the trench, thus limiting potential environmental impact.</p> <p>If the 2023 survey confirms that the umbilical is buried to 0.75 m or more along its length, the umbilical is unlikely to be strong enough to withstand being pulled from the trench by reverse reeling alone; the trenched section would have to be excavated, for example using an MFE. This would cause significant seabed disturbance which would be disproportionate to the small potential environmental impact of leaving the umbilical to degrade in situ.</p>
Contingency Recommendation	Justification
OPRED Guidance Notes Option 1, Remove by reverse reeling	<p>Should our studies conclude that excavation is not required to permit removal, we would elect to remove the umbilical by reverse reeling. The section under the live pipelines would be recovered at a later date.</p> <p>The operational and legacy impacts of pulling the line through a shallow over-burden would be small. Removal would eliminate any potential long-term legacy environmental effects from degrading materials and eliminate any potential long-term safety risks to other users of the sea. All the umbilical material would be returned to shore for reuse, recycling or disposal, as appropriate.</p>



3.4 Pipeline Stabilisation Features

As described in Section 3.1, the only stabilisation features are the concrete mattresses, and all of them will be removed as detailed in Table 3-3, regardless of which option is approved.

Stabilisation features	Number	Option	Disposal Route
Concrete mattresses	Approx. 45	Full recovery It is intended that the mattresses will be recovered to shore. However, in the event of practical difficulties during the removal OPRED will be consulted and an alternative method of decommissioning will be examined through a comparative assessment.	Recover to shore for reuse or disposal. Note, if necessary and in suitable condition, the mattresses might be relocated to protect the cut ends at the trench transitions.

3.5 Waste Streams

The project has set a target to recycle and re-use at least 97% by weight of all the equipment and materials that is retrieved to shore.

As described for the sister umbilical PLU4562 in [1], the amounts of the different types of material within the umbilical PLU6294 is not known and for this reason PLU4562 was excluded from the overall pipeline inventory estimates in [1]. We therefore cannot predict how much of each type of material from PLU6294 will ultimately be reused, recycled or disposed of, only the weight returned to shore under the different options. The percentages of total materials presented below are based on the product unit weight of 25 kg/m, as described in Section 2.3.

PLU6294 is a flexible umbilical and does not contain any concrete. Of the associated concrete mattresses, 100% will be recovered and returned to shore regardless of the final decommissioning option approved for the umbilical.

In Option 3, where the surface laid sections only are recovered, approximately 18% of the umbilical materials will be returned to shore for reuse, recycling or disposal as appropriate; 82% will remain in situ to degrade. However, because the concrete mattresses represent the majority of the material associated with this scope, approximately 92% of the materials from the umbilical and the associated mattresses will be returned to shore for reuse, recycling or disposal.

If studies confirm the feasibility of Option 2 however, then 100% of the umbilical materials will be returned to shore for reuse, recycling and/or disposal as appropriate.

The waste arising from the recovery of PLU6294 and associated stabilisation features will be recovered as part of an amalgamated campaign with the Brent Field Pipelines DP [1] infrastructure.



Table 3-4: Waste Stream Management Methods	
Waste Stream	Removal and Disposal method
Umbilical contents	The hydraulic fluid was previously displaced and captured in waste tanks on Brent Alpha and returned to shore for disposal under CP/1234.
Steel/plastics/other materials	Removed to shore and recycled or disposed of as appropriate.
Concrete	Concrete mattresses will be recovered and transported to shore for reuse and/or disposal as appropriate.
NORM/LSA Scale	No NORM is expected to be present.
Asbestos	No asbestos is expected to be present.
Other hazardous wastes	Will be recovered to shore and disposed of under appropriate permit.
Onshore Dismantling sites	Appropriately licenced UK sites are to be used to receive recovered materials. No trans-frontier shipment of waste is planned.

Note: the umbilical severance device located on the NLGP SSIV end of the umbilical is believed to contain 25 g of explosive material. All necessary management procedures, permits and consents will be in place to ensure the safe handling, transportation and disposal of this device.



4 ENVIRONMENTAL SENSITIVITIES/POTENTIAL ENVIRONMENTAL IMPACTS & THEIR MANAGEMENT

4.1 Summary of Environmental Sensitivities

The potential environmental impacts of the approved Brent Field Pipelines DP [1] have been summarised in the Brent Field Environmental Appraisal [2]; however, these assessments were completed before PLU6294 was identified as a Shell umbilical.

In summary, no particularly environmentally sensitive habitats exist close to the Brent Field. The closest environmentally protected areas are the Pobie Bank Reef, a Site of Community Importance (SCI) located approximately 85 km south-west, and the NE Faroe Shetland Channel Marine Protected Area (MPA) located approximately 110 km to the north and west of the Field. There are no designated Special Areas of Conservation (SAC) close to the Brent Field.

Seabed communities in the general area are diverse and abundant but are not unique to the region. Seabed surveys have identified elevated concentrations of metals and hydrocarbons in the sediment around each Brent Field platform. The elevated concentrations are localised, with elevated THC concentrations detected in seabed samples for several hundred metres from the platforms; adverse effects from other pollutants are restricted to smaller areas. This is typical of North Sea facilities due to the historical discharge of drill cuttings contaminated by residual oil-based (and water-based) drilling fluids. Samples indicate that benthic fauna are significantly influenced locally at some locations around the platforms (typically less than 250 m from the platform), but at more than 500 m from the platforms, benthic communities were indicative of undisturbed conditions.

The Brent Field is a relatively small area located within larger spawning grounds used by cod, haddock, saithe, Norway pout, mackerel, sandeels and blue whiting. The area is considered to be low in terms of commercial fishery effort and value, and in terms of shipping density.

A number of marine mammal species have been observed in the Brent Field, including harbour porpoises (an Annex II species), white-sided dolphins, minke and killer whales and other species.

The overall vulnerability of seabirds to oil pollution in the Brent Field and surrounding blocks is considered to be 'low', however the months of January, March, July and between September to November show a 'high' seabird vulnerability in some blocks.

The decommissioning of PLU6294 will be supported by a Marine Licence³ which will detail the environmental sensitivities in the area and identify the impacts expected to arise from its decommissioning.

³ Permits for the 2023 decommissioning works at Brent are already in place under Master Application Template PLA/767. It is intended that the appropriate permits will be updated with the decommissioning of PLU6294.



5 INTERESTED PARTY CONSULTATIONS

Table 5-1: Pipeline Being Decommissioned		
Consultee	Comment	Response
Informal Stakeholder Consultations		
SFF	Advised of emerging scope with PLU6294 and that a mini-DP for this scope was being prepared and would be issued for an expedited consultation shortly.	The SFF had no initial concerns with the proposed scope, but that a full review of the mini-DP will be performed once received.
Statutory Consultations		
National Federation of Fishermen's Organisation	No comments received	Not applicable.
Scottish Fishermen's Federation	<p>"The SFF appreciate the need for further depth of cover survey of the trenched and buried section of the umbilical to determine the feasibility of Option 2 (Complete Removal by Reverse Reeling without Excavation), and the challenges associated with undertaking Option 1 (Complete Removal by Reverse Reeling with Excavation). In addition, we thoroughly understand the reasons for suitability of Option 3 (Leave in Place with Remediation) for the project. However, considering the legacy issues and the potential snagging hazards that the trenched and buried section of the umbilical (PLU6294) would create for the fishing vessels, SFF's preferred options are 'Option 1 and Option 2', the total removal of the umbilical. Where any of the option 1 or 2 are adopted, we would recommend mechanical backfilling of the trench followed by overtrawl sweeps to ensure no snagging hazard is left behind on the seabed to fishing vessels."</p>	<p>As you note, should the depth of cover survey confirm that reverse-reeling without excavation is feasible, then this would be our preferred decommissioning solution for this umbilical thus removing any legacy risk to fishermen. We do not anticipate any residual indentation or collapsed trench should the umbilical be successfully removed, both because of the sediments in the area and the small diameter of the umbilical itself requiring minimal disturbance in Option 2; however, this will be confirmed at the end of the removal operation and any remedial action taken.</p>



	<p>“Regarding concrete mattress, we appreciate Shell UK’s plan for total removal of the concrete mattresses. We would take this opportunity to make the point that if any section of concrete mattress is found to be uncovered, then our recommendation would be for such localities to be spot rock dumped.”</p>	<p>Any visible concrete mattress will be removed. However, we have noted that should there be risk to full removal due to any lack the integrity, the SFF preference would be for appropriately graded and profiled rock cover to be used. We will relay this preference to OPRED should such discussions be required.</p>
	<p>“As you will be aware, any pipelines and associated materials 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.”</p>	<p>As above.</p>
	<p>“Given past experiences of both abandoned wellhead and oil and gas field decommissioning works, the SFF would take the opportunity to reaffirm that it has serious reservations regarding the use of survey data to verify that an area is safe for fishing activity to resume following decommissioning activity. It is our view that the undertaking of trawl verification sweeps under controlled conditions, which replicated the fishing operations that will be permitted in the area following the decommissioning work, is the best method of establishing that it is safe for fishing to resume in said area.”</p>	<p>We understand the SFF position on recommending the areas be over-trawled to ensure no hazards to fishing or fishing gear remain. Although our current intention is to use debris surveys along pipeline corridors, we are planning to conduct over-trawls within each of the Brent platform structure 500m zones. This intention applies to the Brent Alpha footings, despite the 500m zone having been removed and will also cover a portion of PLU6294.</p>
<p>Northern Ireland Fish Producers Organisation</p>	<p>No comments received</p>	<p>Not applicable.</p>
<p>Global Marine Systems Limited</p>	<p>“Please can you advise where the nearest telecommunication cable is to the proposed works”</p>	<p>The closest cable is the CANTAT 3, which lies approximately 65km north-east from PLU6294. As such, we would not expect any impact to</p>



		the cable.
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6 PROGRAMME MANAGEMENT

6.1 Project Management and Verification

The decommissioning of the Brent Field pipelines and umbilicals is being undertaken in a staged campaign over a number of years. The 2023 campaign to remove subsea structures, and selected pipelines and umbilicals, in accordance with the approved DP [1] is currently underway. The campaign has the appropriate vessels and equipment mobilised in the field to execute the proposed decommissioning solution for PLU6294, if this is approved. This campaign also intends to recover the Brent Alpha splitter box to which PLU6294 is currently connected, and to undertake a depth-of-cover survey for the trenched and buried section of PLU6294.

If this DP is approved by OPRED, it is intended that the decommissioning of PLU6294, beyond the disconnection from the Brent Alpha splitter box (i.e. the recovery of the surface laid sections and associated mattresses and/or reverse reeling of the umbilical without excavation) will be the subject of a Variation Order (VO) with the existing sub-contractor and the existing execution, monitoring and reporting procedures and the required permits and consents will be updated to allow the partial removal of PLU6294.

As with the overall campaign, should any problems with the planned execution be encountered, these will be discussed with OPRED.

6.2 Post-Decommissioning Debris Clearance and Verification

After the removal of the surface laid sections of PLU6294 or the whole umbilical (except for the section under the currently live pipelines), an as-left survey will be carried out within a 100 m corridor (50 m either side) of the full umbilical route. At the end of all the operations to decommission the Brent Field pipelines, umbilicals and subsea structures, we will locate and remove all items of oil and gas debris that would pose a snagging risk to other users of the sea, within a 100 m wide corridor centred on each pipeline and at the former locations of the four subsea structures. It is anticipated that most of these items will be historical items of debris and already surveyed and mapped, but any items of debris that have accidentally arisen as a result of the permitted decommissioning operations will also be recovered.

All operations to remove debris will be performed from vessels. It is most likely that all the vessel-based operations to remove debris will be conducted in one or more 'campaigns' when the work for all Brent platforms (separate DP approval) and pipelines has been completed.

Debris items will be removed using a combination of ROVs, baskets and vessel cranes, and the programme may extend over more than one season. All the recovered debris will be returned to shore for recycling or disposal as appropriate.

On completion of the entire scope of work to complete the Brent Field Pipelines DP [1] and this standalone DP for PLU6294, verification of a clear seabed will be obtained by surveying the pipeline and umbilical corridors.



6.3 Schedule

Subject to the approval of this Decommissioning Programme, Shell will seek to include this scope within an ongoing aggregated campaign of subsea decommissioning at the Brent Field (Figure 6-1). Therefore, it is expected that the partial removal scope and as-left survey indicated in the sections above will be executed during the current campaign, thus realising the synergies for the scope with the ongoing works in 2023.

Debris clearance, seabed clearance verification, post-decommissioning environmental survey and post-decommissioning monitoring surveys will be combined with the same activities being undertaken for the Brent Field Pipelines Decommissioning Programme [1].

Figure 6-1: Proposed schedule

PLU6294 - Execution	2023				2036	2037	2038	2039
	Sep	Oct	Nov	Dec				
Milestones	 Disconnect Umbilical Splitter Box at Brent Alpha (Current SID Scope)							
Decommissioning	 Decommission PLU6294 incl Debris Removal				 Decommission Section PLU6294 under Live Lines			

6.4 Costs

Costs will be communicated to OPRED separately.



6.5 Close Out

As required by OPRED, a close out report will be submitted to OPRED within 1 year of the completion of all Brent Field offshore execution work, verification and the first post-decommissioning environmental survey.

The decommissioning of the Brent Field Pipelines has and will continue to be executed in stages over a number of years and as such, it has been agreed with OPRED that regular Progress Reports will be submitted as work progresses. It is proposed that following approval of this standalone DP for PLU6294, all activities related to the decommissioning, verification and monitoring of PLU6294 shall be incorporated into the overall Brent Field Pipelines Progress Reports and final Close Out report.

6.6 Post-Decommissioning Monitoring and Evaluation

A post-decommissioning environmental survey will be conducted when offshore work has been completed for the whole Brent Field (including the pipelines, umbilicals and subsea structures), debris removed, and the debris sweep successfully carried out. The survey will re-visit all the stations sampled in the two pre-decommissioning baseline surveys, to obtain a directly comparable set of data which would allow us to determine with a high degree of certainty if the offshore operations have had any impacts on the local environment.

The scope and timing of a second post-decommissioning environmental survey will be discussed and agreed with OPRED.



7 SUPPORTING DOCUMENTS

Table 7-1: Supporting Documents	
<i>Document Number</i>	<i>Title</i>
1	Brent Field Pipelines Decommissioning Programme, BDE-F-PIP-AA-5880-00002
2	Brent Decommissioning Programmes Environmental Appraisal, BDE-F-GEN-HE-0702-00006

These documents are available as follows:

1. At the Shell website at <https://www.shell.co.uk/sustainability/decommissioning/brent-field-decommissioning/brent-field-decommissioning-programme.html>
2. Electronic copies may be requested by emailing SUKEP-Shell-Decommissioning-Correspondence@shell.com or by writing to Decommissioning Business Opportunity Manager, Decommissioning Strategy, Shell U.K. Limited, The Silver Fin Building, 455 Union Street, Aberdeen, AB11 6DB



8 PARTNER LETTER OF SUPPORT

Esso Exploration and Production UK Limited
Correspondence:
john.gillies@exxonmobil.com



Fiona Livingstone
Department for Business, Energy and Industrial Strategy
Offshore Decommissioning Unit
AB1 Building, 3rd Floor
Crimon Place
Aberdeen
AB10 1BJ

12th September 2023

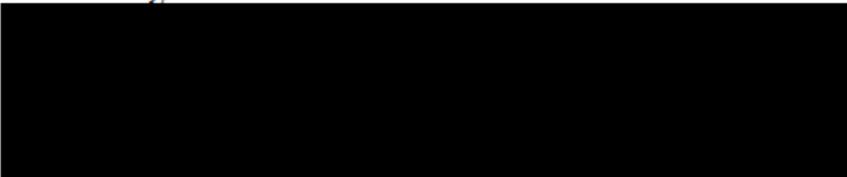
Dear Fiona,

Petroleum Act 1998
Brent PLU6294 – Offshore Pipeline

Further to your letter dated 6 September 2023 regarding the decommissioning of PLU6294 in the Brent Field, this letter confirms that Shell U.K. Limited as Brent Field Operator is authorised to submit a decommissioning programme for approval as directed by the Secretary of State on behalf of the current equity holders.

Esso Exploration and Production UK Limited confirms support for the proposals detailed and submitted by Shell U.K. Limited in so far as they relate to the facilities in respect of which we are required to submit an abandonment programme under Section 29 of the Petroleum Act 199

Yours faithfully,



Decommissioning Adviser
For and on behalf of Esso Exploration and Production U.K. Limited