



Offshore Decommissioning Unit

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FAO: Alex Mateo, Decommissioning Manager

16 October 2015

RE: ARTHUR FIELD DECOMMISSIONING PROGRAMME PETROLEUM ACT 1998

Dear Sir,

We, Perenco UK Limited, hereby submit an abandonment programme dated 15 October 2015 relating to the Arthur Field as directed by you on behalf of the Secretary of State on 14 October 2015.

The Arthur Field Decommissioning Programme is submitted on behalf of Section 29 Notice holder EOG Resources United Kingdom Limited as a requirement under section 29 of the Petroleum Act 1998.

Yours faithfully

Brian James
General Manager and Director
Perenco UK Limited

ARTHUR FIELD DECOMMISSIONING PROGRAMME



DOCUMENT CONTROL

Approvals

	Name	Signature	Date
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Reviewed by	Ying Wang Xavier		15 th Oct 2015
Approved by	Frederic De Meo		15 th Oct 2015

Revision Control

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0	Develop outline programme		30 th Aug., 2012
1	First draft		31 st Mar., 2013
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Distribution List

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Steve Holmes	EOG Resources United Kingdom Limited.	1
Alex Mateo	DECC	6

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A. LIST OF TERMS AND ABBREVIATIONS

Abbreviation	Explanation
CoP	Cessation of Production
DECC	Department of Energy and Climate Change
DPs	Decommissioning Programmes
DSV	Diving Support Vessel
ES	Environmental Statement
DSV	Diving Support Vessel
ESDV	Emergency Shut Down Valve
FPSO	Floating Production, Storage and Offloading System
HLV	Heavy Lift Vessel
LAT	Lowest Astronomical Tide
NUI	Normally Unattended Installation
OGUK	Oil & Gas UK
OSPAR	Oslo and Paris Convention
Perenco	Perenco (UK) Ltd
P & A	Plug and Abandonment
PL	Pipe Line
SLV	Sheer Leg Vessel
SNS	Southern North Sea
SWAT	Suspended Well Abandonment Tool
UKCS	UK Continental Shelf

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1. **EXECUTIVE SUMMARY**

1.1 **Combined Decommissioning Programmes**

This document contains two decommissioning programmes for (i) the Arthur Field installation and (ii) the Arthur Field Pipelines. A separate programme for each set of associated notices under Section 29 of the Petroleum Act 1998 is incorporated within this document.

Thames area Decommissioning Project activities include Thames Complex, Arthur, Gawain, Horne and Wren, Wissey, Thurne and Orwell work scopes. There may be constraints that require some fields for the well and facility decommissioning to be stand alone projects. There are separate Decommissioning Programmes associated with the whole Thames area Decommissioning

The Cessation of Production (CoP) date was 14th May 2014. The CoP documentation was approved by DECC.

PUK have explored all avenues for continuing production, these include the addition of offshore compression, greater liquid handling and subsea well stimulation. Therefore PUK concluded that due to reduction of gas production, operations were uneconomical so CoP was declared in preparation for decommissioning.

1.2 **Requirement for Decommissioning Programmes**

Installation: In accordance with the Petroleum Act 1998, Perenco (UK) Ltd as operator of the Arthur field which is part of Thames field complex and on behalf of the Section 29 notice holders of the Arthur field in the Block 53/2 (see Table 1.2) are applying to the Department of Energy and Climate Change (DECC) to obtain approval for decommissioning the installations detailed in Section 2 of this programme. (See also Section 8 - Partner(s) Letter(s) of Support).

Pipelines: In accordance with the Petroleum Act 1998, Perenco as operator of the Arthur export line to Thames PL2047, Arthur I Jumper Line PL2047/JP1, Arthur II Jumper Line PL2047/JP2, Arthur III Jumper Line PL2047/JP3 and Arthur control umbilical from Thames PLU2048, A1 to Manifold umbilical PLU2048/JP1, A2 to Manifold umbilical PLU2048/JP2 and A3 to Manifold umbilical PLU2048/JP3 (see Table 2.3) and on behalf of the Section 29 notice holders are applying to DECC to obtain approval for decommissioning the pipelines detailed in Section 2 of this document. (See also Section 8 – Partner(s) Letter(s) of Support).

In conjunction with public, stakeholder and regulatory consultation, the decommissioning programmes are submitted in compliance with national and international regulations and DECC guidelines. The schedule outlined in this document is for a five year decommissioning project plan due to begin in Quarter 3 2014.

1.3 Introduction

The Arthur field is located in the Southern North Sea on the United Kingdom Continental Shelf (UKCS), approximately 42 kilometres East of Bacton Terminal off the coast of Norfolk and 28 kilometres South West of the Thames field. The Arthur field straddles UKCS Block 53/1d and 53/2b.

The Arthur field discovery well, 53/2-11 (ART-1), was drilled in 2003 and encountered a 198 ft TVD gas column with an original GWC at -6221ft TVDSS near the northern margin of a NW/SE trending horst block. Field development began in 2003 with completion of the 53/2-11 well, followed in 2004 and 2005 by the 53/2-12 (ART-2) and 53/2-13/13z (ART-3). ART-2 produced from a separate accumulation.

The Arthur flowlines deliver wet gas to the Thames platform. The Arthur field is produced only by three subsea wells. Each well is tied back to a subsea manifold and then by a single flowline to the Thames platform.

Arthur Field decommissioning project activities will be integrated with Thames, Gawain, Horne and Wren, Wissey, Thurne and Orwell decommissioning activities to optimise efficiency. A joint Cessation of Production (COP) and Environmental Impact Assessment (EIA) document for the Arthur field and the wider Thames Area was submitted to DECC. Although efforts will be made to have a positive synergy between Arthur decommissioning and the wider Thames Area decommissioning, there may be constraints that may require the Arthur field (wells and other facilities) decommissioning to be stand alone projects, hence the Arthur Decommissioning Programme (DP) is still a standalone document.

The Cessation of Production (CoP) date was 14th May 2014. Perenco UK have explored all options for continuing production but concluded that none were viable, so the field is ready for decommissioning.

Following public, stakeholder and regulatory consultation, the decommissioning programme for the installation is submitted without derogation and in full compliance with DECCS guidelines. The decommissioning programme explains the principles of the removal activities and is supported by an environmental impact assessment.

1.4 Overview of Installation(s)/Pipeline(s) Being Decommissioned

1.4.1 Installation(s)

Table 1.1: Installation(s) Being Decommissioned					
Field Name	Arthur	Quad/Block	53/1a and 53/2	Number of Platforms	None
Distance from nearest UK coastline (km)	42	Distance to median (km)	290	Platform type	N/A
Number of Subsea Installation(s)	4	Number of Drill Cuttings Pile(s):	None	Topsides Weight (Te): Jacket Weight (Te):	N/A
Number of Wells: Platform: Subsea:	3 Subsea wells 1 Subsea manifold	Production Type (Oil / Gas / Conde)	Gas	Water Depth (m)	N/A

Table 1.2 Installation(s) Section 29 Notice Holders Details		
Section 29 Notice Holder(s)	Registration Number	Equity Interest (%)
Perenco UK Limited	04653066	70
EOG Resources United Kingdom Limited	04458621	30

1.4.2 Pipeline(s)

Table 1.3: Pipeline(s) Being Decommissioned		
Number of Pipeline(s)/ Umbilical(s)	4/4	(See Table 2.3)

Table 1.4: Pipeline(s) Section 29 Notice Holders Details		
Section 29 Notice Holder(s)	Registration Number	Equity Interest (%)
Perenco UK Limited	04653066	70
EOG Resources United Kingdom Limited	04458621	30

Note: EOG and PUK agreed that EOG's 30% equity would be assigned to PUK effective end 2012, but EOG remains liable for its 30% share of decommissioning costs

1.5 Summary of Proposed Decommissioning Programmes

Table 1.5: Summary of Decommissioning Programmes		
Selected Option	Reason for Selection	Proposed Decommissioning Solution
1. Topsides		
N/A		
2. Jackets		
N/A		
3. Subsea Installations		
Wellhead protection frames will be removed by HLV or crane vessel	To remove all seabed structures and leave a clean seabed. To comply with OSPAR requirements.	Wellhead protection frames will be removed along with the top sections of piles. Piles for wellhead protection structures will be severed below the seabed level at such a depth to ensure that any remains are unlikely to become uncovered. Piles will be severed at least -3.0m below the seabed. If any practical difficulties are encountered PUK will consult DECC
4. Pipelines, Flowlines & Umbilical		
Pipelines will be flushed and buried in-situ (Refer to Table 2.3)	Minimal seabed disturbance, lower energy usage, reduced risk to personnel engaged in activity. Pipelines are sufficiently buried and are stable.	The flowlines and umbilical will be left in situ, with the cut ends re-buried below the seabed level at such a depth to ensure that any remains are unlikely to become uncovered. Surveys indicate pipelines and umbilical will remain buried with flooding. Degradation will occur over a long period within seabed sediment and not expected to represent a hazard to other users of the sea.
5. Well Abandonment Operations		
Plug and abandoned to comply with the HSEs "Offshore Installations and Wells (Design and Construction, etc) Regulations 1996" and in accordance with O&GUK for the Suspension and Abandonment of Wells.	Meets DECC and HSE regulatory requirements.	A Master Application Template (MAT) and the supporting Subsidiary Application Template (SAT) will be submitted in support of works carried out. A PON 5 will also be submitted to DECC for application to abandon the Wells.
6. Drill Cuttings		
Leave in place to degrade naturally	Cuttings were widely dispersed and fall below OSPAR 2006/5 threshold	Left undisturbed on seabed
7. Interdependences		
Not applicable.		

1.6 Field Location/Layout and Adjacent Facilities

Figure 1.1: Field Location in UKCS

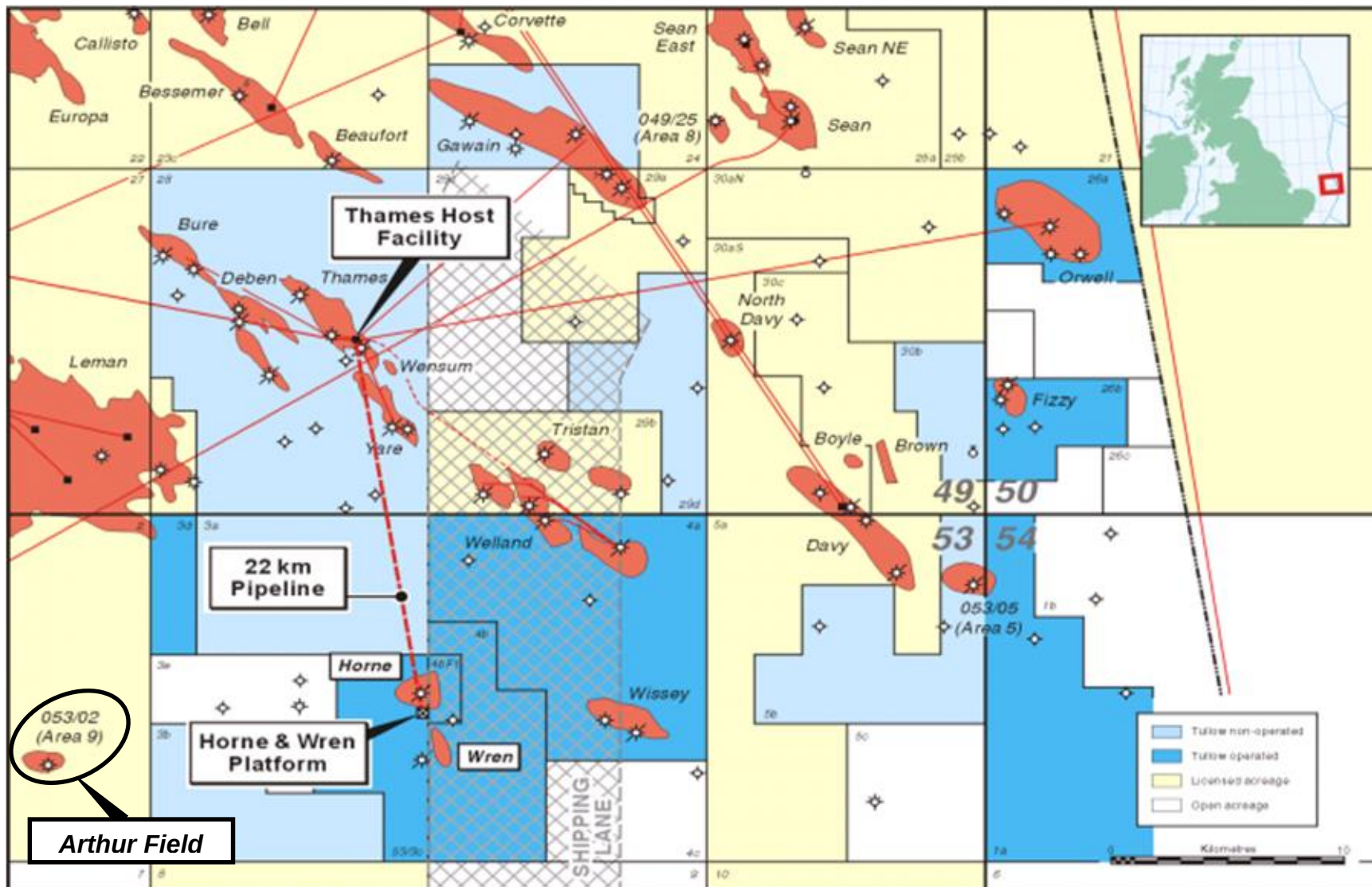
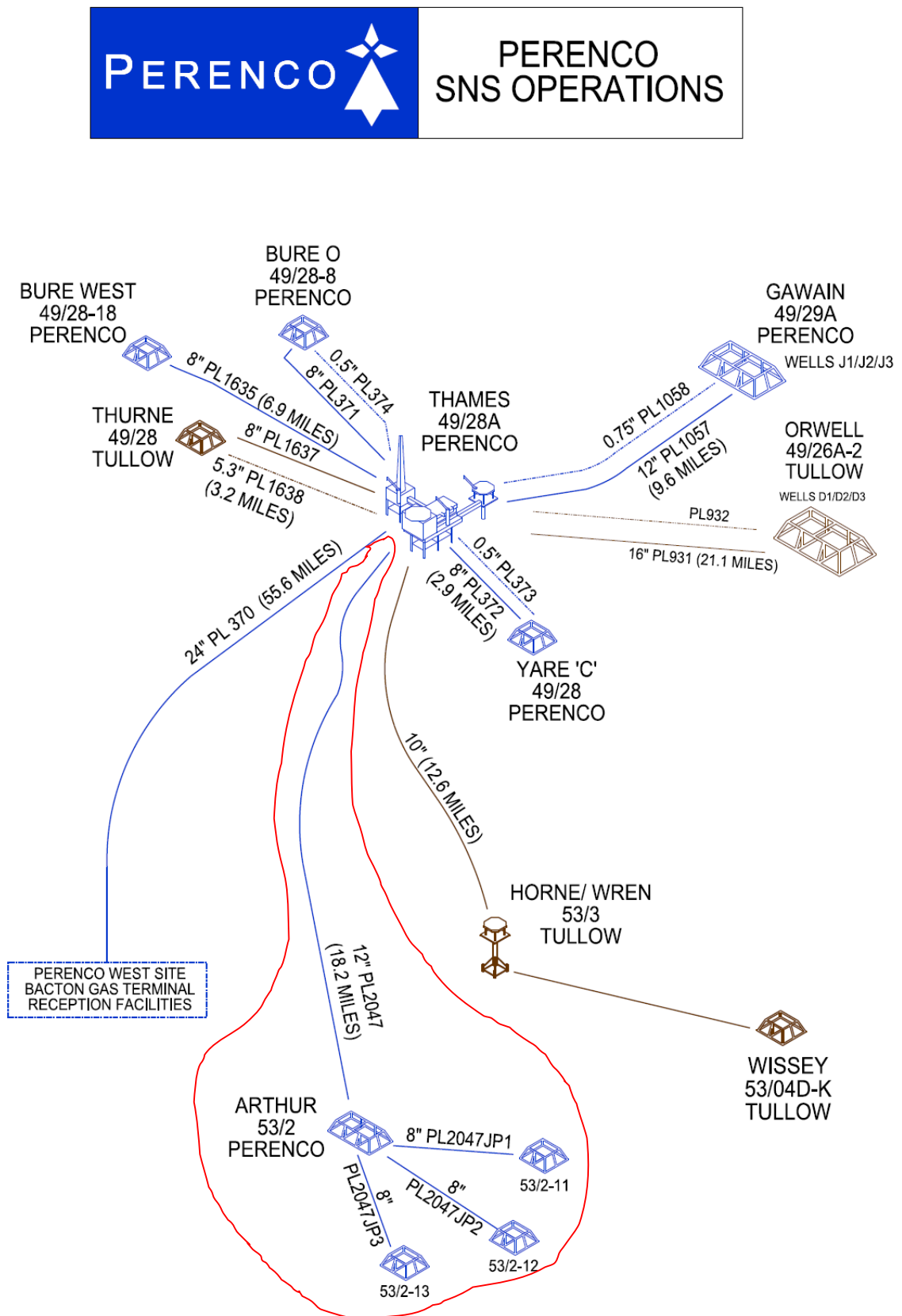


Figure 1.2: Field Layout



Key: Red line indicates the assets affected by this decommissioning programme

Note: Adjacent facilities refer to those potentially impacted by this programme (see DECC Guidance Notes for Industry: Version 6).

Table 1.6 List of Adjacent Facilities					
Owner	Name	Type	Distance/Direction	Information	Status
Perenco	Thames	Platforms	From Gawain well to Thames is 15.4km	Gas production from Gawain subsea wells flows into Thames AW platform	Operational
Tullow	Orwell	Subsea well	From Orwell well to Thames is 34km	Gas production from Orwell flows into Thames AW platform	Out of use
Tullow	Thurne	Subsea well	From Thurne well to Thames is 5.2km	Gas production from Thurne flows into Thames AR platform	Operational
Tullow	Horn &Wren	NUI	From Horn & Wren to Thames is 20.3km	Gas production from Horn & Wren flows into Thames AR platform	Operational
Tullow	Wissey	Subsea well	From Wissey to Thames is 30.9km	Gas production from Wissey flows into Horn & Wren NUI	Operational
Perenco	Arthur	Subsea well	From Arthur well to Thames is 29.3km	Gas production from Arthur flows into Thames AW platform	Operational
Perenco	Davy	NUI	From Davy platform to Thames is about 22km	Gas production from Davy flows into Inde 23A platform	Operational
Perenco	PL2047/ PL2048	Arthur flowline and umbilical	From Arthur manifold to Thames is 29km	Crosses over 1) PL 311; 30" Sean - Bacton (Shell) 2) redundant cable (Winterton to Spiekeroog) 3) telecom cable Norseia Com1 (Draupener to Lowestoft)	Operational

Note: The decommissioning of the above mentioned pipelines will have no impact on adjacent facilities.

[illegible]

1.7 Industrial Implications

Pipeline cleaning (base case is to flush and clean from Thames complex back to individual fields. If this is not possible, the uncompleted scopes will be included in the DSV phase). The project includes the following key activities:

- DSV (pipeline severance; decommissioning of stabilisation materials).
- Well Plugging & Abandonment.
- Removal of subsea well heads and well head protection structures.
- Removal of platforms and jackets

The above activities will need to be planned carefully to recognise synergies and efficiencies, however the engineering and planning will be completed to understand the possibilities of potential integration of various activities.

Strategically, suppliers with working vessels and assets on the UKCS will be favoured. All contracts will be competitively tendered or novated to either party.

Current operational contracts for items such as environmental permitting, potential vessel sharing and logistic support will be implemented to support decommissioning activities.

2. DESCRIPTION OF ITEMS TO BE DECOMMISSIONED

2.1 Surface Facilities (Topsides/Jacket(s)/FPSO etc)

Table 2.1: Surface Facilities Information								
Name	Facility Type*	Location ED50 Format	Topsides/Facilities		Jacket (if applicable)			
			Weight (Te)	No of modules	Weight (Te)	Number of Legs	Number of piles	Weight of piles (Te)
N/A	N/A							

2.2 Subsea Installations and Stabilisation Features

Table 2.2: Subsea Installations and Stabilisation Features				
Subsea installations and Stabilisation Features	Number	Size/Weight (Te)	Location(s) ED50 Format	Comments/ Status
Wellhead(s)	3	52.5	Arthur I Well 52° 54' 46.436" N 02° 14' 56.071" E	
			Arthur II Well 52° 53' 48.675" N 02° 17' 15.266" E	
			Arthur III Well 52° 54' 25.366" N 02° 13' 00.574" E	
Manifolds(s)	1	23	Arthur manifold 52° 54' 47.696" N 02° 14' 56.555" E	
Protection Frame(s)	4	355	Arthur manifold and each 3 wellheads	Piled – 24", 18.5m long
Concrete mattresses	58	87	Within 500m of each Arthur manifold and wells	Drawings enclosed
Fronnd Mats	49	73.5	Within 500m of each Arthur manifold and wells	Drawings enclosed
Rock Dump	2	5200	On PL2048 JP2 near Arthur 1 well 449 525.0 E 5862 950.0 N	

2.3 Pipelines/Flowlines/Umbilicals

Table 2.3: Pipeline/Flowline/Umbilical Information									
Description	Pipeline No. (as per PWA)	Diameter (inches)	Length (km)	Composition ¹	Contents ²	From – To End Points	Condition	Status ³	Contents ⁴
Arthur export line to Thames	PL2047	12	29.2	Steel	Gas	Arthur manifold to Thames AW	Trenched and buried, 80.34 metres exposed, No free spans	Operational	Hydrocarbons
Arthur I Jumper Line	PL2047/JP1	8	0.07	Steel	Gas	A1 subsea well to manifold	Trenched and buried, No exposed lines, No free spans	Operational	Hydrocarbons
Arthur II Jumper Line	PL2047/JP2	8	3.3	Flexible pipe	Gas	A2 subsea well to manifold	Trenched and buried, No exposed lines, No free spans	Operational	Hydrocarbons
Arthur III Jumper Line	PL2047/JP3	8	2.6	Flexible pipe	Gas	A3 subsea well to manifold	Trenched and buried, No exposed lines, No free spans	Out of use	Hydrocarbons
Arthur control umbilical from Thames	PLU2048	6	29.2	Umbilical	Chemicals	Thames AR to Arthur manifold	Trenched and buried, 240.78 metres exposed, 1 free span, length of free span 4.75 meters	Operational	Chemicals in line
A1 - Manifold umbilical	PLU2048/JP1	3	0.07	Umbilical	Chemicals	A1 manifold to A1 subsea well	Trenched and buried, No exposed lines, No free spans	Operational	Chemicals in line

Table 2.3: Pipeline/Flowline/Umbilical Information – cont'd

Description	Pipeline No. (as per PWA)	Diameter (inches)	Length (km)	Composition ¹	Contents ²	From – To End Points	Condition	Status ³	Contents ⁴
A2 - Manifold umbilical	PLU2048/JP2	3	3.3	Umbilical	Chemicals	A2 manifold to A2 subsea well	Trenched and buried, 178.09 metres exposed, 3 free spans, total length of free spans 14.0 meters	Operational	Chemicals in line
A3 - Manifold umbilical	PLU2048/JP3	3	2.6	Umbilical	Chemicals	A3 manifold to A3 subsea well	Trenched and buried, 4.64 metres exposed, No free spans	Out of use	Chemicals in line

¹ e.g. Concrete; Steel; umbilical; Flexible; Bundle

² e.g. Oil; Gas; Water; Chemicals

³ e.g. Operational; Out-of-use; Interim pipeline Regime

⁴ e.g. Cleaned; Flushed; Hydrocarbons and/or Chemicals in line

Table 2.4: Subsea Pipeline Stabilisation Features				
Stabilisation Feature	Number	Weight (Te)	Location(s)	Comments/ Status
Concrete mattresses	99	148.5	Flowlines to/from Arthur manifold and each of the 3 wellheads	Drawings enclosed
Formwork	1	42	Crossing between PL 2047 and Shell PL 311	Drawings enclosed
Frond Mats	62	93	Flowlines to/from Arthur manifold and each of the 3 wellheads	Drawings enclosed
Rock Dump	1	2600	On PL 2047 near Thames AW	

2.4 Wells

Table 2.5 Well Information			
Platform Wells	Designation 1	Status	Category of Well
N/A			
Subsea Wells			
53/2-11 (A1)	Gas Production	Producing	SS-3-3-3
53/2-12 (A2)	Gas Production	Producing	SS-3-3-3
53/2-13 (A3)	Gas Production	Loss of Communication	SS-3-3-3

Category of well as per OGUK Guidelines for the suspension and abandonment of wells, Issue 4, July 2012.

2.5 Drill Cuttings

There are no drill cuttings piles associated with the installation in the area. Drill cuttings that were generated during drilling activity have been distributed widely during drilling due to the local currents. Although there is no evidence of drill cuttings in the immediate vicinity of the wells, Perenco will be carrying out sea bed sampling to verify the absence of cutting debris that may affect the environment.

Should any evidence of drill cuttings be discovered, Perenco will contact DECC to review findings and extent and agree any necessary remedial actions.

2.6 Inventory Estimates

Figure 2.1: Pie Chart of Estimated Inventories (Installations)

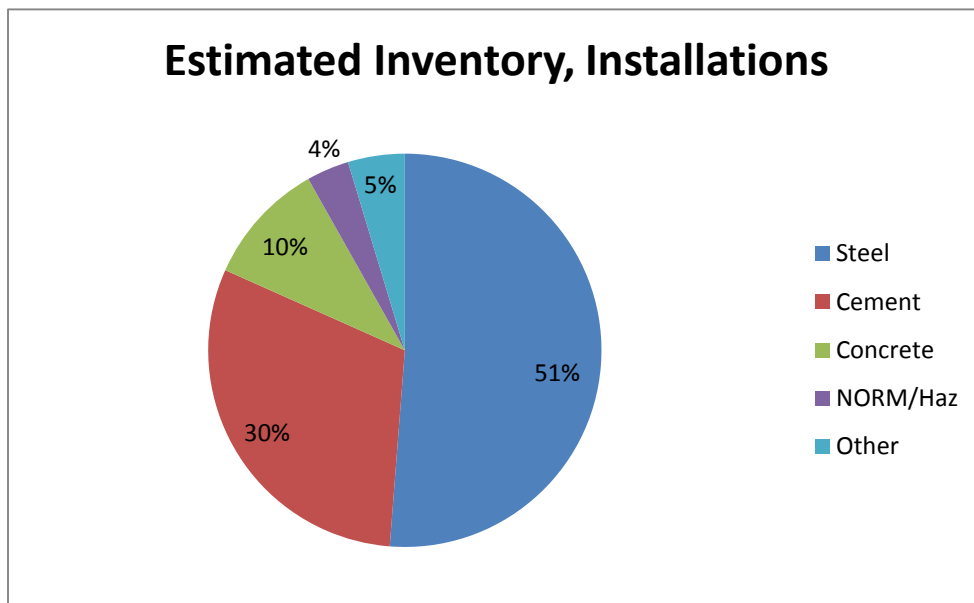
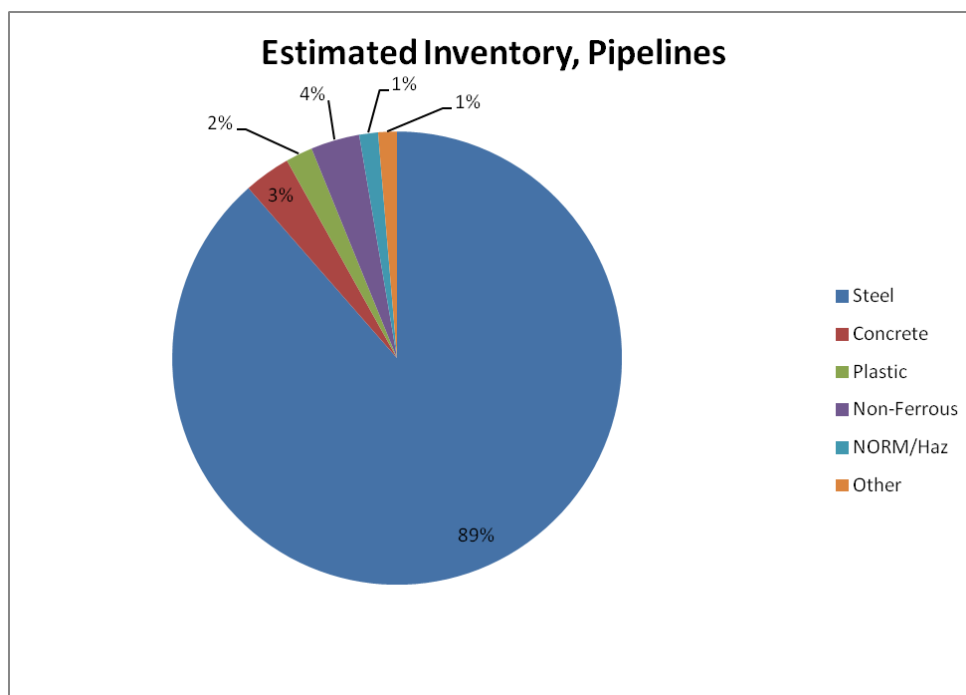


Figure 2.2: Pie Chart of Estimated Inventory (Pipelines)



Estimated Total Weight of Thames, including Arthur installation and pipelines is 86,412 tonnes

3. REMOVAL AND DISPOSAL METHODS

In line with the waste hierarchy, the re-use of an installation (or parts thereof) was first in the order of preferred decommissioning options for assessment. The proposed decommissioning options were developed through an extensive programme of continual assessment which included a comparative assessment process involving a multi-disciplinary team participating in a Comparative Assessment workshop and a preliminary Quantitative Risk Assessment (QRA) of the available decommissioning options.

3.1 Topsides

N/A

3.2 Jacket(s)

N/A

3.3 Subsea Installations and Stabilisation Features

All subsea installations will be removed to shore for disposal. Piles will be severed at least - 3.0m below the seabed. If any practical difficulties are encountered PUK will consult DECC. The means of cutting could be diamond wire, high pressure water jet abrasive cutting or by explosives.

It is intended that the mattresses should be recovered to shore, however in the event of practical difficulties DECC will be consulted and a Comparative Assessment submitted.

Table 3.1: Subsea Installation and Stabilisation Features Decommissioning		
Subsea installations and stabilisation features	Option	Disposal Route (if applicable)
Wellhead(s)	Remove	Transport ashore for disposal and recycling
Manifold(s)	Remove	Transport ashore for disposal and recycling
Protection Frame(s)	Remove	Transport ashore for disposal and recycling
Concrete mattresses	It is intended that the mattresses should be recovered to shore, however in the event of practical difficulties DECC will be consulted and a Comparative Assessment submitted	Transport ashore for disposal
Grout bags	All grout bags will be decommissioned in accordance with the current DECC Guidance notes (Version 6 , March 2011)	Transport ashore for disposal
Formwork	Assess integrity and burial depth. If it is buried leave in situ. Otherwise bury & leave in situ	Not applicable.
Froned Mats	All frond mats will be decommissioned in accordance with the current DECC Guidance notes (Version 6 , March 2011)	Transport ashore for disposal
Rock Dump	Leave in situ	Leave in situ

3.4 Pipelines/Flowlines/Umbilicals

Decommissioning Options:

Table 3.2: Pipeline or Pipeline Groups/Decommissioning Options			
Pipeline or Group (as per PWA)	Status of the line or characteristics of the pipeline group	Decommissioning Options considered	Whole or part of pipeline/group being decommissioned
PL2047	Buried	1,2,3,4,5	Whole pipeline
PL2047/JP1	Buried	1,2,3,4,5	Whole pipeline
PL2047/JP2	Buried	1,2,3,4,5	Whole pipeline
PL2047/JP3	Buried	1,2,3,4,5	Whole pipeline
PLU2048	Buried	1,2,3,4,5	Whole pipeline
PLU2048/JP1	Buried	1,2,3,4,5	Whole pipeline
PLU2048/JP2	Buried	1,2,3,4,5	Whole pipeline
PLU2048/JP3	Buried	1,2,3,4,5	Whole pipeline

Key to Options

- 1) Completely remove the line(s);
- 2) Trench and bury the exposed / uncovered areas of the line(s);
- 3) Rock dump the line in specific areas where the line is uncovered;
- 4) Partial removal of uncovered sections of the line;
- 5) Leave in situ with monitoring as agreed with DECC

Comparative Assessment Method:

The Comparative Assessment process involved a multi-disciplinary team participating in a Comparative Assessment workshop and a preliminary Quantitative Risk Assessment (QRA) of the available decommissioning options. At the Comparative Assessment workshop, each decommissioning option has been scored against a set of assessment criteria using categories derived from DECC guidance: 1. Safety; 2. Environmental; 3. Technical; 4. Societal; 5. Commercial. The Comparative Assessment can be found in Section 7, Supporting Documents, and Document 2.

The Comparative Assessment concluded the pipelines and umbilicals will be left in situ due to difficulty and cost to remove. They are predominantly trenched and buried. An agreement will be made with DECC on continuous monitoring of the pipelines.

Outcome of Comparative Assessment:

Table 3.3: Outcomes of Comparative Assessment		
Pipeline or Group	Recommended Option*	Justification
PL2047	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PL2047/JP1	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PL2047/JP2	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PL2047/JP3	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PLU2048	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PLU2048/JP1	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.
PLU2048/JP2	Option 5	Line is buried and will be safe to leave in situ (5). End sections will be removed & exposures/spans rectified as required. Continual monitoring will be performed to confirm pipeline remains buried.

Key to Options

- 1) Completely remove the line(s);
- 2) Trench and bury the exposed / uncovered areas of the line(s);
- 3) Rock dump the line in specific areas where the line is uncovered;
- 4) Partial removal of uncovered sections of the line;
- 5) Leave in situ with monitoring as agreed with DECC

3.5 Wells

Table 3.4: Well Plug and Abandonment

The wells which remain to be abandoned, as listed in Section 2.4 (Table 2.5) will be plugged and abandoned in accordance with Oil and Gas UK Guidelines for the suspension and abandonment of wells and a PON 5 will be submitted. A Master Application Template (MAT) and the supporting Subsidiary Application Template (SAT) application will be submitted in support of any such work that is to be carried out.

3.6 Drill Cuttings

Drill Cuttings Decommissioning Options: N/A
(Please refer to Section 2.5)

Comparative Assessment Method: N/A

Outcome of Comparative Assessment: N/A

3.7 Waste Streams

Table 3.5: Waste Stream Management Methods

Waste Stream	Removal and Disposal method
Bulk liquids	Removed from vessels and discharged to disposal wells or sent to Bacton via the export line for disposal. Vessels, pipework and sumps will be drained prior to removal to shore and shipped in accordance with maritime transportation guidelines. Package filtration equipment for disposal of liquids to sea may be utilised and relevant permits will be sought for such operations.
Marine growth	Removed offshore /onshore. Disposed of according to guidelines.
NORM/LSA Scale	Tests for NORM/LSA will occur offshore and will be dealt/disposed with according to guidelines and company policies.
Asbestos	Tests for asbestos will occur offshore and will be dealt/disposed with according to guidelines and company policies.
Other hazardous wastes	Detailed survey for other hazardous wastes will be undertaken offshore and will be dealt/disposed with according to guidelines and company policies.
Onshore Dismantling sites	Appropriate licensed sites will be selected. The chosen facility must demonstrate proven disposal track record and waste stream management throughout the deconstruction process and demonstrate their ability to deliver innovative recycling options.

Table 3.6 Inventory Disposition

	Total Inventory Tonnage	Planned tonnage to shore	Planned left in situ
Installations	591	431	160
Pipelines	5000	6	4995

4. ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Environmental Sensitivities

Table 4.1: Environmental Sensitivities	
Environmental Receptor	Main Features
Conservation interests	Marine Protected Areas (MPAs): The Thames Infrastructure overlaps with the boundaries of three MPAs described below: • Cromer Shoal Chalk Beds rMCZ (NG2); • Haisborough, Hammond and Winterton cSAC; • North Norfolk Sandbanks and Saturn Reef cSAC. Annex I Habitats: Annex I shallow sandbanks may be present along some of the pipeline routes along with discrete populations of <i>S. spinulosa</i> identified in the side scan sonar mosaic and using seabed imagery. Overall the site survey identified some areas of 'low' to 'moderate reefiness' but no areas of high reefiness which has previously been found at the Saturn Reef to the north of the Thames field (outside of the current working area). Therefore, the survey data indicates that Annex I habitats from <i>S. spinulosa</i> reefs. Annex II Species: The Annex II species that could be present in the vicinity of the Thames Decommissioning Area include: • Harbour porpoise (<i>Phocoena phocoena</i>); • Grey seal (<i>Halichoerus grypus</i>); • The harbour (or common) seal (<i>Phoca vitulina</i>).

Table 4.1: Environmental Sensitivities – cont'd	
Environmental Receptor	Main Features
Seabed	Seabed imagery found that much of the surveyed area comprised bare sand with some areas of gravel and shell fragments (CMACS, 2013). Side scan sonar data demonstrated that sand waves across large areas of the seabed. This indicates strong seabed and water column currents, and subsequently highly mobile sediments (CMACS, 2013) which is consistent with the southern North Sea in general. The results of the chemical testing indicate that the concentrations of the individual PAH compounds all fall below the laboratory detection limits. Similarly, the aliphatic and aromatic total petroleum hydrocarbon (TPH) compounds also fall beneath lab detection limits, along with the other organic compounds and phenols listed. The organic content of sediments was generally low, ranging from 0.47 per cent to 1.54 per cent, with no discernible trend across the survey area (CMACS, 2013). Of all the metal contaminants, only arsenic was present above Level 1 thresholds (Cefas L1 threshold is 20 ppm) at the majority of stations. Elevated levels of arsenic can occur following geological inputs and/or industrial discharge (CMACS, 2013). Cadmium was the only other metal found at concentration above the Level 1 threshold with 0.4 ppm. Barium was detectable at all stations sampled with levels of between 6 and 36 ppm across the sites and no evidence of any 'hotspots' of barium concentration (CMACS, 2013).
Fish	There are potential fish spawning area in ICES rectangles 34F1, 34F2, 35F, 35F2 and 35F3 for cod (<i>Gadus morhua</i>), herring (<i>Clupea harengus</i>), lemon sole (<i>Microstomus kitt</i>), mackerel (<i>Scomber scombrus</i>), <i>Nephrops</i>, plaice (<i>Pleuronectes platessa</i>), sandeels (<i>Ammodytidae</i>), sole (<i>Solea solea</i>), sprat (<i>Sprattus sprattus</i>) and whiting (<i>Merlangius merlangus</i>) (Coull et al., 1998; Ellis et al., 2012). In addition to the spawning grounds described above, the waters of ICES rectangles 34F1, 34F2, 35F1, 35F2 and 35F3 also act as nursery areas for cod, herring, horse mackerel (<i>Trachurus trachurus</i>), lemon sole, mackerel, <i>Nephrops</i>, plaice, sandeels, sole, sprat, thornback ray (<i>Raja clavata</i>), tope shark (<i>Galeorhinus galeus</i>) and whiting (Coull et al., 1998; Ellis et al., 2012).

Table 4.1: Environmental Sensitivities – cont'd	
Environmental Receptor	Main Features
Fisheries	Specific fishing effort and landings data for ICES Rectangles 34F1, 34F2, 35F1, 35F2 and 35F3 indicated that annual fish landings were greatest in 2010 for ICES Rectangle 35F3 (328.5 tonnes), 2011 for ICES Rectangles 34F1 (2,527.3 tonnes), 34F2 (411.1 tonnes), and 35F2 (217.8 tonnes) and in 2012 for ICES Rectangles 35F1 (886.8 tonnes). Conversely, annual fishing catches by tonnage were lowest during 2009 in ICES Rectangles 34F1 (93.3 tonnes) and 35F1 (326.6 tonnes), during 2008 in ICES Rectangle 34F2 (35.4 tonnes) and during 2012 in ICES Rectangles 35F2 (36.4 tonnes) and 35F3 (53.7 tonnes) (<i>Marine Scotland, 2013</i>). On the whole, fishing activity for this area is low throughout the year. When averaged, catches by weight (tonnes) between 2008 and 2012 were highest during March and April in ICES Rectangle 34F1, December in ICES Rectangle 34F2, March to July in ICES Rectangle 35F1, January in ICES Rectangle 35F2 and January and November in ICES Rectangle 35F3. Species which were routinely caught in higher quantities (tonnes) during 2012 in ICES Rectangle 34F1 were whelks (38%) and crabs (C.P. mixed sexes; 27%), in ICES Rectangle 34F2 were sprats (83%), in ICES Rectangle 35F1 were whelks (81%), in ICES Rectangle 35F2 were plaice (63%) and in ICES Rectangle 35F3 were plaice (59%) and sole (23%).
Marine Mammals	According to Reid et al. (2003) three species have been previously been sighted in the area around the Blocks of Interest. Harbour porpoise, White-beaked dolphins and minke whale.
Birds	Within these Blocks, seabird vulnerability generally peaks to high (2 out of 4 on the JNCC scale) during February, March and December. The Blocks containing only pipeline follow a similar trend. The highest seabird vulnerability on the JNCC ranked scale (1 out of 4) only occurs in Blocks 48/28 and 52/3 during October.
Onshore Communities	All waste produced during the Thames Area Decommissioning will be transferred to an onshore decommissioning and waste facility for processing. Perenco will ensure the chosen facility is fully regulated and licensed with current legislation.

Table 4.1: Environmental Sensitivities – cont'd	
Environmental Receptor	Main Features
Other Users of the Sea	Shipping: Shipping movements in the vicinity of Blocks of Interest are regarded as very high to low throughout the year. Blocks 49/29, 49/30 and 53/4 lie within a deep water route. Oil & Gas: Previously, there has been significant oil and gas activity within and around the Blocks of Interest; Military Activity: The Blocks of Interest do not lie within any marine military exercise areas. However, part of the pipeline PL370 does within a military low flying zone. Dredging and Dumping Activity: There are no offshore dredging sites within the Blocks of Interest. The nearest offshore dredging site is the Lowestoft Extension Aggregates Application site approximately 31 kilometres to the southwest of the Arthur 2 wellhead. Wind Farms: There are no active windfarms in close proximity to the Blocks of Interest. The nearest active wind farm site is the Round 2, Dudgeon East site approximately 32 kilometres to the north west of the Thames to Bacton (PL370) pipeline (Crown Estates, 2013). This site is in the consent/authorisation phase (4COffshore, 2013). Archaeology: There are two charted wreck sites located within the Blocks of Interest.
Atmosphere	Atmospherics emissions will be generated during the Thames Area Decommissioning operations. However, it is expected that the emissions will be localised to the area of release.

4.2 **Potential Environmental Impacts and their Management**

The Environmental Impact Assessment provides a review of the key features of the environment in the proposed Thames Decommissioning Programme Area which is located across thirteen (13) UKCS Blocks (48/28-30, 49/26-30, 50/26, 52/3, 53/2-4) in the southern North Sea (SNS).

A key consideration when planning and finalising the decommissioning of the Thames field infrastructure is a clear understanding of the surrounding environment. In order to understand the potential for the project to interact with the environment, so that appropriate controls can be adopted to mitigate negative impacts, the physical, biological and socio-economic environments have been assessed.

The assessment has been conducted on two different levels: from within the UKCS Blocks 48/28-30, 49/26-30, 50/26, 52/3, 53/2-4 and in the surrounding area encompassing them, including along the adjacent coastline of the east coast of England.

It is largely based on data provided in published information sources, including:

- The DECC (formerly DTI) Offshore Strategic Environmental Assessment (SEA) Reports (2002-2011);
- The UK Digital Marine Atlas (*UKDMAP, 1998*);
- Fisheries Sensitivity Maps in British Waters (*Coull et al., 1998*);
- Spawning and Nursery Grounds of Selected Fish Species in UK waters (*Ellis et al., 2012*);
- The JNCC Cetacean Atlas of Cetacean distribution in north-west European waters (*Reid et al., 2003*);
- Scientific Advice on Matters Related to the Management of Seal Populations by the Special Committee on Seals (*SCOS, 2012*);
- SCANS-II 2008 data (in *DECC, 2009*);
- Seabird Vulnerability in UK Waters (*JNCC, 1999*); and
- Fishing Effort and Quantity and Value of Landings by ICES Rectangle (Marine Scotland, 2008-2013);
- UK-DEAL (2012).

In addition to the above, Perenco has undertaken site specific geophysical, geotechnical and environmental (including Annex I habitat assessment) surveys within the proposed Thames Decommissioning Programme area (*Osiris Projects, 2013*), the results of which are discussed, where relevant, throughout this section of the ES.

Environmental Impact Assessment Summary:

Decommissioning project activities with the potential to cause environmental impacts were identified from discussions with the Perenco / Tullow project team, an informal scoping exercise with key stakeholders and from the EIA team's previous oil and gas EIA project experience.

Impacts associated with the Thames Area Decommissioning project have been grouped within the EIA under the following headings:

- Physical Presence;
- Seabed Impacts;
- Noise;
- Atmospheric Emissions;
- Marine Discharges;
- Unplanned Releases;
- Solid Wastes;
- Trans boundary Impacts;
- Cumulative Impacts.

Any relevant social-economic issues have been assessed within these sections.

In summary, all residual impacts are considered to be of minor significance, provided the proposed mitigation and management measures, as identified within the ES, are implemented during the Thames Area Decommissioning.

The exception to this is in the event of an accidental spill, where there would be a release of condensate from the pipeline or diesel fuel loss from the drilling rig / SLV; here the residual impact has been assessed as moderate. In addition, the assessment of potential cumulative impacts indicated that there would be no significant impacts and no significant trans boundary impacts are expected to occur as a result of the decommissioning operations.

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Overview:

Table 4.2 Environmental Impact Assessment Summary		
Activity	Main Impacts	Management
Topsides Removal	N/A	N/A
Jackets Removal	N/A	N/A

Table 4.2 Environmental Impact Assessment Summary – cont'd

Activity	Main Impacts	Management
Subsea Installations Removal	Energy use and atmospheric emissions Underwater noise Dropped object Accidental hydrocarbon release Production of waste Damage or loss of fishing gear Disturbance to the seabed	Vessels will be audited as part of selection and pre-mobilisation. Work programmes will be planned to optimise vessel time in the field. Offshore vessels will avoid concentrations of marine mammals. A post decommissioning debris survey will be conducted and any debris recovered. As part of the OPEP Perenco will have specialist oil spill response services provided by Oil Spill Response Ltd. (OSRL). Materials are reused and recycled where possible. Compliance with UK waste legislation and duty of care. Underwater cutting could be a potential source of sound, the operation of well-maintained equipment during decommissioning will ensure noise of operating machinery is kept as low as possible. Use of explosives underwater is expected to cause a significant source of sound. Use of explosives underwater is expected to cause a significant source of sound. Consultation with JNCC and DECC will occur before agreement on any operation. Perenco will also conform to 'JNCC guidelines for minimising the risk of injury to marine mammals from using explosives.' An MMO will be onboard the vessel during cutting and/or explosive operation. UK Hydrographical Office and Kingfisher will be informed of all activities.

Table 4.2 Environmental Impact Assessment Summary – cont'd

Activity	Main Impacts	Management
Decommissioning Pipelines (left in situ)	Energy use and atmospheric emissions Underwater noise Damage or loss of fishing gear Disturbance to seabed Dropped object Accidental hydrocarbon release	Pipelines have been pre-flushed with seawater and risk assessments will indicate the potential for any environmental impact. Pipeline ends and exposed areas will be buried in situ preventing the release of pipeline contents into the marine environment Rock placement will be deposited from a dedicated rock placement vessel. This will be applied for under a DEPCON application. Perenco will apply for a Marine Licence to cover the potential disturbance of the seabed. Perenco will ensure that disturbance is kept to a minimum during the operations. A post decommissioning debris survey will be conducted and any debris recovered. As part of the OPEP Perenco will have specialist oil spill response services provided by Oil Spill Response Ltd. (OSRL). Underwater cutting could be a potential source of sound, the operation of well-maintained equipment during decommissioning will ensure noise of operating machinery is kept as low as possible. An MMO will be onboard the vessel during cutting and/or explosive operation. UK Hydrographical Office and Kingfisher will be informed of all activities.

Table 4.2 Environmental Impact Assessment Summary – cont'd

Activity	Main Impacts	Management
Decommissioning Stabilisation Features	Energy use and atmospheric emissions Underwater noise Damage or loss of fishing gear Disturbance to seabed Dropped object Accidental hydrocarbon release	It is intended that the mattresses should be recovered to shore, however in the event of practical difficulties DECC will be consulted and a Comparative Assessment submitted.
Decommissioning Drill Cuttings	Long-term presence of hydrocarbons in sediments Leaching of hydrocarbons into the surrounding sediments and water column	There are no drill cuttings piles associated with the Arthur subsea installation in the area. Should any evidence of drill cuttings be discovered, Perenco will contact DECC to review findings and extent and agree any necessary remedial actions.

5 **INTERESTED PARTY CONSULTATIONS**

Consultations Summary:

Who	Comment	Response
INFORMAL CONSULTATIONS		
N/A	N/A	
STATUTORY CONSULTATIONS		
NFFO	The dismantling process or partially dismantled structures and associated equipment presents an ongoing danger to fishermen, therefore we would request Perenco ensure an arrangement is in place which constantly updates risk assessments based upon potential threat to other users, until the area has been deemed safe and free from any debris. Perenco UK to give consideration to providing a guard vessel at the location of the free span on pipeline PL 370 until it is rectified.	Perenco UK have previously notified Kingfisher / Fish Safe of this free span in accordance with their requirements. Perenco UK will keep the NFFO informed of any planned operations.
SFF	Given the location of the infrastructure and pipelines (southern North Sea), SFF would be in agreement with any comments and recommendations made on this decommissioning project by the National Federation of Fishermen's Organisation (NFFO).	Perenco UK will keep the SFF informed of any planned operations.
NIFPO	The field is outside the main area of operation for our members and as such we have no comment to make on the proposals.	NA.
Global Marine Systems	We don't have any specific comments on the programme of works itself as no cables should be directly affected in the immediate vicinity, and if any interaction was found to be necessary in the course of engineering the project, then Perenco UK should liaise with specific cable owners. Contact details and general cable information for any systems affected can be found using KIS-ORCA cable awareness charts/interactive map http://www.kis-orca.eu/map#.VPmDJHZFDIU . Global Marine Systems would recommend that when notice to mariners is arranged for the offshore works, then the Kingfisher fortnightly bulletin be updated to include details of the work, to inform sea users as well as notifying the relevant authorities and UKHO.	Perenco UK will keep Kingfisher informed of any planned operations.
Public	No concerns or objections were raised.	NA.

6. **PROGRAMME MANAGEMENT**

6.1 **Project Management and Verification**

A Perenco Project Management team will be appointed to manage suitable sub-contractors for the removal of the installation and execution of the Arthur Decommissioning Programme work scopes. Perenco standard procedures for operational control and hazard identification and management will be used. Where possible the work will be coordinated with other decommissioning operations in the SNS. Perenco will monitor and track the process of consents and the consultations required as part of this process. Any changes in detail to the offshore removal programme will be discussed with DECC.

6.2 **Post-Decommissioning Debris Clearance and Verification**

A post decommissioning site survey will be carried out around 500m radius of the installation sites and a 200m corridor along each existing pipeline route. Oil and gas seabed debris will be recovered for onshore disposal or recycling in line with existing disposal methods. Independent verification of seabed state will be obtained by trawling the platform area. This will be followed by a statement of clearance to all relevant governmental departments and non-governmental organisations.

6.3 **Schedule**

Project Plan:

Figure 6.1: Gantt Chart of Project Plan

The current Thames Decommissioning Project, including the Arthur installation & pipelines is a 5 year plan. The availability of the key vessels including the heavy lift vessel for removing Thames platforms and rig for wells plugging and abandonment drives the completion dates of the overall project.

	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018	Q4 2018
Pre-engineering / planning / resourcing / normal ops																				
Develop Decomm Prog & Dismantling SC & EIA																				
Subsea wells kill & clean interfield pipelines																				
Flush / pig / clean export pipeline to Bacton																				
Topsides engineering-down / piece-small																				
DSV pipelines disconnection																				
Subsea wells P&A campaign																				
Platform wells P&A rigless																				
Heavy lift removal bridges, topsides & jackets																				
Remove remaining subsea protection frames																				
Site clearance & post-activity surveys and close out report completion																				

6.4 **Costs**

Table 6.1 – Provisional Decommissioning Programme(s) costs	
Item	Estimated Cost (£m)
Platform(s) /Jacket(s) - Preparation / Removal and Disposal	0
Pipeline(s) and Umbilical(s) Infrastructure Decommissioning	3.4
Subsea Installation(s) and Stabilisation Feature(s)	3.5
Well Abandonment	33
Continuing Liability – Future Pipeline and Environmental Survey Requirements	0.2
TOTAL	44.1

6.5 **Close Out**

In accordance with the DECC Guidelines, a close out report will be submitted to DECC explaining any variations, from the Decommissioning Programme (normally within 4 months of the completion of the offshore decommissioning scope) including debris removal and independent verification of seabed clearance and the first post-decommissioning environmental survey.

6.6 **Post-Decommissioning Monitoring and Evaluation**

A post decommissioning environmental seabed survey, centred around sites of the Arthur subsea installation, will be carried out. The survey will focus on chemical and physical disturbances of the decommissioning and compared with the pre-decommissioning survey. Results of this survey will be available once the work is complete, with a copy forwarded to DECC. All pipeline routes and structure sites will be the subject of surveys when decommissioning activity has concluded. The survey will include the 200m corridor along the pipeline routes and 500m radius around the wellheads. After the surveys have been sent to DECC and reviewed, the post-decommissioning monitoring regime to be discussed and agreed with DECC

7 **SUPPORTING DOCUMENTS**

Table 7.1: Supporting Documents	
Document Number	Title
1	Environmental Statement
2	Comparative Assessment
3	THAMES PIPELINE SURVEYS - C13021b

8. PARTNER(S) LETTER(S) OF SUPPORT



EOG Resources
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Department of Energy & Climate Change
Offshore Decommissioning Unit
Atholl House
86-88 Guild Street
Aberdeen
AB11 6AR

16 October 2015

For the attention of: Alex Mateo, Decommissioning Manager

Dear Sir/Madam,

ARTHUR FIELD DECOMMISSIONING PROGRAMME

We, EOG Resources United Kingdom Limited, confirm that we have received and reviewed, and do support the proposals detailed in the Arthur Field decommissioning programme dated 15 October 2015, which will be submitted by Perenco UK Limited on behalf of the Arthur Owners, as required by section 29 of the Petroleum Act 1998.

Yours faithfully,

Adam Farrow
Country Manager - UK

For and on behalf of EOG Resources United Kingdom Limited

9. **APPENDIX**

Thames Field Layout(s)

