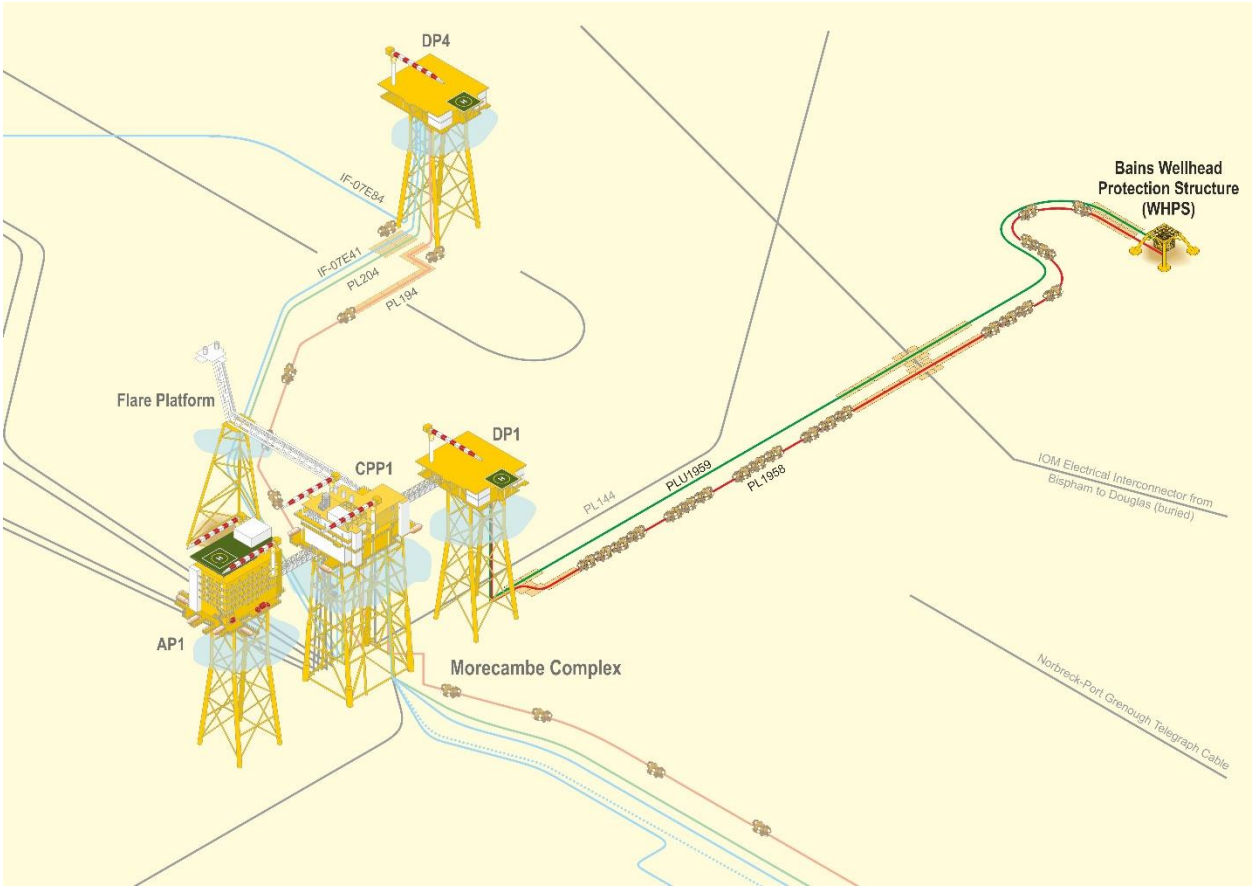
Bains Decommissioning Environmental Appraisal



SPIRIT ENERGY

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HOLD No.	DESCRIPTION	SECTION	ACTIONEE
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TABLE OF ACRONYMS

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
"	Inch (25.4mm)	mm	Millimetre
%	Percentage, parts per hundred	N/A	Not Applicable
(p)SPA	(proposed) Special Protection Area	NB	Nominal bore
BMS	Business Management System	Nm	Nautical mile
c.	circa (when referring to a distance or length)	NORM	Naturally Occurring Radioactive Material
CA	Comparative Assessment	OCR	Offshore Chemicals Regulations
CO_2	Carbon dioxide	OGUK	Oil and Gas UK
CPP	Central Processing Platform	OPEP	Oil Pollution Emergency Plan
CSV	Construction Support Vessel	OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
DP	Drilling Platform (as in DP1)	OSPAR	OSlo and PARis Convention
DSV	Dive Support Vessel	PAH	Polycyclic aromatic hydrocarbon
EA	Environmental Appraisal	PL, PLU	Pipeline/Umbilical Identification Numbers (UK)
EC	European Commission	pSAC	Proposed Special Area of Conservation
EIS	East Irish Sea	SEA	Strategic Environmental Assessment
EMS	Environmental Management System	SOPEP	Shipboard Oil Pollution Emergency Plan
EU	European Union	SSS	Side-Scan Sonar
ha	Hectare	Te	Tonne
HSE	Health and Safety Executive	THC	Total Hydrocarbon Content
ICES	International Council for the Exploration of the Sea	TOC	Total Organic Matter
IOM	Isle of Man	TOM	Total Organic Matter
ISO	International Standardisation Organisation	UK	United Kingdom
JNCC	Joint Nature Conservation Committee	UKCS	United Kingdom Continental Shelf
Km	Kilometre	WFD	Water Framework Directive
m	Metre	WHPS	Wellhead Protection Structure
MAT	Master Application Template	UK	United Kingdom

GLOSSARY OF TERMS

TERM	DESCRIPTION
Aspect	Element of an organisation activities, products or services that can interact with the environment (ISO 14001:2015).
Centrica	Spirit Energy
Exposure	A pipeline seen on the surface of the seabed but is not free-spanning.
FishSAFE	FishSAFE charts offshore surface and subsea oil and gas structures on the UK Continental Shelf (http://www.fishsafe.eu/en/home.aspx)
Flexible flowline	Pipeline manufactured from a mixture or composite materials and metals
Free span	A free span occurs when a pipeline or umbilical segment is not supported by the seabed.
Impact	Any change to the environment wholly or partially resulting from an operational activity environmental aspect (ISO 14001:2015).
Facilities	Collective term for the installation, flexible flowline and umbilical
Kingfisher Information Service	Kingfisher work with all the offshore industries, including oil and gas, subsea cable, renewable energy and marine aggregates to provide fishermen with two updates a year of the most accurate and up-to-date positions regarding subsea structures and the seabed.
Protection or Stabilisation features	Mattresses, gabion sacks, grout bags or rock deposited to perform a function of protection, support and or stabilisation depending on the location.
Scour	Erosion of the seabed caused by the flow of water around the pipeline or structure when in an area with a loose sedimentary material.
Spirit Energy	Spirit Energy Production UK Limited, wholly owned subsidiary of Spirit Energy Limited. In November 2017 Centrica Exploration and Production and Bayerngas formed a joint venture called Spirit Energy.
Spool pieces	Short sections of pipe that are typically flanged and bolted together (also known as pipespools).
Umbilical	Various cables or fluid tubes attached to a subsea Xmas tree to provide hydraulic or electrical control, or to inject chemicals.
Wellhead Protection Structure	Structure protecting wellheads, Xmas trees and piping manifolds inside.
Xmas tree	An assembly of valves, spools, pressure gauges and chokes fitted to the wellhead of a completed well to control production.

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1. EXECUTIVE SUMMARY

This summary outlines the findings of the Environmental Appraisal (EA) conducted by Spirit Energy Production UK Limited (Spirit Energy) for the proposed decommissioning of the Bains Field facilities (Bains) located in the East Irish Sea (EIS), Block 110/3c. Spirit Energy Production UK Limited is a wholly owned subsidiary of Spirit Energy Limited. Spirit Energy was formed in November 2017 by a joint venture between Centrica Exploration and Production and Bayerngas.

The assessment considers the potential for, and the significance of, environmental and socio-economic impacts resulting from the proposed decommissioning activities.

The appraisal concludes that the significance of planned impacts, following the adoption of control and mitigation measures, would be 'low'. The appraisal also assessed the significance of unplanned events concluding that the significance of all risks was low, with the exception of the risk associated with an unplanned (accidental) large hydrocarbon release as 'medium'. However the existing control and mitigation measures including the Oil Pollution Emergency Plan (OPEP) and marine procedures manage this risk to a level that is 'as low as reasonably practicable'.

This report and the Comparative Assessment (CA) report [44] support the Decommissioning Programmes [43].

1.1 Background to the project

In accordance with the Petroleum Act 1998, as operator of the Bains Field, Spirit Energy is applying to Offshore Petroleum for Environment and Decommissioning (OPRED) to obtain approval to decommission the following subsea facilities:

- The Bains installation WHPS (wellhead protection structure); and
- The associated pipelines PL1958 (flexible flowline) and PLU1959 (umbilical).

As part of the decommissioning Spirit Energy plans to completely remove and recover to shore for disposal;

- The wellhead protection structure (WHPS); and
- Gabion sacks, grout bags, and unburied fronded mattresses that protect the ends of the flexible flowline and umbilical at the WHPS and at Drilling Platform 1 (DP1).

The ends of the flexible flowline and umbilical that are not sufficiently buried by sediment or protected by buried mattresses at the WHPS and DP1 will be removed and recovered to shore for disposal. The buried flexible flowline and umbilical, buried fronded mattresses and deposited rock will be decommissioned *in situ*.

The adequacy of leaving buried fronded mattresses *in situ* will be tested by carrying out an over-trawl assessment. Unburied fronded mattresses that are recoverable and present a snagging hazard will be removed and recovered to shore for disposal. Should mattresses not be recoverable and should the over-trawl demonstrate that the fronded mattresses would pose a snagging hazard, it is proposed to implement contingency measures. This would involve depositing up to an estimated 350m^3 (520Te) of rock in the scoured area adjacent to the fronded mattresses.

A summary of the decommissioning activities for Bains is shown in Table 1.1.

ITEM	OPTION	METHOD
WHPS	Complete removal and recovery to shore.	The structures integrated suction piles will be removed by reverse installation, pumping seawater into the suction cans allowing them to be lifted (with the rest of the WHPS) from the seabed. Use of excavation tools (water-jetting and suction equipment) to allow access for cutting and the attachment of lifting equipment, as required.
PL1958	Removal of the end sections (DP1 and WHPS) that are not sufficiently buried. *In situ* decommissioning of the remainder of the flexible flowline which is sufficiently and stably buried under existing cover of a combination of sediment, deposited rock and fronded mattresses.	The end sections at the WHPS and DP1 will be cut using shears at the point at which they are sufficiently buried, lifted using grappling tools and recovered for onshore disposal. Use of excavation tools (water-jetting and suction equipment) to allow access for cutting and the attachment of lifting equipment, as required.
PLU1959	Removal of the end sections that are not sufficiently buried. *In situ* decommissioning of the remainder of the umbilical which is sufficiently and stably buried under existing cover of a combination of sediment and fronded mattresses.	As for PL1958, above.
Deposited rock	Decommissioning *in situ*.	No activity.
Gabion sacks and grout bags	Complete removal of gabion sacks and grout bags.	The features will be lifted using grappling tools from the seabed and recovered for onshore disposal. Local excavation using water-jetting or suction equipment may be required to allow access for removal.
Fronded mattresses	Complete removal of unburied fronded mattresses. Decommissioning *in situ* of buried fronded mattresses.	The items will be lifted from the seabed and recovered for onshore disposal. Should the over-trawl assessment show that they are a snagging hazard and they are not recoverable, rock will be deposited over fronded mattresses to allow decommissioning *in situ*.
Note: Onshore disposal or recovered items and features will be in accordance with the waste hierarchy.		

Table 1.1: Summary of Bains Decommissioning Activities

1.2 Impact assessment

The EA process presented in this report considers the impact of the planned activities associated with the decommissioning of the Bains facilities. Impact was determined by considering each of the planned activities and the characteristics of the receiving environment to categorise the significance of the interaction as either ‘low’, ‘medium’ or ‘high’. Following assessment, those activities that present an impact to the environment other than ‘low’ are assessed further, and appropriate control and mitigation measures identified to reduce the impact to a level that is ‘as low as reasonably practicable’.

The risks presented by unplanned (accidental) events were also considered in terms of their likelihood and their impact on the receiving environment. This provides a risk level of 'low', 'medium' or 'high'.

1.2.1 Summary of assessment

Following the EA process, it can be concluded that activities associated with the decommissioning of the Bains facilities are unlikely to have a significant impact on the environment or other sea users, for example shipping traffic and fishing, provided that suitable mitigation and control measures are effectively applied.

The impact which affects the largest area is that associated with the over-trawl assessment. The impact of this was originally assessed as 'medium'. However, given the existing fishing practices in the area, the short-term duration of the over-trawl assessment and the temporary nature of the impacts, after more detailed assessment the impact associated with the over-trawl assessment was assessed as 'low'.

The cumulative impact on the seabed resulting from all uses of the marine environment in the area was originally assessed as 'medium'. However, after more detailed assessment and given the distances to other marine uses and likely schedules for activity the cumulative impact on the seabed was assessed as 'low'.

The possible impact of a loss to sea of the entire hydrocarbon inventory of the DSV while at Bains was assessed. Due to Bains being within a potential extension to the Liverpool Bay / Bae Lerpwl pSPA the potential impact was assessed as 'medium'. This risk will be managed to a level that is 'as low as reasonably practicable' by following the existing OPEP which will be amended should the maximum inventory of the DSV be materially greater than the maximum inventory assessed in the OPEP currently.

Spirit Energy will adopt routine environmental management measures when carrying out the decommissioning activities.

1.2.2 Control and mitigation measures

A summary of proposed control and mitigation measures is shown in Table 1.2.

CONTROL AND MITIGATION MEASURES
General and Existing
• Lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate; • Vessels will be managed in accordance with Spirit Energy's existing marine procedures; • The vessels' work programme will be optimised to minimise vessel use; • The OPEP is one of the controls included in a comprehensive management and operational controls plan developed to minimise the likelihood of large hydrocarbon releases and to mitigate their impacts should they occur; • All vessels undertaking decommissioning activities will have an approved Shipboard Oil Pollution Emergency Plan (SOPEP); • Existing processes will be used for contactor management to assure and manage environmental impacts and risks; and • Spirit Energy management of change process will be followed should changes of scope be required.

CONTROL AND MITIGATION MEASURES
Seabed Disturbance
• All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised; • The careful planning, selection of equipment, and management and implementation of activities; • A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; • The area that requires and over-trawl assessment will be optimised through discussion with the relevant fishing organisations and the regulators.
Large Releases to Sea
• Releases will be managed under the existing OPEP. The OPEP will be updated with additional inventory, and additional measures identified and implemented, should modelling show increased risk.

Table 1.2: Summary of Proposed Control and Mitigation Measures

2. INTRODUCTION

2.1 Background

This EA report supports the Decommissioning Programmes [43] required by the OPRED for the proposed decommissioning of the Bains Field facilities (Bains).

The purpose of the EA is to assess the significance of the environmental impacts and risks associated with decommissioning, and to identify control and mitigation measures to reduce the level of these impacts and risks to 'as low as reasonably practicable'.

The Bains Field lies within the East Irish Sea (EIS) in UK Block 110/3c (Figure 2.1). The field lies approximately 26km due west of Blackpool in water depths of 18-27m LAT (Lowest Astronomical Tide).

The Bains Field was developed as a single well subsea tie-back and achieved first gas production in 2002. The Bains Field facilities are owned by Spirit Energy.

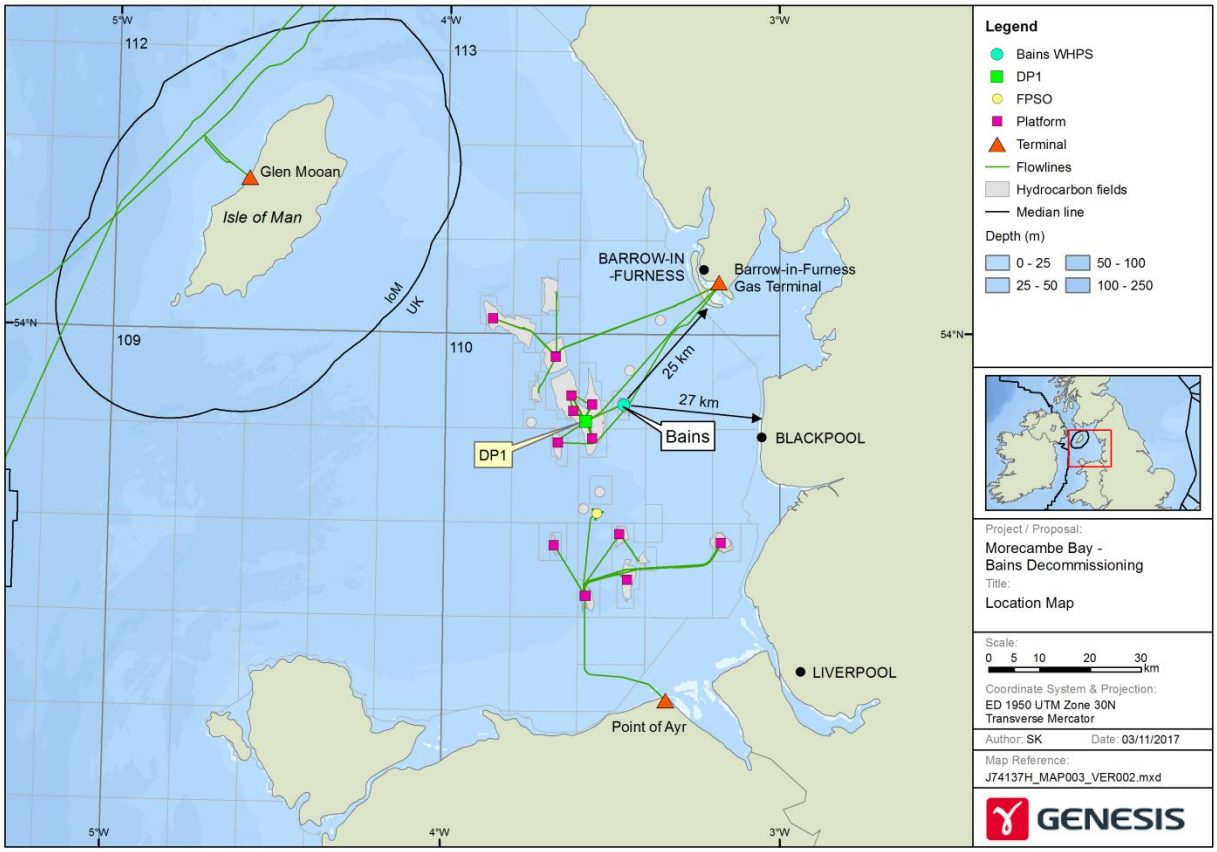


Figure 2.1: Location of the Bains Field in the East Irish Sea

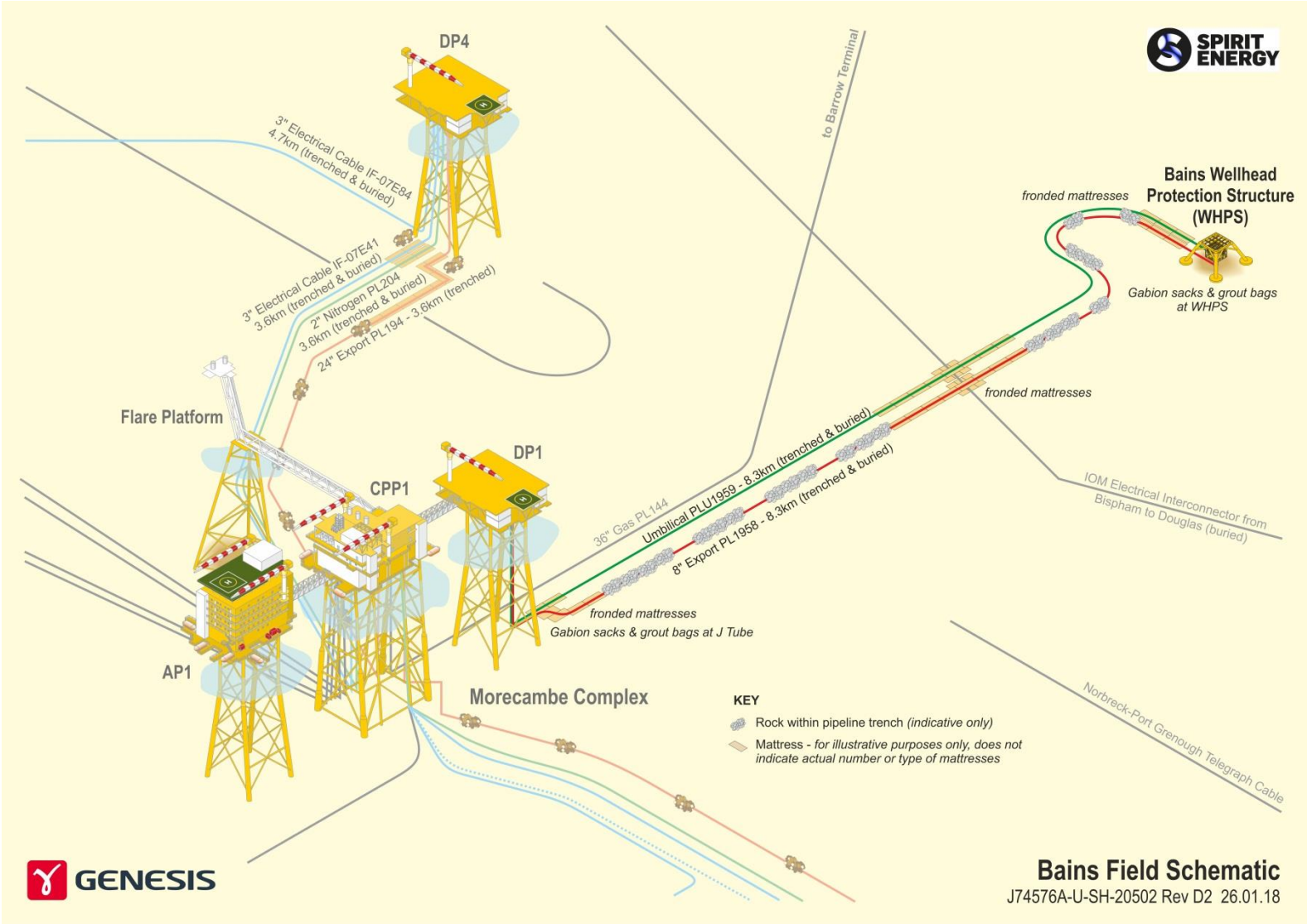


Figure 2.2: Bains Field Facilities

2.2 Boundaries to the decommissioning

The scope of this EA is aligned with the scope of the Decommissioning Programmes [43]. The level of detail presented and assessed in the EA is aligned with the level of engineering detail developed at the time of the preparation and submission. The scope covers the following:

- The Bains installation (wellhead protection structure); and
- The associated pipelines PL1958 (flexible flowline) and PLU1959 (umbilical).

The scope excludes well abandonment and preparatory works (Section 4.1).

The environmental impacts and risks associated with the Bains facilities during installation and production phases have been assessed and reported in the development Environmental Impact Statement [5], the Morecambe Hub OPEP [47] and the Master Application Template (MAT) for the South Morecambe Field [6].

2.3 Regulatory context

There is no requirement to undertake a statutory Environmental Impact Assessment (EIA) to support a Decommissioning Programme. However, OPRED requires that a Decommissioning Programme must be supported by an assessment of the potential environmental impacts and risks associated with the preferred decommissioning solution [31].

Spirit Energy manages environmental impacts via an International Standardisation Organisation (ISO) 14001 certified Environmental Management System (EMS). Decommissioning of Bains will be managed in accordance with the Spirit Energy EMS through to completion.

2.4 Stakeholder engagement

Stakeholder engagement including consultation is important throughout the decommissioning process. Informal responses received to date from stakeholders have been incorporated into this EA and are described in the Decommissioning Programmes [43], as appropriate.

2.4.1 Future consultation

The formal consultation process will begin with the submission of the draft Decommissioning Programmes, supported by this EA report, to OPRED. The process at this stage will include the use of the Spirit Energy's external website to make the documents publicly available.

2.5 Contractor management

Contractor management is one of the primary mechanisms for managing environmental impacts and risks. Spirit Energy will appoint a project management team to select and manage the operations of contractors. The team will ensure the decommissioning is executed safely in accordance with Spirit Energy Health and Safety principles, and safeguard the environment in line with the environmental policy [46]. Any change to the proposed decommissioning activities will be discussed with OPRED.

3. ENVIRONMENTAL APPRAISAL PROCESS

Activities are first reviewed to identify planned and unplanned (accidental) interactions with the environment (aspects). Using baseline environmental information to identify receptors, the environmental and socio-economic impact of planned aspects are then assessed using the method described in Spirit Energy's Guidance for Environmental Management in Capital Projects [Appendix B]. This evaluates the impacts (on a scale of 'low' to 'high' significance) as a function of their extent and duration (recovery time) given the application of industry routine control and mitigation measures.

The hierarchy of control and mitigation measures is to preferentially avoid, minimise, restore and finally offset adverse impacts to reduce them to a level that is 'as low as reasonably practicable' in line with Spirit Energy's Environmental Policy [46].

The environmental and socio-economic assessment risk (of impact) from unplanned aspects follows a similar process. Following the assessment of the impact, the risk of impact is determined by factoring in the likelihood of the aspect occurring using the Spirit Energy Risk Assessment Matrix [Appendix B].

Aspects with impacts or risks which have been categorised as of 'low' significance are not subject to further assessment (Section 5). Aspects with impacts or risks which have been categorised as of 'medium' or 'high' significance are assessed in more detail with additional control and mitigation being considered (Section 6).

The process is represented diagrammatically in Figure 3.1.

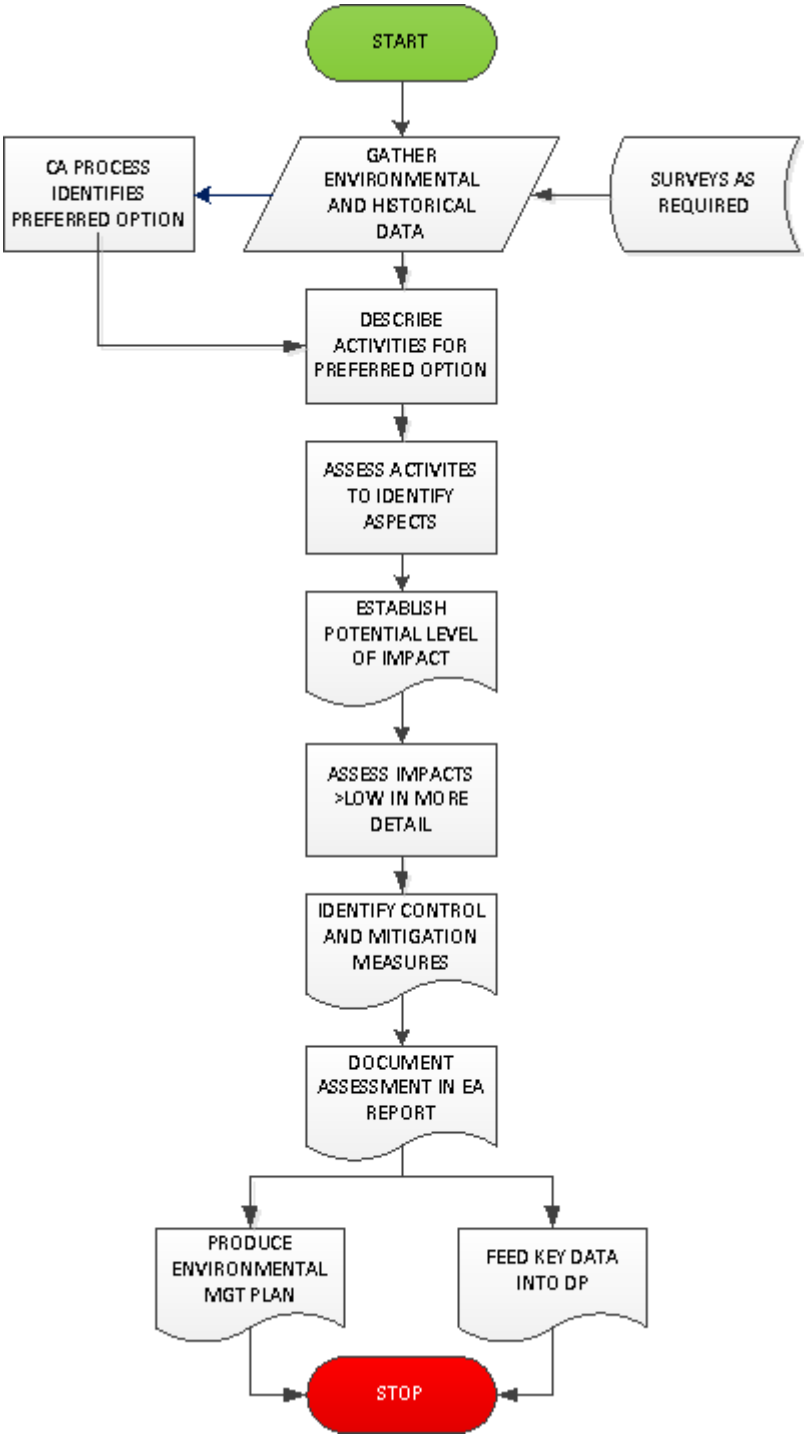


Figure 3.1: EA Process

4. PREFERRED DECOMMISSIONING SOLUTION

The preferred decommissioning solution is presented in the Decommissioning Programmes [43], Section 3.

The preferred decommissioning solution involves[1]:

- Complete removal and onshore disposal of the WHPS, gabion sacks and grout bags and exposed and recoverable fronded mattresses;
- *In situ* decommissioning of the buried flexible flowline, buried umbilical, buried fronded mattresses and deposited rock; and
- Removal and onshore disposal of the unburied flexible flowline and umbilical ends.

At the time of preparing this EA the detailed engineering required to define the methods for decommissioning had not been completed. Where more than one method could be used, that which presents the worst case potential environmental impact has been assessed.

4.1 Well abandonment and facilities preparatory works

The Bains well (110/3c-5) will be abandoned in compliance with Health and Safety Executive (HSE) regulations [17] and with Oil and Gas UK (OGUK) guidelines [36].

The preparatory works encompasses the cleaning of the facilities. The flexible flowline carried predominantly gas with small volumes of condensate and produced water which will have been removed by a method developed during detailed design and that will be agreed with OPRED using the environmental permitting process and associated consultation. It is likely that a combination of pigging and flushing will be used.

The methanol / corrosion inhibitor cores of PLU1959 will be flushed. The cores containing hydraulic fluid will not be flushed.

4.2 Bains facilities

The installation and pipelines covered under the Decommissioning Programmes are described in Table 4.1, Table 4.2 and Table 4.3. They are shown in Figure 2.2, Figure 4.1, Figure 4.3 and Figure 4.2.

ITEM	SIZE/WEIGHT (Te)
Wellhead (110/3c)	14.2
Xmas Tree	27.2
WHPS including piles	75.4

Table 4.1: Subsea Installations Including Stabilisation Features

[1] The preference for the flexible flowline and umbilical was determined via a Comparative Assessment [44].

ITEM	DIAMETER (NB) (INCHES)	LENGTH [2] (KM)	PRODUCT CONVEYED	FROM – TO END POINTS
Flexible flowline Gas pipeline PL1958	8	8.309 Trenched and buried.	Gas and condensate.	Xmas tree tie-in spool at Bains 110/3c to ESDV at top of riser at DP1.
Umbilical consisting of hydraulic hoses and electrical cables PLU1959	4	8.335 Trenched and buried.	Methanol, glycol, water.	Topside termination box at DP1 to Xmas tree stab plate at Bains 110/3c.

Table 4.2: Pipelines

STABILISATION FEATURE	TOTAL NUMBER	TOTAL WEIGHT (TE)	LOCATION(S)	EXPOSED/BURIED/CONDITION
Concrete mattresses (fronded)[3]	56	553.6	12 (PL1958) + 8 (PLU1959) 6m x 3m x 0.3m at DP1.	All fronded mattresses on approach to DP1 and Bispham to IOM Electrical Interconnector Crossing are buried and indistinguishable from the seabed. The situation at Bains is more complicated as the area is subject to scour. Parts of the fronded mattress concrete bases may be exposed.
			7+2 x 6m x 3m x 0.3m (PL1958) at Bispham/IOM cable crossing.	
			7+2 x 6m x 3m x 0.3m (PLU1959) at Bispham/IOM cable crossing.	
			9 (PL1958) + 9 (PLU1959) x 6m x 3m x 0.3m at Bains approach.	
Gabion sacks	11	10	3 at DP1 as support and protection for PLU1959.	Exposed.
			8 at Bains as support and protection for PL1958.	
Grout bags[4]	664	16.6	147 at DP1. 517 at Bains.	Exposed and mounted on top and at the side of the gabion sacks.
Deposited rock	N/A	10,294	Deposited throughout the length of PL1958 in >7m long sections at 20m intervals.	Buried under seabed sediment within the trench.

Table 4.3: Subsea Pipeline Stabilisation Features

[2] Initial 59m length is within J tube on DP1, not on seabed.

[3] See Figure 4.1, Figure 4.2 and Figure 4.3 for locations

[4] The number of grout bags has been estimated using available data including sketches and as-built drawings. There is a large element of uncertainty associated with the exact numbers quoted.

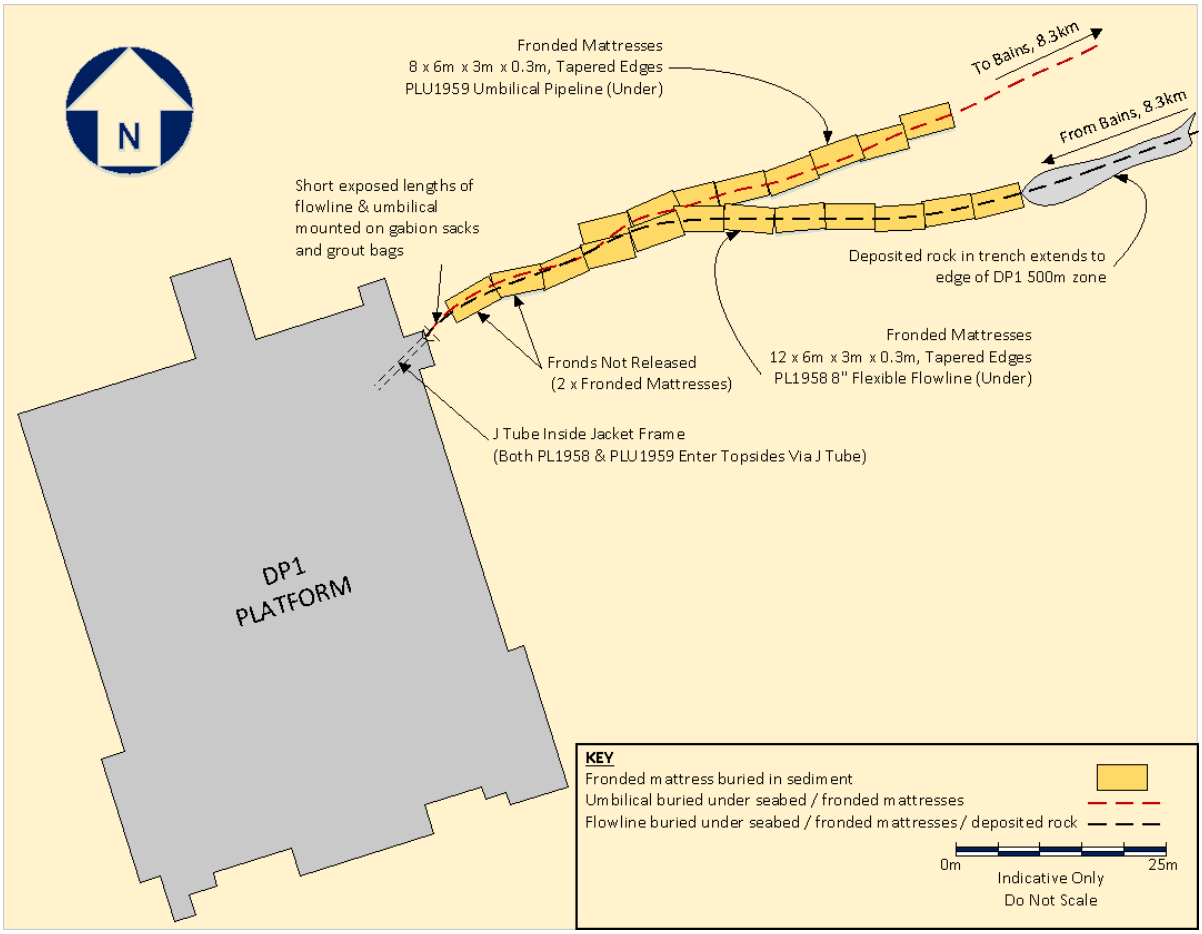


Figure 4.1: Overview of DP1 Approaches

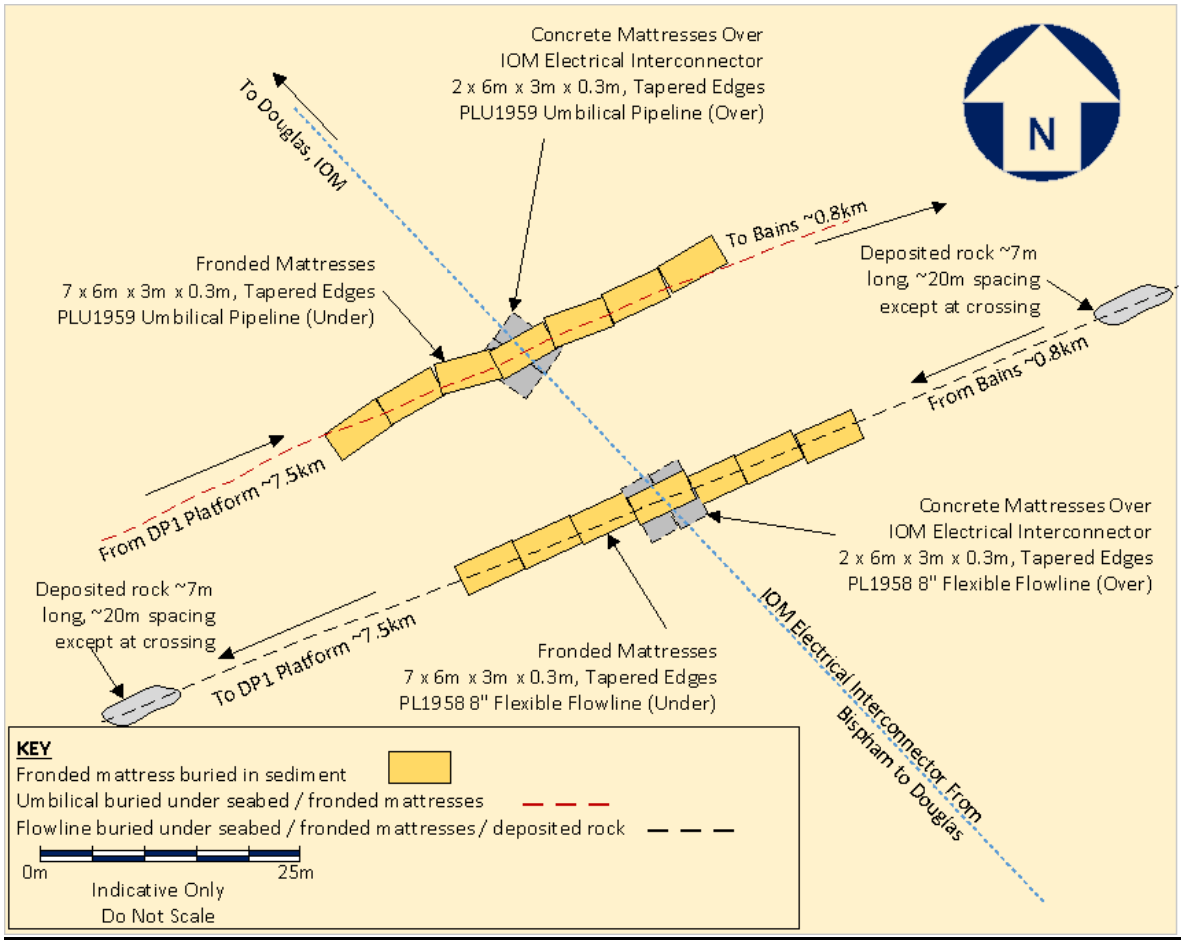


Figure 4.2: Overview of IOM Electrical Interconnector Crossing

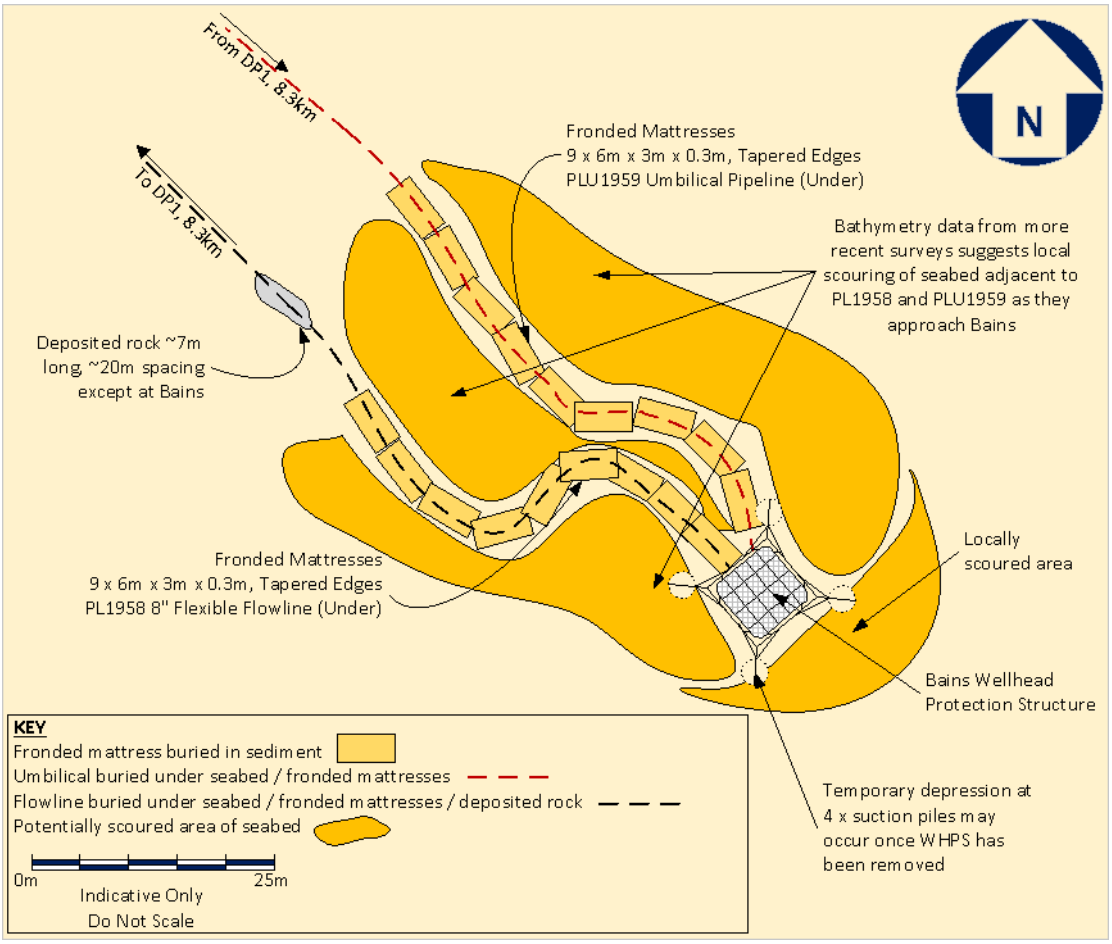


Figure 4.3: Overview of Bains Approaches

4.3 Decommissioning activities

The preferred decommissioning solution is described below and in Table 4.4. It is shown graphically in Figure 4.7 and Figure 4.8. The fronded mattresses are described separately in Section 4.3.4.

4.3.1 Installation

The Bains WHPS and its integrated suction piles will be completely removed from the seabed and recovered to shore for onshore disposals.

4.3.2 Flexible flowline and umbilical

The flexible flowline and umbilical will be left *in situ* except for short exposed sections between the end of burial and bottom of the J tube at DP1 and the connection points at the Xmas tree at Bains.

Minimal local excavation will be carried out at each end, but enough to ensure safe removal of short exposed ends of the pipelines.

Should any overlying fronded mattresses require to be removed, the resulting exposed section of flowline or umbilical will also be removed (Section 4.3.4).

Surveys indicate that both pipelines will remain buried. Their degradation will occur over a long period within the seabed sediment; they are not expected to represent a hazard to other users of the sea.

4.3.3 Pipeline stabilisation features

The gabion sacks and grout bags will be completely removed and recovered. Fronded mattresses will be left *in situ* unless the edges are exposed due to scour in which case attempts will be made to recover them. Should the mattresses be found to be unrecoverable and, with the use of an over-trawl assessment, also be found to present a snagging hazard, a contingency plan to deposit rock adjacent to the scoured mattresses will be carried.

ITEM	OPTION	METHOD
WHPS	Complete removal and recovery to shore.	The structures integrated suction piles will be removed by reverse installation, pumping seawater into the suction cans allowing them to be lifted (with the rest of the WHPS) from the seabed. Use of excavation tools (water-jetting and suction equipment) to allow access for cutting and the attachment of lifting equipment, as required.
PL1958	Removal of the end sections (DP1 and WHPS) that are not sufficiently buried. *In situ* decommissioning of the remainder of the flexible flowline which is sufficiently and stably buried under existing cover of a combination of sediment, deposited rock and fronded mattresses.	The end sections at the WHPS and DP1 will be cut using sheers at the point at which they are sufficiently buried, lifted using grappling tools and recovered for onshore disposal. Use of excavation tools (water-jetting and suction equipment) to allow access for cutting and the attachment of lifting equipment, as required.

ITEM	OPTION	METHOD
PLU1959	Removal of the end sections that are not sufficiently buried. *In situ* decommissioning of the remainder of the umbilical which is sufficiently and stably buried under existing cover of a combination of sediment and fronded mattresses.	As for PL1958, above.
Deposited rock	Decommissioning *in situ*.	No activity.
Gabion sacks and grout bags	Complete removal of gabion sacks and grout bags.	The features will be lifted using grappling tools from the seabed and recovered for onshore disposal. Local excavation using water-jetting or suction equipment may be required to allow access for removal.
Fronded mattresses	Complete removal of unburied fronded mattresses. Decommissioning *in situ* of buried fronded mattresses.	The items will be lifted from the seabed and recovered for onshore disposal. Should the over-trawl assessment show that they are a snagging hazard and they are not recoverable, rock will be deposited over fronded mattresses to allow decommissioning *in situ*.
Note: Onshore disposal or recovered items and features will be in accordance with the waste hierarchy.		

Table 4.4: Summary of Bains Preferred Decommissioning Solution

4.3.4 Fronded mattresses

When a pipeline or structure is placed into an area with a loose sedimentary material, under certain conditions the flow of water around the pipeline or structure can cause erosion of the seabed, and this is called scour. Scour around a pipeline or structure will undermine its stability, and so is undesirable.

Fronded mattresses are put in place to provide protection against scour, and when they perform their function the fronds act like natural seaweed, and silt and sediment that is carried in the water column builds up within the fronds. They depth of seabed increases locally around the mattresses and eventually they become buried reinforcing the seabed.

A number of gravity-based fronded mattresses were installed to protect and stabilise both the 8" flexible flowline and the umbilical at otherwise exposed locations (Figure 4.4). The mattress dimensions are 6m x 3m x 0.3m and the edges are tapered to avoid snagging of on-bottom fishing gear. They are present on top of PL1958 and PLU1959 at DP1 and Bains approaches as well as on the Bispham to IOM Electrical Interconnector crossing.

Figure 4.4: Typical Fronded Mattress Types (gravity based)[5]

4.3.4.1 Fronded mattresses decommissioning proposal and contingency measures

The indications are that where fronded mattresses were installed at DP1 approach and at the Bispham to IOM Electrical Interconnector crossing they have performed their function and are now quite indistinguishable with the surrounding seabed (Figure 4.5). Therefore, the base proposal would be to decommission the fronded mattresses by leaving them *in situ.* The adequacy of this as a proposal will be tested by carrying out an over-trawl assessment.

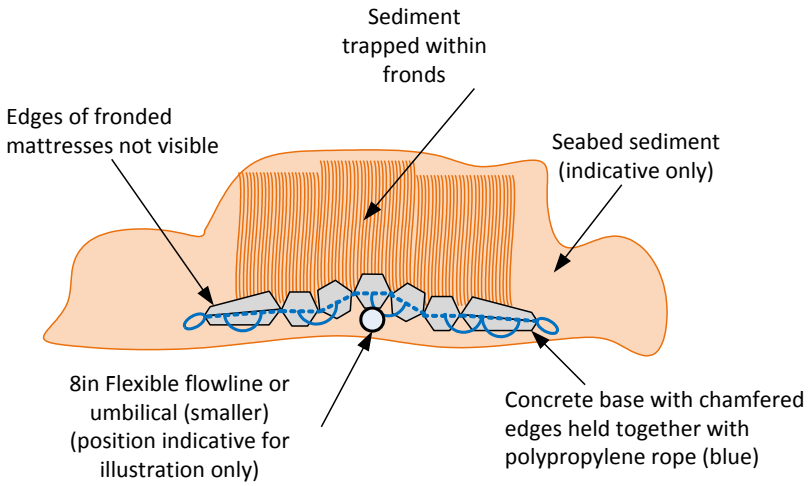


Figure 4.5: Fronded Mattress - Buried Edges

However, there is historical evidence that the seabed in the vicinity of the pipeline approaches and WHPS at Bains has experienced scour (Figure 4.6). The scour may cause the edge of a fronded mattress to become exposed, in which case it would be propose to attempt recovery of the mattress and underlying pipeline. Visibility in the area is poor, so in the event that it cannot be verify whether the edge of a fronded mattress is exposed a contingency measure is proposed. An over-trawl assessment will be undertaken to establish if a snagging risk is present.

[5] Photos courtesy of http://www.sscsystems.com/

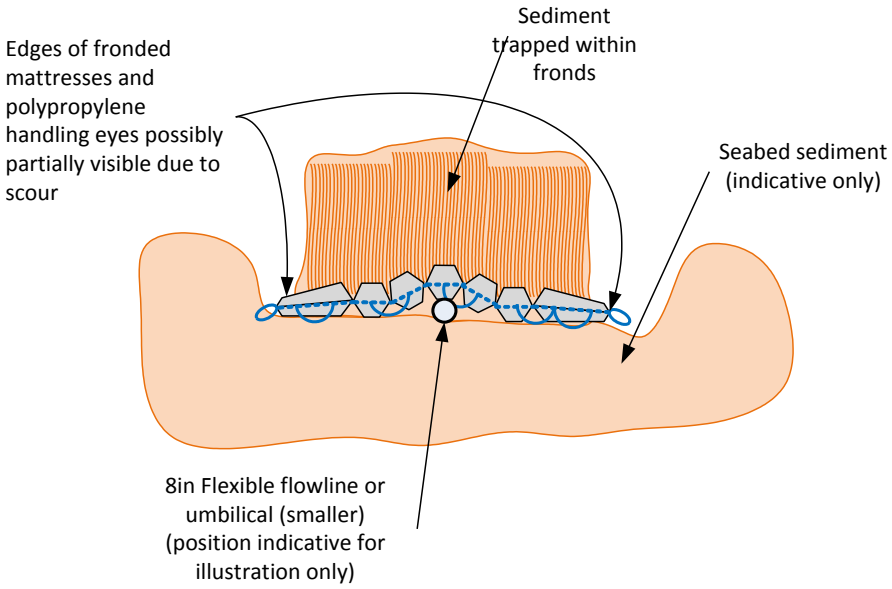


Figure 4.6: Fronded Mattresses - Exposed Edges

Should the over-trawl assessment demonstrate that the fronded mattresses do not pose snagging hazards no further work will be carried out. Should the over-trawl assessment demonstrate that the fronded mattresses pose a snagging hazard, it would be proposed to deposit up to an estimated 350m^3 (520Te) of rock in the scoured area adjacent to the fronded mattresses.

4.4 Surveys

A series of surveys will be required to be undertaken before, during, and potentially after the decommissioning project execution phase. These are summarised in Table 4.5.

4.4.1 Pre-decommissioning environmental survey

A pre-decommissioning environmental survey will be undertaken in advance of execution phase activities to inform decommissioning plans, marine licences, permit and consent applications, and provide a baseline against which to reference the results of any post-decommissioning environmental surveys. The environmental survey data will be used in the planning of any legacy surveys.

4.4.2 Execute Phase and legacy surveys

When all infrastructure and materials have been either removed, or decommissioned *in situ*, a series of surveys will be undertaken.

- The Dive Support Vessel (DSV) or Construction Support Vessel (CSV) will undertake a visual seabed debris survey before leaving the field;
- At a time after any debris has been removed a fishing vessel will undertake a seabed over-trawl assessment. When this assessment has been completed to its satisfaction, the National Federation of Fishermen's Organisations (NFFO) will issue a Clear Seabed Certificate; and
- Post decommissioning environmental surveys will also be undertaken using a survey vessel.

The results of these surveys will identify any changes to the seabed following infrastructure decommissioning, will feed into the project close-out report, and will inform the requirements for possible future legacy surveys. The timing and extent of required legacy environmental surveys will be agreed in conjunction with OPRED.

PHASE	SURVEY	REQUIREMENT
Preparation for decommissioning activities	**Pre-decommissioning environmental survey**	Feeds into decommissioning plans.
Execute phase decommissioning	**Visual seabed debris survey** (DSV, CSV deploying ROV). **Over-trawl assessment** to verify absence of snagging hazards (fishing vessel deploying bottom trawling equipment).	Obtain Clear Seabed Certificate. Feeds into project close out report.
	Post-decommissioning environmental survey	Feeds into close-out report and informs requirements for future surveys. Dependent on outcome of earlier surveys.
Future	**Legacy environmental survey(s)**	Dependent on outcome of earlier surveys.

Table 4.5: Survey Requirements

4.5 Vessel use

Offshore vessel use will take place primarily at the WHPS location with transits between ports and this location.

Different vessel types will be required (e.g. DSV, Construction Support Vessel (CSV), burial survey vessel) at various times, and for various durations, to undertake the decommissioning activities.

The fuel consumption rate of the generic vessel types required are understood which, in conjunction with a high level and worst case vessel schedule, has allowed fuel consumption to be estimated (Table 4.6). Estimates of fuel use are based on Institute of Petroleum Guidelines [19].

VESSEL TYPE	DURATION (Days)	FUEL USAGE (Te)
DSV, CSV	20	280
Burial survey vessel	4	86
Environmental survey vessel	6	129
Fishing vessel	7	28
TOTAL	**37**	**523**

Table 4.6: Vessel Req'ts for the Bains Decommissioning Scope (incl. Legacy Surveys)

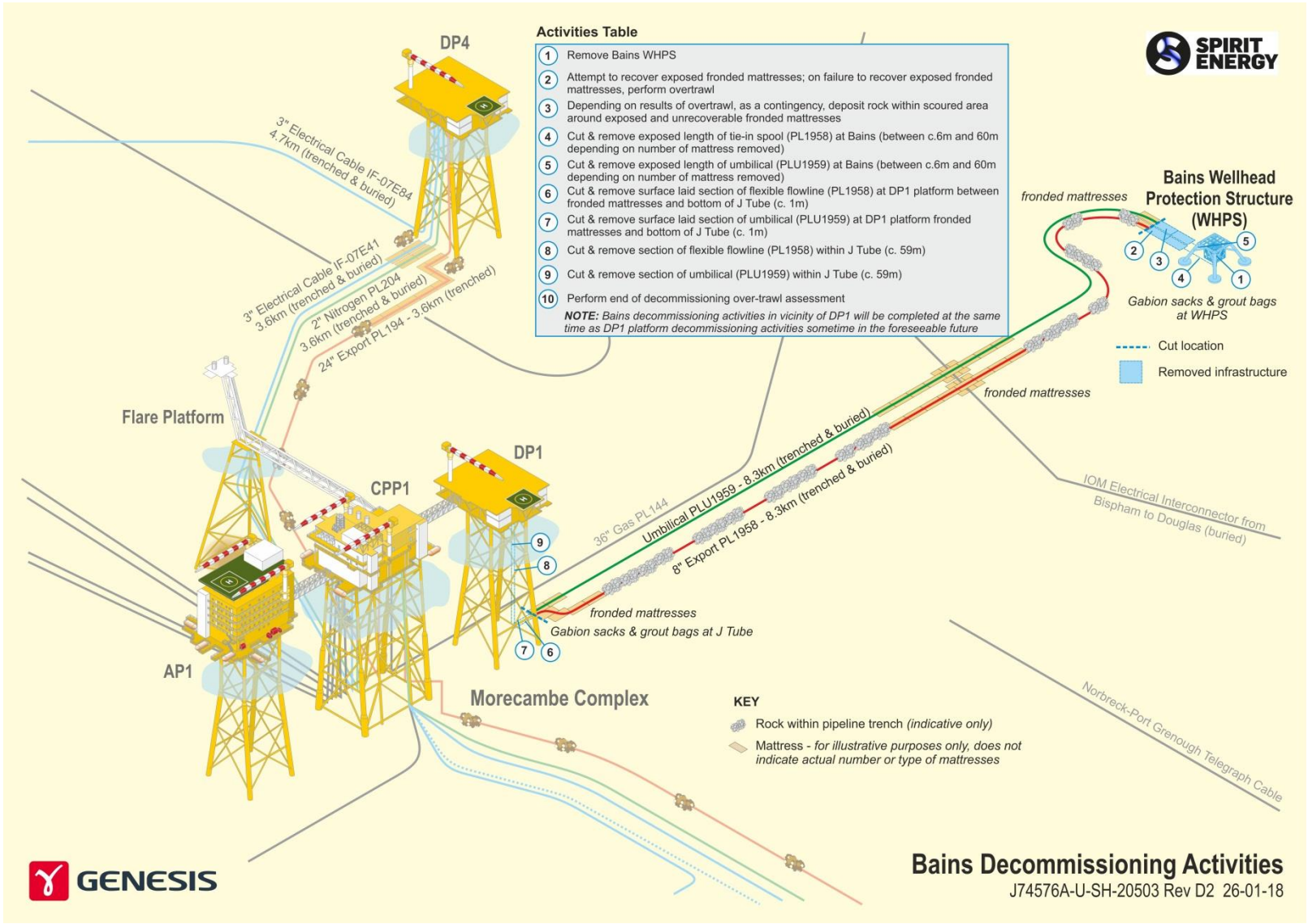


Figure 4.7: Bains Facilities to be Removed from the Seabed

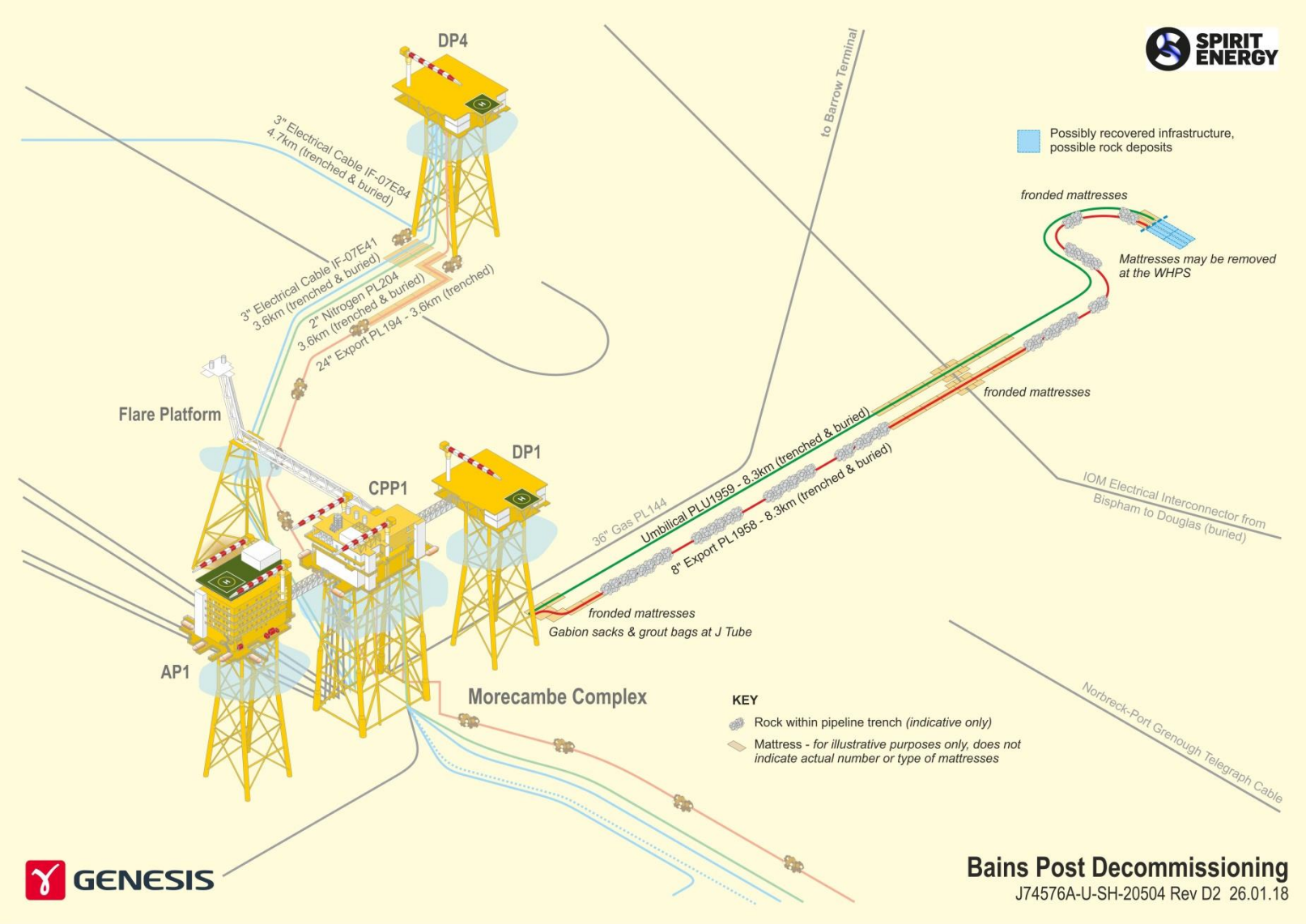


Figure 4.8: Bains Facilities Following Removal

4.6 Management of waste and recovered materials

All material recovered will be returned to a shore base for initial laydown.

Non-hazardous material includes scrap metals (steel, aluminium and copper), and concrete and plastics that are not cross-contaminated with hazardous material. Hazardous materials will include oil contaminated material and chemicals. An estimate of the proportions of the materials that comprise the installation; and flowline and umbilical is provided in Table 4.7.

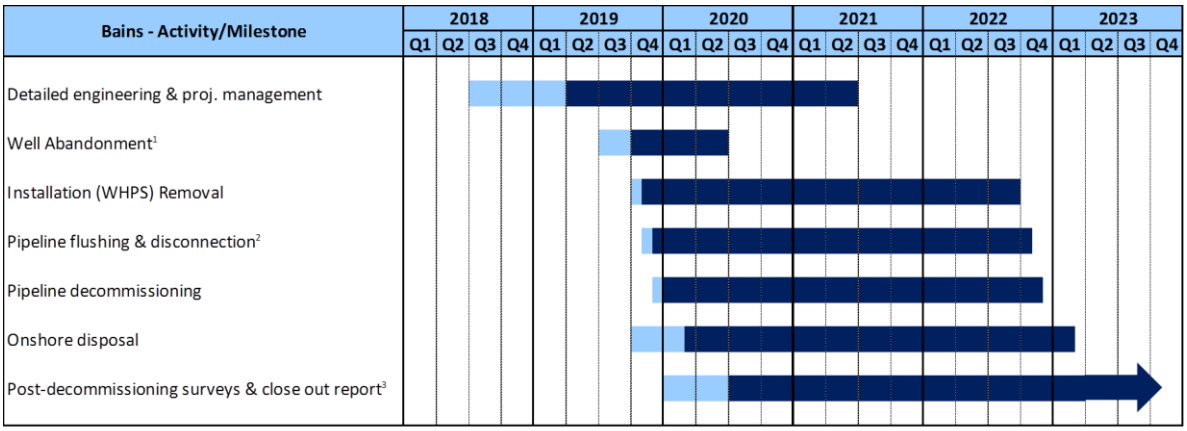
Pipework that has been exposed to produced fluids may be contaminated by Naturally Occurring Radioactive Material (NORM). Any NORM contaminated equipment will be handled, transported, stored, maintained and disposed of in a controlled manner. Any NORM associated with items decommissioned in situ will degrade naturally.

ITEM / FEATURE		INSTALLATION	FLEXIBLE FLOWLINE AND UMBILICAL	FRONDED MATTRESSES	GABION SACKS AND GROUT BAGS
PERCENTAGES OF TOTAL INVENTORY	Weight (Te)	75.4	703.4	553.6	26.6
	Steel % of total	100	85.7	0	0
	Plastics / Rubber % of total	0	12.5	2.5	0.5
	Non-Ferrous Metals % of total	0	1.7	0	0
	Concrete / Grout / Sand % of total	0	0	97.5	99.5
RECOVERED ONSHORE	Total (Te)	75.4	1.9	533.8	19.9
	Recycle (steel, grout) (Te)	75.4	1.6	520.5	19.8
	landfill (Te)	0	0.3	13.3	0.1
	Decommissioned *in situ* (Te)	0	696.6	19.8	0
	Deferred (DP1) (Te)	0	4.9	0	6.7

Table 4.7: Summary of Bains Material Inventory

4.7 Schedule

A proposed schedule is provided in Figure 4.9. The activities are subject to the acceptance of the Decommissioning Programmes [43].



Notes / Key

Earliest potential activity

Activity window to allow commercial flexibility associated with well abandonment and decommissioning activities

1. Current indications are that well abandonment will be carried out in 2019
2. Flexible flowline (and umbilical) will be prepared for flushing prior to being disconnected from the Xmas tree
3. Removal of the WHPS will be done sometime after well abandonment activities have been completed, but timed to coincide with other decommissioning
4. Decommissioning of the flexible flowline and umbilical will be carried out in connection with other decommissioning operations in the wider Morecambe Hub Area
5. Post decommissioning surveys and close out reports will be prepared on completion of Bains decommissioning activities

Figure 4.9: Gantt Chart of Project Plan

4.8 Summary of planned decommissioning activities (aspects)

ACTIVITY	ASPECT
General (in support of all execution decommissioning activities)	Vessels for the deployment of subsea tools; the lifting (removal) from the seabed, and the transport (recovery) to shore, of facilities and materials; and for surveying. Positioning of vessels e.g. use of dynamic positioning (DSV). Possible temporary deposit on the seabed of tools, or items being recovered.
Removal and recovery of WHPS	Disconnection of flowline and umbilical from the WHPS using cutting shears. Complete removal of WHPS from the seabed using pumping spread, tools and lifting apparatus, and recovery to shore. Possible localised excavation using dredging tool to allow access for lifting apparatus. The WHPS will, following reconditioning, preferentially be re-used in accordance with the waste hierarchy.
Removal and recovery of flexible flowline and umbilical ends	Local excavation to allow access of cutting shears and lifting apparatus. Recovery to shore for disposal in accordance with the waste hierarchy.
Removal and recovery of grout bags and gabion sacks, and unburied fronded mattresses,	Local excavation to allow access of tools and lifting apparatus. Recovery to shore for disposal in accordance with the waste hierarchy. Contingent deposit of rock to remediate snagging hazards should they be identified.
Seabed over-trawl assessment	Use of fishing gear to trawl the area of the decommissioned facilities to establish the absence of snagging hazards.
Onshore processing of recovered materials	The onshore transport and light processing (cleaning, cutting, crushing etc. but excluding recycling) of recovered materials at a shore base by a variety of plant and equipment in preparation for

ACTIVITY	ASPECT
	their preferential re-use, recycling, or as a last resort, disposal to landfill. Use of miscellaneous services.
Note: No activity on existing deposited rock or buried fronded mattresses.	

Table 4.8: Summary of Planned Decommissioning Activities and Associated Aspects

5. INITIAL ASSESSMENT

An Environmental Assessment and Management Workshop was held on the 26th September 2017 during which project aspects were identified and assessed (Section 3) [45]. The outcome of this initial assessment is presented in Table 5.1. Aspects that were categorised as of 'low' significance and therefore not selected for detailed assessment are discussed below (Sections 5.1 to 5.6). Aspects that were categorised as of 'medium' significance, and therefore selected for further assessment, are discussed in Section 6.

ACTIVITY / ASPECT	Energy use & Atmospheric Emissions	Underwater Sound	Seabed Disturbance	Discharges to Sea	Small Releases to Sea	Large Release to Sea	Waste Production	Communities	Employment	Commercial activities	Cumulative	Transboundary
Vessel transits	L	L		L	L	M	L	P	P	P	L	L
Vessel presence at site	L	L	L	L	L	M	L	P	P	P	L	L
Localised excavation		L	L								L	
Cutting		L	L								L	
Lifting (general)			L				L				L	
Temporary deposit			L								L	
Dropped objects			L	L						L	L	
Discharge of flowline or umbilical contents short-term				L	L						L	
Recovery of unburied fronded mattresses, gabion sacks and grout bags			L				L				L	
Pressurised water injection to suction cans		L	L								L	
Lifting of WHPS and suction cans			L				L				L	
Flowline (also buried under rock) or umbilical remaining *in situ*										L	L	
Fronded mattresses remaining *in situ* (buried under sediment)										L	L	
Discharge of flowline or umbilical contents long- term				L	L						L	
Over-trawl assessment			M						P		M	
Use of side-scan sonar		L									L	
Waste management	L						L	P	P	P	L	

L	Low – Impact broadly acceptable and considered 'as low as reasonably practicable' (1-5)
M	Medium – Impact is tolerable but to be managed to 'as low as reasonably practicable' (6-12)
H	High – Impact intolerable. Control and mitigation measures required to be reduce impacts to 'as low as reasonably practicable' (>12)
P	Positive – Positive or beneficial impact
	No interaction

Table 5.1: Summary of Bains Initial Environmental Assessment [45]

Spirit Energy vessel use from selection, assurance through to all operational aspects is governed by standards and procedures which are in line with relevant regulations and industry best practice and guidelines.

5.1 Energy Use and Atmospheric Emissions

The principal sources of energy use and atmospheric emissions are associated with vessel use, and the onshore transport and processing of materials and waste.

Vessel activities will be of relatively short duration (worst case 37 days) with an estimate of CO_2 emissions in the region of 1,673Te CO_2. To put this into context, the UK shipping emissions 2014 [4] were 9,900,000Te CO_2. Proportionally, the worst-case vessel emissions from Bains decommissioning equates to less than 0.02% of the UK shipping emissions. Vessel use will be optimised (e.g. by partnering with other projects to reduce the number of mobilisations) and their operation will be managed under Spirit Energy's existing marine procedures.

A relatively small volume of materials will be disposed of onshore (Table 4.7). All material will be handled by licenced waste management contractors at sites that hold Environmental Permits or PPC permits. The impact of energy use and atmospheric emissions will have been assessed as part of obtaining these licences. There will also be a requirement to ensure any impacts are minimised.

Given the above, the significance of this aspect has been assessed as 'low'.

5.2 Underwater Sound

The principal sources of underwater sound are vessel use, excavation, cutting, lifting and the use of side-scan sonar.

Vessel activities will be of relatively short duration. Their use will be optimised (e.g. by partnering with other projects to reduce the number of mobilisations) and their operation will be managed under Spirit Energy's existing marine procedures. The duration of the vessels being on site is relatively short and will occur in an area of relatively high vessel traffic [27], therefore the impact of underwater sound on the receptors is considered 'low'.

A relatively small number of cuts to the flowline and umbilical (and associated excavation and lifting operations) will be required. The likely cutting method will be with shears. The area excavated will be relatively small and local to the edges of the items to be cut or lifted.

There is very little information available on underwater sound generated by tools used for underwater cutting operations. Anthony *et al* [2] present a review of published underwater sound measurements for various types of diver-operated tools. Several of these are underwater cutting tools, including a high-pressure water jet lance, chainsaw, grinder and oxy-arc cutter.

There is no published information on the response of marine mammals to sound generated by underwater cutting. However, reported source levels are relatively low compared with those generated by vessels.

The equipment used during acoustic surveys (echo sounders and SSS) emit high frequencies which attenuate rapidly [22]. Under these conditions JNCC considers that injury or disturbance would be unlikely.

Given the above, the significance of this aspect has been assessed as 'low'.

5.3 Discharges to Sea and Small Releases to Sea

The principal sources of discharges and small releases to sea are associated with the contents of the flowline and umbilical after having been cut, and the use of vessels.

The flowline will have been cleaned prior to cutting, and the methanol and corrosion inhibitor will have been flushed from the umbilical. Any chemical use or discharge required for or resulting from the decommissioning activities will be permitted under the Offshore Chemicals Regulations 2002 (OCR).

Vessel activities will be of a relatively short duration and the Bains area is subject to relatively a high shipping traffic density [27]. Vessel use will be optimised (e.g. by partnering with other projects to reduce the number of mobilisations) and their operation will be managed under Spirit Energy's existing marine procedures. Small releases from vessels will be managed under the existing OPEP and the vessel SOPEPs [47].

Given the above, the significance of these aspects has been assessed as 'low'.

5.4 Waste Production

Most of the material recovered during the Bains decommissioning will be non-hazardous, including steel (WHPS) or concrete (mattresses, grout bags and gabion sacks) (Table 4.7). The end sections of flowline and umbilical comprise a mixture of materials including steel, plastics and non-ferrous metals.

Until a waste management contractor has been selected and disposal routes investigated the final disposal for the material is unknown. The project aspiration is that all steel and concrete will be recycled, as well as the components of the flexible flowline and umbilical.

All waste will be managed in compliance with relevant waste legislation by a licenced waste management contractor (Appendix A).

As part of Spirit Energy's standard processes, all sites and waste carriers will have appropriate environmental and operating licences to carry out this work and will be closely managed within Spirit Energy's contractor assurance processes.

Should NORM be encountered Spirit Energy will obtain a permit from the Environment Agency to dispose of radioactive waste arising from the production of oil and gas for Bains.

Given the above, the significance of this aspect has been assessed as 'low'.

5.5 Socio-economic

The positive impact on communities, employment and other commercial activities is associated with the duration and complexity of the offshore work, the mass and associated processing of material brought to shore, and future activities. The duration of the offshore work is relatively short and will occur in an area of relatively high vessel traffic. Likewise, the mass of material that would be brought to shore for processing is relatively small and, for the most part, limited to steel and concrete (Table 4.7).

Future work is anticipated to be limited to surveys of the flowline and umbilical. This is likely to be a small addition to survey work planned for the area, therefore contributing a small amount to future employment.

The sections of the flowline and umbilical that will be decommissioned *in situ* will present a small, residual snagging hazard to fishing activity should they become exposed. Since original installation in 2002 no exposures have been recorded therefore it is anticipated that the flowline and umbilical will remain buried [43].

Given the above, the overall significance of both positive and negative impacts associated with this aspect has been assessed as 'low'.

5.6 Transboundary

The Bains facility is located approximately 45km from the UK/Isle of Man joint territorial sea median line, and more than 115km from the UK/Republic of Ireland median line. Vessel activities will be a relatively short duration. While it is plausible that a large hydrocarbon release could reach the median lines the risk is considered small and will be managed under the OPEP.

Given the above, the significance of this aspect has been assessed as 'low'.

6. ENVIRONMENTAL ASSESSMENT

Project aspects were identified and assessed during a workshop (Section 5). The following aspects were categorised as of 'medium' significance and were therefore selected for detailed assessment:

- Seabed Disturbance (Section 6.2);
- Large Releases to Sea (Section 6.3); and
- Cumulative (Section 6.4).

For ease, available survey data and description of the receiving environment is described upfront in Section 6.1 with additional information where appropriate provided as part of the assessment.

6.1 Environmental surveys / receiving environment

Several surveys have been undertaken near the Bains Field and the wider East Irish Sea since the Bains facilities have been installed. The location and key points from these surveys are shown in Figure 6.1 and Table 6.1, respectively.

The area-wide surveys provide an indication of the general environment, and the site-specific surveys provide confirmation that the area is as expected. Environmental sampling was not undertaken at the Bains facilities at the time of installation. Environmental sampling data from within 1km of Bains was collected in 2008. Regular acoustic monitoring surveys (using SSS) have been undertaken along the pipeline corridors. The acoustic monitoring surveys (2008, 2009, 2012 and 2014) have shown only small changes to the bathymetry over the six years.

No additional environmental sampling data has been collected to support this EA as the data available from 2008 indicates that the environment in the area is consistent with that expected. Targeted additional survey data will be collected as requirements are identified as the project moves into detailed engineering.

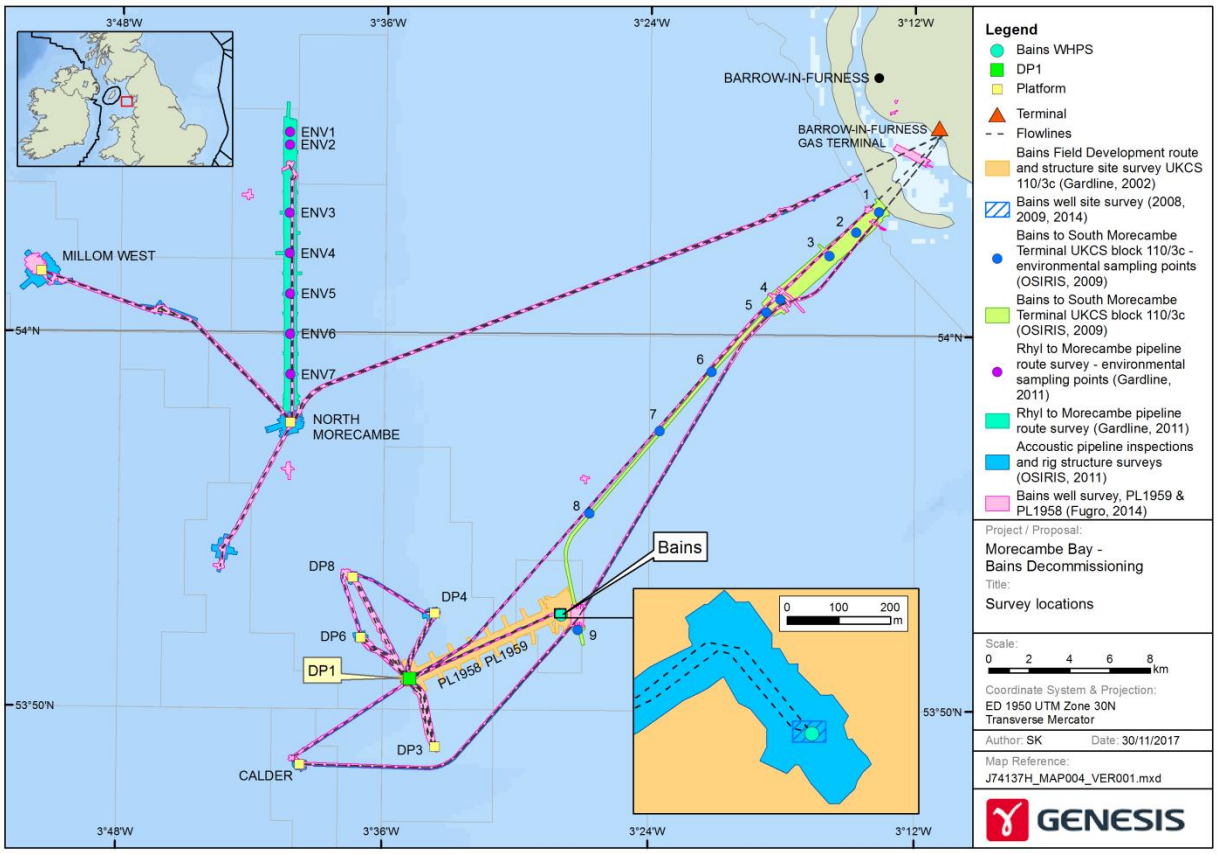


Figure 6.1: Map Showing Locations of Surveys in the Vicinity of Bains

YEAR	SURVEY	LOCATION	KEY FINDINGS
2002	Bains Field Development Route and Structure Site Survey UKCS 110/3c April 2002 (Pre-installation)	The flexible flowline and umbilical route and the site. 500m corridor and 1km by 1km at site.	Side-scan sonar and multibeam survey. Depth at well 18.4m LAT along route 18.4 to 26.0 LAT. Essentially flat. Sandy clays and silts.
2008	Acoustic Inspection J1951-Bains-RP-001	Bains WHPS.	Scour up to 0.30m at the WHPS

YEAR	SURVEY	LOCATION	KEY FINDINGS
2008	Bains to south Morecambe Terminal 2008 Block 110/3c	Within same block, samples c. 1km south southeast and side-scan sonar data within 500m.	Generally flat, featureless sandy silts (clayey sandy silts). Water depth 20m. No habitats of conservation significance. Data collected 500m from Bains WHPS location: • TOC and TOM collected; • THC relatively high (35,535 to 57,307ng/g), but in line with background for the Irish sea, areas with low sediment mobility and high proportions of silt; • All metals analysed showed generally low to moderate levels, as expected for the North Irish Sea; and • Macrofaunal data obtained. Polychaetes dominant in the silty sediments at the proposed well. Identified as circalittoral sandy mud (SS.SMu.CSaMu), probably "*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud".
2008	Marram Appraisal Well 2008 Block 110/4	c. 20km east of Bains.	Sandy sediment water depths of less than 20m. No evidence of sandbanks.
2009	Acoustic Inspection SRD_2027_Bains	Bains WHPS.	Average scour around the WHPS in the region of 0.13m and 0.23m.
2010	Rhyl to Morecambe Pipeline Route Survey 2010 Blocks 113/27 and 110/02	c. 20km northwest of Bains.	Poorly to very poorly sorted, muddy, fine to very fine sand (modified Folk Classification). THC within the range regarded as background. Metals similar to background. No species or habitats of conservation significance.
2011	Acoustic Pipeline Inspections and Rig Structures Survey Volume 11 – Bains Well Report	Bains WHPS.	Some scouring is evident around the well, and is most prominent to the south of the installation where seabed levels are up to 1.2m deeper than the ambient seabed level.
2014	Bains Well Survey Report 2014 14/J/3/02/2562/1686	Well site. PL1958.	Side-scan sonar and multibeam survey. Depth 18.6 to 19.8m LAT. Clayey sandy silt. Scour around WHPS and mattresses up to 1.3m deeper than the surrounding seabed. Rock appears as 0.1m depressions along the pipeline.
2014	PL1959 – Chemical Injection Pipeline CPP1 to Bains 14/J/3/02/2562/1650 2014	Umbilical. PL1959.	Greatest depths in scour at CPP1 – 27.1m and shallowest depth at the WHPS 16.1m Survey shows rock adjacent to the umbilical at DP1. Side-scan sonar and multibeam survey. Clayey sandy silt.

YEAR	SURVEY	LOCATION	KEY FINDINGS
2014	PL1958 – 8" Wet Gas Pipeline CPP1 to Bains Survey Report 2014	Flexible flowline. PL1958.	Greatest depths in scour at CPP1 – 27.1m and shallowest depth at the WHPS 16.1m Survey shows rock along the pipeline and covering the pipeline end at DP1. Side-scan sonar and multibeam survey. Clayey sandy silt.

Table 6.1: Summary of Surveys in the Vicinity of Bains

On a local scale, Osiris 2009 [32] identifies the sediments in the vicinity of the Bains WHPS to be clayey sandy silts. The sediment around the South Morecambe facilities (which Bains exported via) consists mainly of muds, sand and gravel [48]. A large broad-scale seabed survey east of the IOM was carried out in 1997 by the University of Liverpool [16]. The survey found the area to be relatively uniform, consisting of fine and medium sands with various amounts of stones and shell. SSS and video survey identified widespread areas of fine sand waves or ripples. On a wider scale still a range of seabed sediments are present in the Irish Sea including large areas of mud to the east and west of the IOM where currents are weak, with coarser sand and gravel in areas of stronger tidal and wave-driven currents and rock and boulders in the most exposed areas [7].

Osiris 2009 showed macrofaunal population to reflect the sediment types, a community typical for shallow low energy environment of the Irish Sea, dominated by polychaetes. The survey [32] showed the habitat and biotype near Bains WHPS to be cohesive sandy mud characterised by abundant to superabundant *Amphiura filiformis* with *Mysella bidentata*. This community occurs in muddy sands in moderately deep water. Conspicuous surface fauna were predominantly *Ophiuroids Ophiura ophiura* and *O.affinis*.

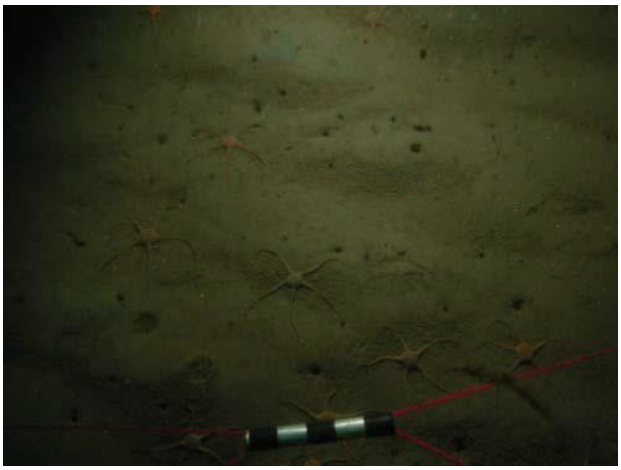


Figure 6.2: Photograph from Osiris 2009 in the Vicinity of Bains WHPS [32]

The characteristic benthic invertebrates for this area are the anemone *Adamsia carciniopados* and the sea urchin *Psammechinus miliaris* both of which are epifaunal species [10]. The benthic fauna around the South Morecambe Facility do not consist of any rare or unusual species.

A total of 475 taxa were recorded during the University of Liverpool survey [16]. Video analysis indicated that the areas of fine/medium sands are colonised by *Spantangus purpureus*, *Asteria rubens*, *Pagurus bernhardus* and *Astropectin irregularis* whilst coarser areas of seabed are commonly inhabited by *Ophiothrix fragilis*.

Most species recorded from benthic communities in the SEA 6 area have broad distributions and large populations; however, reviews of the literature have identified a variety of species and communities which are recognised as being rare or of conservation significance [54], [53], [34]

and [30]. No environmentally sensitive habitats or communities were recorded in any of the 2008 surveyed points [32].

A benthic species which may be of importance to the SEA 6 area is the polychaete worm *Sabellaria spinulosa* [23]. Aggregations of this small, tube-building worm may form dense subtidal reefs which provide a biogenic habitat. *S. spinulosa* form reefs only in sandy sediments therefore they are not expected in the area of the Bains facilities.

A survey carried out in Block 110/4 in 2008 to inform the Venture Marram Appraisal Well Environmental Statement [49] reported that the polychaetes *Pholoe synophthalmica*, *Nephtys juvs* and *Nephtys cirrosa*; and the mollusc *Nucula nittdosa* were recorded at all seven stations sampled in Block 110/4. *P. synophthalmica* was the most abundant taxon recorded and is common in shallow sublitoral sands and muddy sands favouring nutrient/eutrophication rich conditions and hydrocarbons. This taxon is also reported as being tolerant of hydrocarbon contamination, but highly intolerant to other synthetic chemicals [49].

Chemical analysis of the samples recovered in 2009 (that of heavy and trace metals Table 6.2, organic carbon and sediment hydrocarbons Table 6.3), all showed typically low to moderate levels expected for this part of the northern Irish Sea. The patterns in chemical concentrations were attributed to the physical sediment factors such as mean particle size, proportion of fines, sorting coefficient etc. Total sediment hydrocarbons (THC) and polycyclic aromatic hydrocarbons (PAH) revealed slightly elevated concentrations in the vicinity of the Bains WHPS, up to 57.8µg.g-1 and 2.3µg.g-1, respectively (Table 6.3). A detailed review of the individual saturates, PAH compounds and the unresolved complex mixtures revealed a high natural background of material from generally terrigeneous sources (either land plants or pyrolytic PAHs) deposited into the sediments relative to the proportion of sediment fines.

	Aluminium	Arsenic	Barium	Cadmium	Chromium	Copper	Iron	Lead	Mercury	Nickel	Tin	Vanadium	Zinc
Bains 9A	27000	9	288	1.8	42.3	10.6	15400	33.6	0.17	17.7	1.9	41.3	71.2
Bains 9b	37200	6.96	282	0.97	39	12.2	18040	28.5	0.32	18.8	4.85	40.3	60.1
Bains 9C	31300	8.6	247	1.6	44.7	12.7	16100	46.9	0.18	17.9	2.4	40.6	73.2
Bains 9d	36700	7.51	287	1.07	41.1	13.8	18900	44	0.36	20.2	5.36	45.5	67.5
Bains 9e	40600	7.82	294	0.97	41.8	14.4	20100	36.9	0.37	21.1	5.04	47.4	70.3
Bains 9F	39300	9.1	292	1.3	46.8	11.8	19600	37.8	0.19	18.5	2.5	42.1	58.8
Mean	**35350**	**8.17**	**282**	**1.29**	**42.6**	**12.6**	**18023**	**38.0**	**0.27**	**19.0**	**3.7**	**42.9**	**66.9**
OSPAR BRC	-	-	-	0.2	60	20	-	25	0.05	45	-	-	90

Table 6.2: Summary of Total Heavy and Trace Metal Concentrations [32]

	TPH (ng/g)	Total n-alkanes (ng/g)	Carbon Preference Index	Pristane/ Phytane Ration	Petrogenic/ Biogenic Ratio	Alkane proportion (%)	Total PAHs (ng/g)	NPD PAHs (ng/g)
Bains 9A	56,468	1,090	2.01	4.85	0.43	1.63	1,876	478
Bains 9b	48,179	1,101	2.44	3.30	0.30	2.29	2,162	497
Bains 9C	42,009	901	2.21	3.94	0.37	2.14	1,280	336
Bains 9d	35,525	822	2.35	4.82	0.25	2.31	1,375	344
Bains 9e	57,867	1,309	2.68	5.25	0.27	2.26	2,336	576
Bains 9F	57,307	1,002	2.02	3.76	0.47	1.75	1,931	476
Mean	**49,559**	**1,038**	**2.29**	**4.32**	**0.35**	**2.06**	**1,827**	**451**

Table 6.3: Summary of Hydrocarbon Concentrations [32]

Hall-Spencer *et al* 2000 [10] note that the sediment is of the type that will not contribute to

absorption of pollutant chemicals and therefore it is unlikely that chemical discharges associated with hydrocarbon processing operations will be present within the sediment.

6.2 Seabed Disturbance

This section identifies, and assesses the impact of the various sources of planned seabed disturbance from the decommissioning activities. It also considers potential sources of unplanned (accidental) seabed disturbance.

6.2.1 Sources

The Environmental Assessment and Management Workshop identified temporary and permanent impacts to the seabed from removal activities, *in situ* decommissioning and surveys. To allow an assessment of the cumulative impact to the seabed (discussed in this section and section 6.4.), all activities that could disturb the seabed have been assessed. The activities that cause temporary disturbance to the seabed are the local excavation of sediments, the lifting (removal) of the WHPS, flowline and umbilical ends, gabion sacks and grout bags, possible lifting of mattresses, the temporary deposit of items on the seabed and survey activities. There will also be permanent disturbance caused to the seabed from changes to the burial status of items decommissioned *in situ*; the buried flowline and umbilical, the buried fronded mattresses, and possible deposits of rock.

Temporary disturbance

Temporary disturbance from decommissioning activities can result in direct mortality or physical injury to benthic species, and in mobilisation and re-suspension of sediment. This can result in indirect impacts from increases in suspended solid concentrations in the water column and subsequent re-deposition on the seabed with the potential to change its physico-chemical characteristics and impact benthic communities.

The sources of seabed disturbance are described in Table 6.4, with the locations shown in Figure 2.2, Figure 4.1, Figure 4.2 and Figure 4.3.

ACTIVITY	DESCRIPTION OF IMPACT
Local excavation of sediment and marine growth	Disturbance is related to the: • Number of locations at which the flowline, umbilical and WHPS will need to be accessed; • Extent to which each location requiring access is buried with sediment; • Number of grout bags, gabion sacks and mattresses to be moved and recovered and their burial status; and • Extent of marine growth. It is assumed that less than a 1m zone around the items to be removed could be affected, a subset of the 3m zone impacted by temporary seabed deposits and the corridor impacted by the over-trawl assessment.
Lifting (removal)	Disturbance is related to the: • Length of the flowline and umbilical sections being removed; • Area covered by grout bags, gabion sacks and mattresses being removed; • Area covered by the WHPS and its suction piles; and • Extent to which the items and features above are buried by sediment prior to lifting.

ACTIVITY	DESCRIPTION OF IMPACT
Temporary seabed deposit	Disturbance is related to the: • Area and number of pieces of equipment, or the items being recovered, being temporarily deposited (laid down) on the seabed. It is assumed that a 3m zone around the items to be removed could be affected.
Over-trawl assessment	This typically involves a fishing vessel deploying 'rock hopper' fishing gear with scraper chains to determine if there are any snagging hazards. The area is a 500m radius around the WHPS, and up to 50m either side of the length of decommissioned flowline and umbilical.
Vessels	The wash from vessel propulsion and dynamic positioning activities has the potential to disturb the seabed depending upon vessel draught, vessel operating mode and the water depth. Given the prevailing currents near Bains and the dynamic nature of the seabed (Table 6.1), it is anticipated that certain sediment sizes would routinely be mobilised. It can therefore be expected that the local fauna would be habituated to this environment, would recover quickly and would not be significantly affected.
Unplanned activities and events	During all lifting activities there is the potential for materials and equipment to be accidentally dropped because of a procedural failure, or mechanical failure of the lifting apparatus. The degree of disturbance will be related to the area of the dropped object.

Table 6.4: Sources of Temporary Seabed Disturbance

Estimates of the area impacted by the main sources of temporary seabed disturbance are itemised in Table 6.5. It should be noted that a UKCS licence block covers approximately 200km^2. The area impacted by comparison can therefore be considered very small.

SOURCE OF SEABED DISTURBANCE	ASSUMPTIONS MADE	AREA IMPACTED (km^2)
Removal of WHPS and suction piles	Additional 1m added on all sides to allow for disturbance including localised excavation around the WHPS (14m^2).	0.000196
Removal of flowline and umbilical ends	The area of seabed disturbance was assumed to be a corridor width of 10m, allowing for sediment to be moved from its current location and deposited either side of the sections that are being removed (1m long sections on the umbilical and flowline).	0.0005
Removal of grout bags and gabion sacks	Removal of approximately 664 grout bags (impacted area of 0.25m x 0.25m per bag) and 11 gabion sacks (impacted area of 1m x 1m per sack).	0.000052
Over-trawl assessment	The flowline and umbilical are 50m apart therefore the assessment is 75m corridor along the flowline and the umbilical (8.335km) and the HSE 500m safety zone at Bains.	1.88
TOTAL		**1.884**

Notes:
The flowline and umbilical ends, grout bags and gabion sacks are within the WHPS area, therefore the areas estimated above include some double counting.
An allowance for the excavation of sediment, or the temporary deposit of items on the seabed is not included as line items, but as a zone around the items. The area will be small and within the area already impacted by the removal activities.
The estimated area of disturbance assumes that all the fronded mattresses will be buried and will

SOURCE OF SEABED DISTURBANCE	ASSUMPTIONS MADE	AREA IMPACTED (km^2)
therefore be decommissioned *in situ*. The area impacted could increase should the fronded mattresses need to be recovered. The impact on seabed from vessels is within the existing variability of the area and is therefore not considered. The area impacted by dropped objects cannot be quantified.		

Table 6.5: Estimate of the area of temporary seabed disturbance

Permanent disturbance

Changes to the burial status of the flowline and umbilical, buried fronded mattresses and deposited rock (within the trench over the flowline) decommissioned *in situ* can be considered to cause permanent disturbance to the seabed. The degree of disturbance is related to the dimensions and burial status. All items that will be decommissioned *in situ* are buried with little evidence of scour [43]. Historical data indicates that exposures are unlikely [44], therefore the degree of permanent seabed disturbance anticipated is small.

An estimate of the seabed area potentially affected by permanent disturbance is presented in Table 6.6. The area impacted by comparison to the area of a UKCS licence block is considered very small.

SOURCE OF DISTURBANCE	ASSUMPTIONS MADE	AREA IMPACTED (km^2)
Existing deposited rock	24 Te rock per 7m section within the trench, maximum of 2m wide. A total of 10,294 Te.	0.006
Flowline and umbilical decommissioned *in situ*	Area is calculated based on the length and 0.5m for the width of the flowline and umbilical.	0.000576
Fronded mattresses decommissioned *in situ*	32 fronded mattresses. Area is calculated based on the dimensions of the protection and stabilisation features.	0.00864
TOTAL		**0.01522**
Note: 7 fronded mattresses on top of each of the flowline and umbilical at the IOM Electrical Interconnector crossing and 9 at each of the approaches. The figures *exclude* the mattresses underneath the flowline and umbilical at the IOM Electrical Interconnector crossing. These numbers assume that no contingency rock deposits are required at the WHPS. The area impacted could increase should rock deposits be required.		

Table 6.6: Estimate of the Area of Permanent Seabed Disturbance

6.2.2 Impacts and receptors

Temporary disturbance

Table 6.5 shows a maximum total area of 1.884km^2 of seabed that could be temporarily disturbed because of the decommissioning activities. These activities may result in the **direct** physical injury of benthic species (Table 6.7) and lead to increases in suspended solid concentrations in the surrounding waters with **indirect** impacts. Suspended materials, however, will be rapidly dispersed and diluted by prevailing hydrodynamic conditions before settling back to the seabed and the disturbance will therefore be short-term.

Direct impacts

ACTIVITY	DIRECT IMPACTS
Excavation Lifting (removal)	• Likely to damage/destroy any sensitive surface species settled on the sediment; • Potential for sub-lethal impacts on benthic and epibenthic fauna because of physical abrasion; and • Unlikely to affect mobile species, either on, or under the surface of the sediment, which are likely to move away from the disturbance.
Temporary seabed deposit Unplanned activities and events	Affected substrate no longer available for colonisation by either surface dwelling or burrowing species for the short duration of the deposit.

Table 6.7: Direct impacts from Temporary Seabed Disturbance

Indirect impacts

All direct impacts may cause disturbance of sediment which will mobilise particles in to the water column and increase local suspended sediment concentrations. Sediment, along with any mobilised contaminants, will be dispersed by prevailing hydrodynamic conditions before settling back to the seabed. Coarse sediments will return to the seabed quickly whereas fine sediments will return more slowly and are likely to be dispersed more widely.

Re-deposition of mobilised sediment has the potential to smother seabed communities and expose them to the effects of contaminants associated with the disturbed sediment. It is known that some bottom-dwelling marine organisms are particularly vulnerable to natural or man-made activities which cause disturbance of the seabed, such as deposition of sedimentary material. Most offshore benthic species are recruited from the plankton, and usually recover rapidly once disturbance from the decommissioning activities cease. For any activity directly impacting the sea floor, if the affected area is large, it will take a longer time to recolonize through larval dispersion settlement, whereas if it is small, organisms can recolonize quickly by migration into the area from adjacent undisturbed seabed and therefore recovery is more rapid [24].

Many species of fish are known to spawn within the vicinity of Bains with others using it as a nursery area in the period immediately following spawning, including nursery area for herring and spawning and nursery area for sandeel (Table 6.8). Seabed disturbance is unlikely to affect species that are broadcast spawners because they release the eggs and sperm into the water column after which they are widely dispersed. Seabed disturbance, including sediment re-deposition, has the potential to impact spawning grounds for species that lay their eggs on the seabed (demersal spawners), which include herring and sandeel. Sandeels have specific habitat preferences and are found in coarse and medium sand seabed areas in to which they burrow [13]. However, the sandy clays and silts (Table 6.1) observed around Bains is not a preferred sandeel habitat [13].

The total hydrocarbons are anticipated to be relatively high (Table 6.3), but in line with background for the Irish Sea, areas with low sediment mobility and high proportions of silt [32]. Likewise, metal analysis showed generally low to moderate levels (Table 6.2), as expected for the North Irish Sea.

The geographic extent of sediment mobilisation from seabed disturbance is likely to be limited by the presence of sand as coarse sediment will not disperse far. However, disturbed finer clay and silts will be distributed across a wider area.

The area shows signs of being an area with seabed sediment transport, the scour around the WHPS (Table 6.1).

The risk of smothering is therefore considered to be in line with the normal re-distribution of seabed sediment which occurs because of natural hydrodynamic conditions and is an inherent component of the ecosystem.

Given the above, the level of direct and indirect impacts has been assessed as 'low'.

SPECIES NAME	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cod	SN	SN	Sn	SN	N	N	N	N	N	N	N	N
Whiting	N	SN	SN	SN	SN	SN	N	N	N	N	N	N
Plaice	SN	SN	SN	N	N	N	N	N	N	N	N	SN
Sprat					S	S	S	S				
Lemon Sole	N	N	N	SN	SN	SN	N	N	N	N	N	N
Sole	N	N	SN	SN	SN	N	N	N	N	N	N	N
Mackerel	N	N	SN	SN	SN	SN	SN	N	N	N	N	N
Herring	N	N	N	N	N	N	N	N	N	N	N	N
Sandeels	SN	SN	N	N	N	N	N	N	N	N	SN	SN
Nephrops	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN	SN
Ling		S	S	S								
Anglefish	N	N	N	N	N	N	N	N	N	N	N	N
Spundog	N	N	N	N	N	N	N	N	N	N	N	N
Spotted Ray	N	N	N	N	N	N	N	N	N	N	N	N
Tope Shark	N	N	N	N	N	N	N	N	N	N	N	N
Thornback Ray	N	N	N	N	N	N	N	N	N	N	N	N
S = Spawning		N = Nursery			SN= Spawning and Nursery			None				

Table 6.8: Species which use the Bains Area as a Spawning and Nursery Ground [8]

6.2.2.1 Permanent disturbance

The decommissioning of facilities *in situ* can lead to long-term impacts to the seabed and its habitat, especially modifications to seabed dynamics (and morphology) and changes to the benthic fauna.

There is no additional deposited rock planned for the decommissioning of the Bains Field. However, a small volume, in the region of 2Te to 5Te, may be required as contingency to bury the flowline and umbilical ends at the WHPS location, should sufficient depth of burial with natural sediment not be achieved. Likewise, should the fronded mattresses be found not to be buried and that they present a snagging hazard, (Section 4.3.4.1) there may be a requirement to deposit rock in the scoured area at the edges of the unburied mattresses, estimated to be worst case of 350m^3. As such, there is no planned additional permanent loss of habitat expected.

Should the rock be required the area impacted will be in the region of 300m^2 and within the existing disturbed and scoured area. This will be of similar impact to the rock deposits within the trench. Given the small size of the area affected in relation to the existing similar rock deposits and the low likelihood of this being required the impact of the deposits has been assessed as 'low' and therefore not considered further.

Seabed dynamics

Decommissioning of flowline and umbilical *in situ*, the buried fronded mattresses and 10,294Te of deposited rock in the trench over the flowline could potentially change the seabed dynamics. The total area of flowline, umbilical and fronded mattresses is estimated as 0.01522km^2, a very

small proportion of the area of the EIS.

Since installation the burial status of the flowline and umbilical has not been seen to change ([43] and [5]), and the trenches filled with rock and natural sediment have remained backfilled. This suggests that the decommissioning of the Bains flowline, umbilical, buried fronded mattresses and deposited rock *in situ* is unlikely to have an impact on the seabed morphology and dynamics.

Change to benthic species

The flowline and umbilical will be cleaned prior to decommissioning, however, there is a possibility that a small quantity of residual deposits will remain inside of the flowline. The flowline and umbilical will corrode and degrade over time. Based on available industry degradation studies this is estimated to be greater than 100 years [40]. As such there is a possibility that any residual deposits will be released to the water column. If the residual deposits become bioavailable this could impact benthic species. Any such release would be very gradual, and any impact would be highly localised [26].

Given the above, the relatively small area that will be affected and the homogenous nature of the sediment, the significance of permanent disturbance has been assessed as 'low'.

6.2.3 Control and mitigation measures

The following measures will be adopted to ensure that seabed disturbance and its impacts are minimised to a level that is 'as low as reasonably practicable':

- All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised;
- Where possible, the decommissioning activities will be undertaken outside the spawning periods;
- Careful planning, selection of equipment, and management and implementation of activities;
- A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; and
- The area that requires an over-trawl assessment will be optimised through discussion with the relevant fishing organisations and the regulators.

6.2.4 Conclusion

Seabed disturbance from the decommissioning of Bains will occur due to localised excavation for access for cutting and lifting, lifting (removal), temporary and possible permanent deposits, and the over-trawl assessment. These activities will result in the displacement of substrate and the suspension and subsequent re-settlement of sediment.

Routine measures to control disturbance include operational planning and equipment selection.

The species and habitats observed near Bains are relatively widespread throughout the EIS and the area anticipated to be impacted represents a very small percentage of the available habitat. The environment near Bains shows signs of a mobile sediment due to the scouring at the WHPS, therefore, the seabed community is likely to be tolerant to suspension and subsequent settlement of sediment. Considering this, the disturbed habitats are expected to recover rapidly, through species recruitment from adjacent undisturbed areas.

Over the duration that the flowline, umbilical and the fronded mattresses have been installed they have remained buried. This indicates that they will remain buried, therefore not significantly affecting the seabed dynamics. This includes the rock deposited within the trench at the time of installation. Therefore, it is also anticipated that the small about of contingency rock deposits would also not significantly affect the seabed dynamics. The significance of the impact of decommissioning the flowline, umbilical and mattresses *in situ* are considered 'low'.

Spatially the largest impact on the seabed is associated with the over-trawl assessment. Given the existing fishing practices in the area with associated ongoing impacts to the seabed and the short-term duration of the over-trawl assessment, the impact associated with the over-trawl assessment is expected to be 'low'.

In summary, due to the localised and relatively short duration of the decommissioning activities, and with the identified control and mitigation measures in place, the overall impact of seabed disturbance because of the decommissioning is assessed as 'low'.

6.3 Large Releases to Sea

This section identifies the sources of, and assesses the risk of impact from large releases to sea.

6.3.1 Sources

The largest inventory of fuel oil (diesel) associated with the decommissioning activities is likely to be carried by the DSV. Large unplanned releases of diesel to sea from vessels could occur because of:

- Loss of structural integrity of the vessels' storage tanks following a collision with another vessel or fixed facility; and
- Loss of structural integrity of storage tanks following corrosion or mechanical failure.

The worst case in terms of volume and rate of release would be the immediate total loss of diesel inventory to sea because of collision or mechanical failure. This eventuality is highly unlikely owing to the procedural (vessels' management systems) and operational controls that will be applied.

6.3.2 Receptors

Bains is located within the area that is proposed for the extension to the Liverpool Bay/Bae Lerpwl pSPA which is under consultation. SPAs are special sites designated under the EU Birds Directive to protect rare, vulnerable and migratory birds. The closest approved protected sites are approximately 8km from the Bains facilities (Figure 6.3).

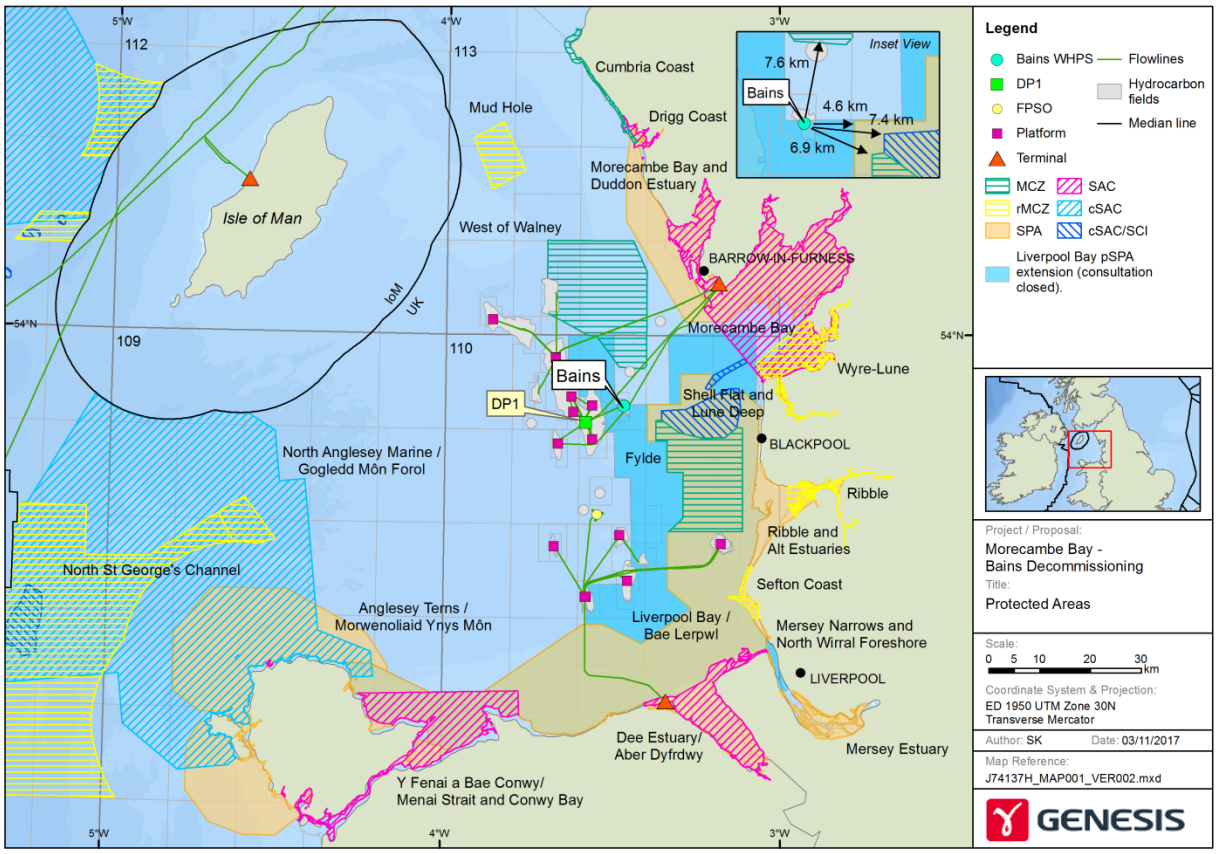


Figure 6.3: Protected Areas in the Vicinity of the Morecambe Hub

The extension to the Liverpool Bay/Bae Lerpwl pSPA would support internationally important populations of:

- Common tern;
- Little tern; and
- Little gull.

This area is particularly important for the terns as the sea around their breeding colonies is the ideal habitat for plunge diving for food.

The proposal is also to add cormorant and red-breasted merganser to the waterbird assemblage as named species.

Figure 6.4 has been extracted from the consultation documents for the extension to the pSPA [21]. It shows the mean density surface with maximum curvature threshold and possible SPA boundary. The bird density at the Bains location is 0.04-0.07 birds per km^2, relatively low in comparison to the majority of the proposed extension area.

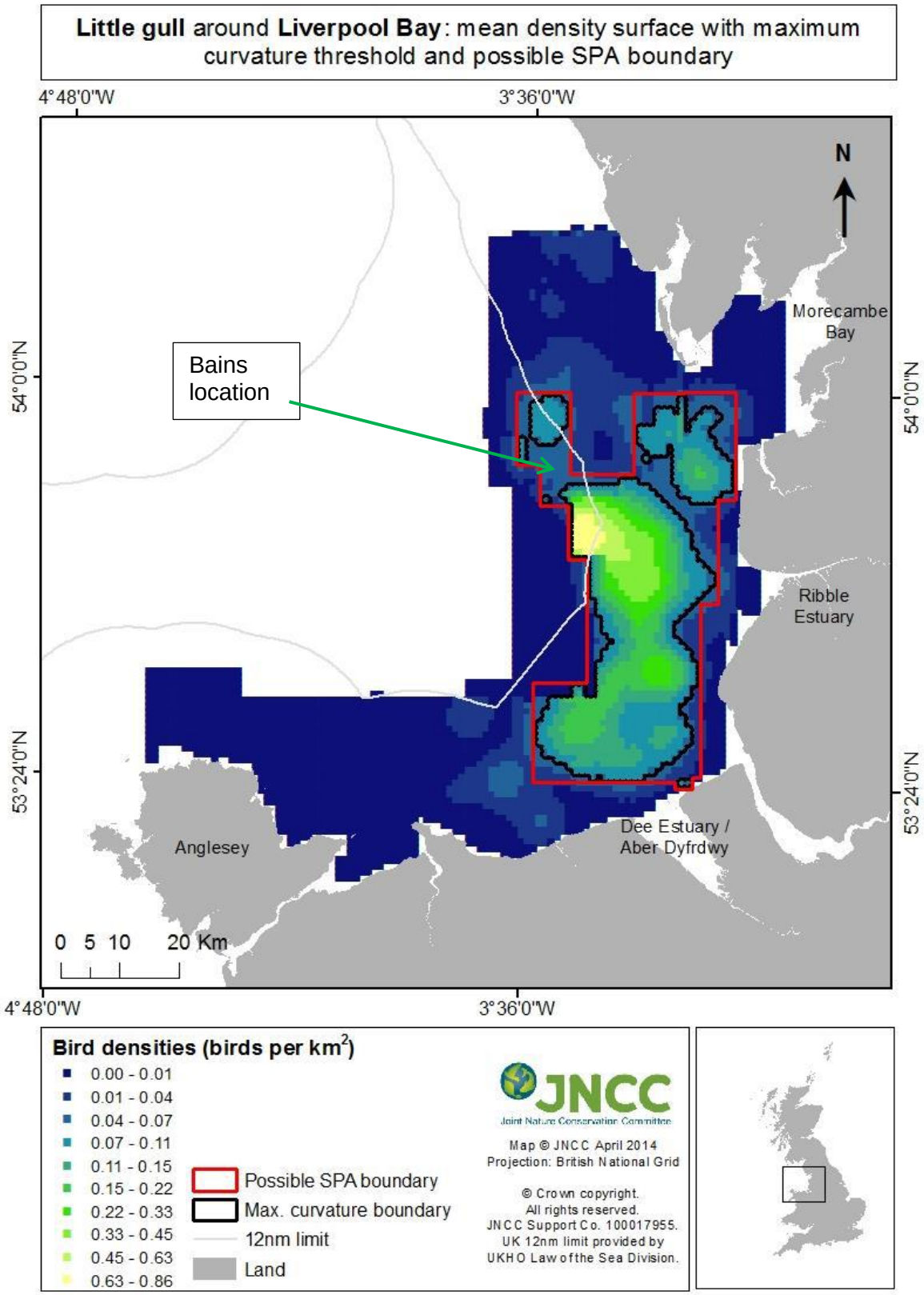


Figure 6.4: Little Gull Mean Density in Liverpool Bay/Bae Lerpwl pSPA

The total area of the Liverpool Bay/Bae Lerpwl pSPA is approximately 252,774ha. The new area proposed comprises approximately 82,481ha.

6.3.3 Impacts

The area impacted by a spill would be within the proposed extension to the Liverpool Bay/Bae Lerpwl pSPA and could extend to the protected areas around the coastline.

The risk and associated impact on the protected areas are managed under the Morecambe Hub OPEP [10] which models a scenario for the release of 916.8m^3 of diesel from the platform supply vessel. If the maximum inventory of the selected DSV materially exceeds this volume remodelling will be undertaken.

The consultation documents for the extension to the Liverpool Bay/Bae Lerpwl pSPA [21] state that

> 'with regards to the extension area for foraging terns, Article 3 of the Birds Directive already requires the "*upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones*." Natural England therefore already advises authorities to consider the impact of activities on areas outside of the current SPA boundary that support features of the SPA. This includes the management of supporting habitats for foraging terns which are qualifying features of the existing SPAs.' and
>
> 'with regards to new species (little gull, cormorant, red-breasted merganser) within the boundaries of the existing SPAs, the ecological requirements of the new species being added are the same as for those species already protected by the existing designations. Therefore no new management measures are required for these new species within the boundaries of the existing SPAs.'

This indicates that the existing management measures will be sufficient to protect the extended area and that no control and mitigation measures in addition to those already covered by the OPEP and Spirit Energy's marine procedures are required.

6.3.4 Control and mitigation measures

- Releases will be managed under the existing OPEP which will be updated if required;
- All vessel activities will be planned, managed and implemented in such a way that vessel durations in the field are minimised; and
- Spirit Energy's existing marine procedures will be followed to minimise risk of hydrocarbon releases.

6.3.5 Conclusions

A possible large hydrocarbon release from the Bains decommissioning could result from a collision with a vessel in the field. Should this occur, the surrounding area, including sites protected for birds could be impacted. The Bains well location is within a newly proposed extension to the existing Liverpool Bay/Bae Lerpwl pSPA therefore the potential impact of a release has been assessed in more detail.

The requirements for the existing pSPA include a requirement to consider the impact of activities on areas outside of the current pSPA boundary that support features of the pSPA. This includes the foraging area which the extension covers.

The risk of the release will be managed through existing measures, marine procedures and the existing OPEP.

In summary, the potential impact on the protected areas has been assessed as 'medium', however the existing control and mitigation measures including the OPEP and marine procedures manage this risk to a level that is 'as low as reasonably practicable'.

6.4 Cumulative

This section identifies and assesses the potential cumulative impact from the Bains decommissioning activities and other activities in the vicinity. Cumulative impacts are impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project.

The other uses of the area potentially impact the same receptors as those impacted by the Bains decommissioning. The potential impacts of the Bains decommissioning are those described in Section 5, with that attributed to seabed disturbance being assessed as having a potential level of impact of 'medium'.

The key other uses of the area are shown in Figure 6.5.

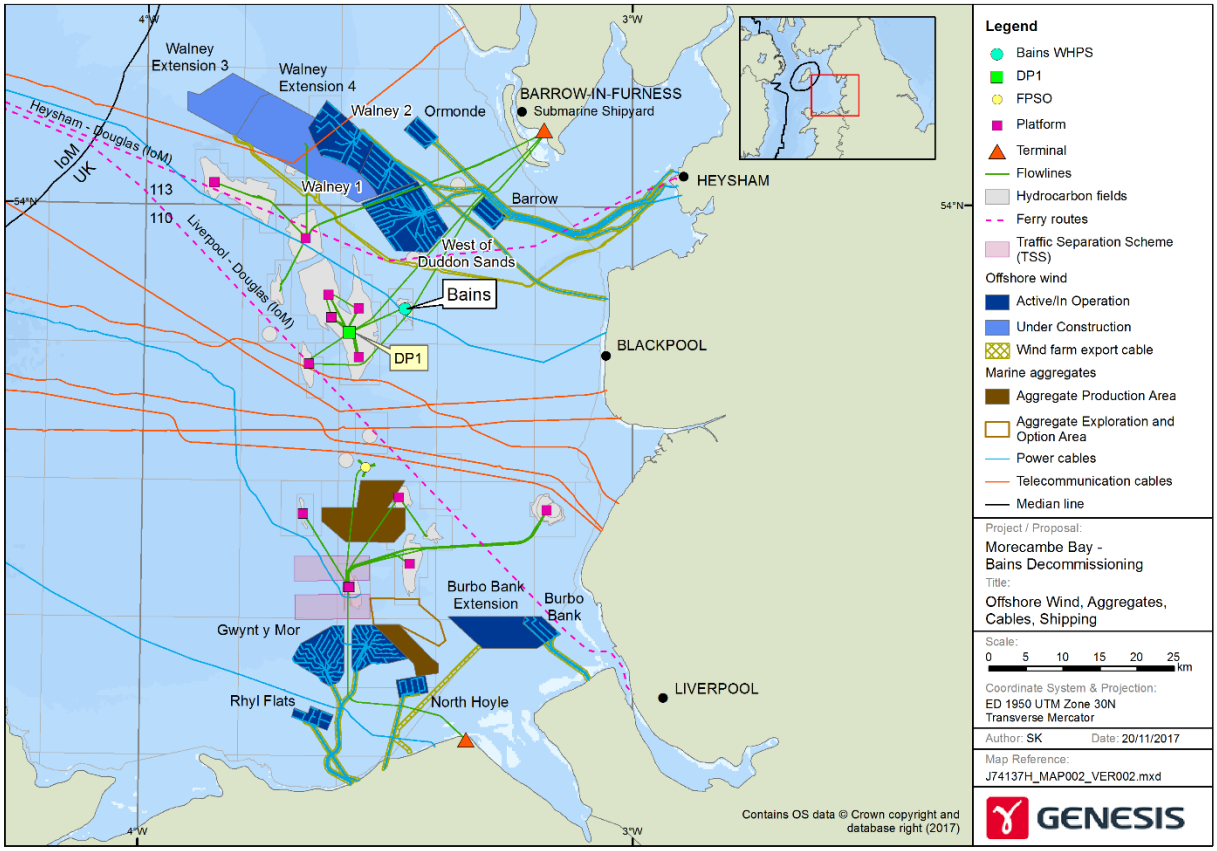


Figure 6.5: Uses of the Marine Environment in the Vicinity of Bains

Section 6.2 assesses the direct and indirect impacts from seabed disturbance. It is found that there are localised short-term and, to a lesser extent, long-term impacts.

Recovery depends on recruitment of affected species from the surrounding area [24]. Should the surrounding area be affected by other uses, recruitment and therefore recovery could be slowed.

The other uses of the area that could disturb the seabed and affect the same receptors are aggregate production, installation of new facilities (e.g. wind turbines) and decommissioning of facilities, all of which present both possible short-term and long-term cumulative impacts.

The aggregate production site is approximately 25km south, and the wind farm installation activities are approximately 15km north, of the Bains WHPS. At this distance it is considered unlikely that effects on recruitment would occur.

Table 6.9 shows the area of the seabed that could be disturbed should *in situ* decommissioning

be the selected solution for the other pipelines or cables in the vicinity of the Morecambe Hub area. The area for permanent disturbance is associated with pipelines remaining *in situ.* The temporary disturbance is associated with the required decommissioning activities including the area affected by the over-trawl assessment of the pipelines.

ELEMENT	PERMANENT (km^2)	TEMPORARY (km^2)
Bains Decommissioning	0.01522	1.2166
CPP1 to Calder electrical cable	0.0035	0.7
PL1945	0.02253	4.506
PL195	0.0019	0.38
PL205	0.0019	0.38
PL2718	0.0019	0.38
IF-07E13	0.0019	0.38
IF-07E31	0.0019	0.38
PL194	0.0018	0.36
PL204	0.0018	0.36
IF-07E41	0.0018	0.36
IF-07E84	0.00235	0.47
PL517	0.0016	0.32
PL682	0.0016	0.32
IF-07E16	0.0016	0.32
IF-07E68	0.00195	0.39
PL572	0.0029	0.58
PL683	0.0029	0.58
PL144	0.0192	3.84
TOTAL	**0.09025**	**16.2225**

Table 6.9: Cumulative Seabed Impact – Morecambe Hub Area

The total cumulative area of seabed identified which may experience temporary impacts is 16.2225km^2. Most of the area impacted is attributed to the over-trawl assessment which is an impact equivalent to fishing activities that are currently undertaken in the area.

The permanent impacts are associated with changes in burial of the infrastructure decommissioned *in situ*. The worst case estimate of area affected is 0.09025km^2 which is relatively small when compared to the total area of the EIS or a licence block.

The South Morecambe Field lies in ICES rectangle 36E6. Fishing effort in this area for 2015 was relatively high with 1,172 days recorded. The level of fishing effort is not equal throughout the ICES rectangle (Figure 6.6) and fluctuates throughout and between years. The most heavily fished months during 2015 were February, August, September and December with 125 to 128 days of recorded effort [39].

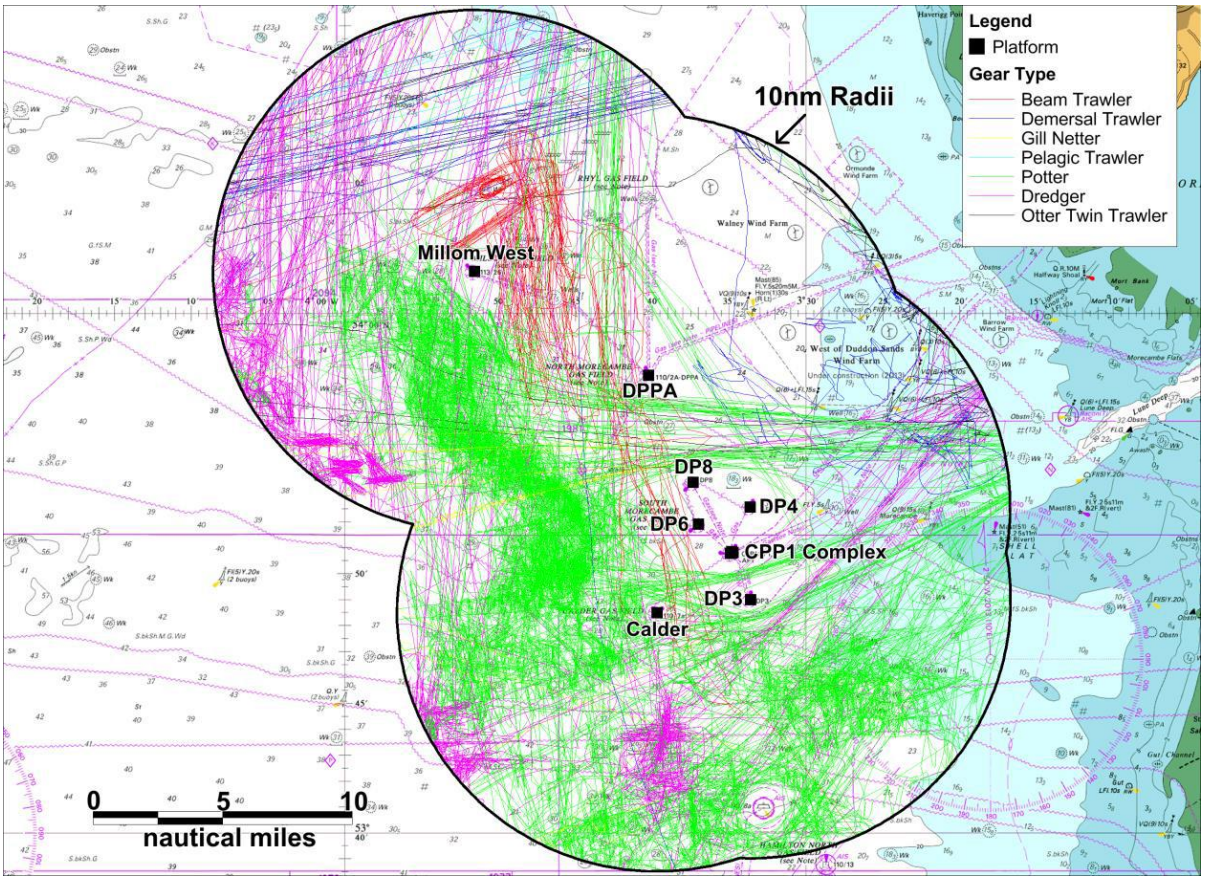


Figure 6.6: Fishing Vessels Within 10nm of the Morecambe Platforms by Gear Type [1]

The significance of the contribution from Bains decommissioning to the total cumulative impact has been assessed as 'low'. This is due to the:

- Short duration and localised nature of the activities and the resulting temporary seabed disturbance;
- Permanent impact only being associated with changes to the buried pipelines; and
- Existing extensive fishing practices in the area with associated ongoing impacts to the seabed.

7. CONCLUSIONS

The Bains Field facilities are to be decommissioned by Spirit Energy between 2018-2023. The WHPS, grout bags and gabion sacks will be completely removed. A CA has been carried out to determine the preferred decommissioning solution for the flexible flowline (PL1958) and the umbilical (PLU1959). The preferred solution is to decommission the flowline and umbilical, and associated buried fronded mattresses *in situ,* with removal of unburied end sections. Existing deposited rock which is within the flowline trench will also be decommissioned *in situ*.

The adequacy of leaving buried fronded mattresses *in situ* will be tested by carrying out an over-trawl. Unburied fronded mattresses that are recoverable and present a snagging hazard will be removed and recovered to shore for disposal. Should the mattresses not be recoverable and should the over-trawl assessment demonstrate that the fronded mattresses would pose a snagging hazard, it would be proposed to implement contingency measures. These would involve depositing up to an estimated 350m^3 (520Te) of rock in the scoured area adjacent to the fronded mattresses.

This EA report considers the impact of the planned activities and possible unplanned events associated with the decommissioning of the Bains facilities. The impact was determined by considering each of the planned activities and the receiving environment to determine the overall level of impact as either ‘low’, ‘medium’ or ‘high’. Following initial environmental assessment the level of the impact of all activities was determined with existing routine control and mitigation measures in place. The impact level was assessed as ‘low’ except for disturbance to the seabed and cumulative activities.

Following further assessment and the implementation of additional control and mitigation measures the level of impact from both seabed disturbance and cumulative impacts was determined to be ‘low’.

The appraisal also assessed the significance of unplanned events concluding that the significance of all risks was low, with the exception of the risk associated with an unplanned (accidental) large hydrocarbon release. Due to Bains being within a potential extension to the Liverpool Bay/Bae Lerpwl pSPA the potential impact of a loss to sea of the entire hydrocarbon inventory of the DSV while at Bains was assessed as ‘medium’. This risk will be managed to a level that is ‘as low as reasonably practicable’ under the existing OPEP and amendments if required.

7.1 Environmental management

Spirit Energy will follow routine environmental management activities for example contractor management, vessel audits and legal requirements to report discharges and emissions, such that the environmental impact of the decommissioning will be minimised. Following the EA process, it can be concluded that activities associated with the decommissioning of the Bains facilities are unlikely to significantly impact the environment or other sea users, for example shipping traffic and fishing, if control and mitigation measures are effectively applied.

A summary of proposed control and mitigation measures is shown in Table 7.1.

CONTROL AND MITIGATION MEASURES
General and Existing
• Lessons learnt from previous decommissioning scopes will be reviewed and implemented as appropriate; • Vessels will be managed in accordance with Spirit Energy's existing marine procedures; • The vessels' work programme will be optimised to minimise vessel use; • The OPEP is one of the controls included in a comprehensive management and operational controls plan developed to minimise the likelihood of large hydrocarbon releases and to mitigate their impacts should they occur; • All vessels undertaking decommissioning activities will have an approved Shipboard Oil Pollution Emergency Plan (SOPEP); • Existing processes will be used for contactor management to assure and manage environmental impacts and risks; and • Spirit Energy management of change process will be followed should changes of scope be required.
Seabed Disturbance
• All activities which may lead to seabed disturbance will be planned, managed and implemented in such a way that disturbance is minimised; • The careful planning, selection of equipment, and management and implementation of activities; • A debris survey will be undertaken at the completion of the decommissioning activities. Any debris identified as resulting from oil and gas activities will be recovered from the seabed where possible; • The area that requires and over-trawl assessment will be optimise through discussion with the relevant fishing organisations and the regulators.
Large Releases to Sea
• Releases will be managed under the existing OPEP. The OPEP will be updated with additional inventory, and additional measures identified and implemented, should modelling show increase risk.

Table 7.1: Summary of Proposed Control and Mitigation Measures

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Appendix A SUMMARY OF WASTE LEGISLATION

The revised Waste Framework Directive (Council Directive 2008/98/EC) was adopted in December 2008 with European Union (EU) Member States being required to implement revisions by December 2010. The overriding aim is to ensure that waste management is carried out without endangering human health and without harming the environment. Article 4 also states that the waste hierarchy shall be applied as a priority order in waste prevention and management legislation and policy.

The Waste (England and Wales) (Amendment) Regulation 2012 outline the requirement for collection, transport, recovery and disposal of waste. They set out the principles of the waste hierarchy which should be considered when treating and handling waste. In addition, the OPRED guidance notes [30] under the Petroleum Act 1998 require all decommissioning decisions to be made in line with the waste hierarchy.

Whether a material or substance is determined as a 'waste' is determined under EU law. The EU Waste Framework Directive defines waste as:

"*any substance or object which the holder discards or intends or is required to discard*".

Materials disposed of onshore must comply with the relevant health and safety, pollution prevention, waste requirements and relevant sections of the Environmental Protection Act 1990. The waste management assessment should be based on the worst case and follow the hierarchy shown below, in line with relevant legislation, permits and consents.

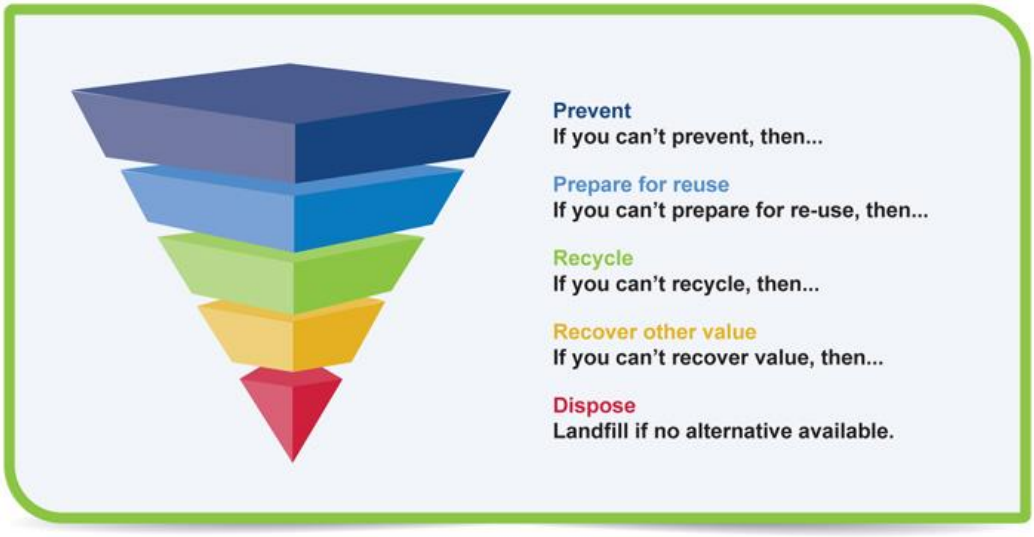

Figure A.1 Waste Hierarchy

Management of radioactive materials is governed under:

- Radioactive Substances Act 1993;
- Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008; and
- The handling and disposal of radioactive waste requires additional authorisation.

Onward transportation of waste or materials must also follow applicable legislation, such as the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009, a highly prescriptive regulation governing the carriage of dangerous goods by road.

Appendix B SUMMARY OF HSE & ENVIRONMENTAL IMPACT MATRICIES

TABLE B.1: ENVIRONMENTAL IMPACT TABLE

							Benefit	**Duration of harmful effect / recovery** (c. 80% of damage rectified)				
					Land and air			within 1 month	within 1 year	≤3 years	>3 years or >2 growing seasons	>20 years
					Surface water (any harm of drinking water source or ground water would be cat 4 or above)			Immediate	< 1 month	≤1 years	>1 year	>10 years
					Reinstatement of Built Environment - Can be repaired			immediately	in <1 year	in <3 years	in >3 years	Cannot be rebuilt
					Recovery for Societal - Decrease in the availability or quality of a resource			Access immediately	Short term decrease	Medium term decrease	Medium to long term decrease	Long term decrease
Habitats / Species	**Air**	**Soil or sediment**	**Water**	**Built Environment**	**Societal**		+1	1	2	3	4	5
Large area of habitat and/or large number or proportion of population or species impacted.	Large increase in contaminants in the air exceeding quality limits	Large area with contamination resulting in hazardous soil to humans (e.g. skin contact) or the living environment, remediation available (but difficult).	Drinking water standards breached for a large number of properties. Large groundwater body effected. Large water body exceeds a water quality guideline or objective.	Complete destruction of an area of built importance	Large population with high dependence on the impacted resource or large loss for other users.	5	-	6 Minor	10 Moderate	15 Significant	20 Major	25 Catastrophic
Moderate area of habitat and/or moderate number or proportion of population or species impacted.	Moderate increase in contaminants in the air exceeding quality limits.	Moderate area with contamination sufficient to be environmental damage[6] or in alignment with contaminated land legislation.	Drinking water standards breached for a moderate number of properties. Moderate groundwater body effected. Moderate water body exceed a water quality guideline or objective.	Loss of integrity to an area of built importance or nationally registered building leading to de-registering / categorisation with a need for remedial / restorative work.	Moderate population with moderate dependence on the impacted resource or moderate loss for other users.	4	-	4 Negligible	8 Minor	12 Moderate	16 Significant	20 Major
Small area of habitat impacted and/or small number or proportion of population or species impacted.	Small Increase in contaminants in the air exceeding quality limits	Contamination not leading to environmental damage	Drinking water standards breached for a small number of properties. Small groundwater body effected. Small water body exceed a water quality guideline or objective.	Loss of integrity to an area of built importance or nationally registered building with a need for remedial / restorative work.	Small population with small dependence on the impacted resource or small loss for other users.	3	-	3 Negligible	6 Minor	9 Minor	12 Moderate	15 Significant
Change is within scope of existing variability (or acceptable mixing zone) but potentially detectable or all within the site boundary / 500m zone (78.5 hectares).				Loss of integrity to an area of built importance or nationally registered building need for remedial / restorative work.	A small population with some dependence on the impacted resource. Negligible loss to other users.	2	-	2 Negligible	4 Negligible	6 Minor	8 Minor	10 Moderate
Effects are unlikely to be noticed or detectable.						1	-	1 Negligible	2 Negligible	3 Negligible	4 Negligible	5 Negligible

Low	Impact broadly acceptable and considered 'as low as reasonably practicable'	High	Impact intolerable without control and mitigation measures required to be reduce impacts to 'as low as reasonably practicable'
Medium	Impact is tolerable but to be managed to 'as low as reasonably practicable'	P	Positive – Positive or beneficial impact

The translation for the impact table to the severity scale is as shown below.

SCALE of IMPACT	Severity ranking in myHSES (High, Medium and Low)	SEVERITY SCALE (Risk Assessment Matrix[7])	ENVIRONMENTAL DESCRIPTION (FROM THE RISK MATRIX) N/A to built env or societal in RAM
25	H	Catastrophic	Catastrophic environmental impact which is widespread or affects a highly sensitive valuable environment requiring long term remediation.
20	H	Major	Major environmental impact to regional or high value environment requiring protracted remediation.
15-16	H	Significant	Significant environmental impact on local area. Long term natural recovery or moderate remediation intervention.
10-12	M	Moderate	Moderate environmental impact in neighbouring area. Longer term natural recovery or minor remediation intervention.
6-9	M	Minor	Minor environmental impact on site or to lower value environment with short term natural recovery.
1-5	L	Negligible	Negligible environmental impact.

[6] Damage is defined as per the EU Environmental liability Directive or equivalent
[7] Spirit Energy Risk Assessment Matrix CEU-HSEQ-GEN-GUI-0051

		Frequency (per yr) and Likelihood					
		$\leq 1x10^{-5}$	$>1x10^{-5}$ to $1x10^{-4}$	$>1x10^{-4}$ to $1x10^{-3}$	$>1x10^{-3}$ to $1x10^{-2}$	$>1x10^{-2}$ to $1x10^{-1}$	$> 1x10^{-1}$
		Highly Unlikely	Very Unlikely	Unlikely	Possible	Moderately Likely	Likely
Consequences – Environment (E)		1	2	3	4	5	6
Catastrophic environmental impact which is widespread or affects a highly sensitive / valuable environment requiring long term remediation.	6	6	12	18	24	20	36
Major environmental impact to regional or high value environment requiring protracted remediation.	5	5	10	15	20	25	30
Significant environmental impact on local area. Long term natural recovery or moderate remediation intervention.	4	4	8	12	16	20	24
Moderate environmental impact in neighbouring area. Longer term natural recovery or minor remediation intervention.	3	3	6	9	12	15	18
Minor environmental impact on site or to lower value environment with short term natural recovery.	2	2	4	6	8	10	12
Negligible environmental impact.	1	1	2	3	4	5	6

Table B.2: Environment Risk Assessment Matrix