Saltire Area
Subsea and Pipelines Infrastructure
Comparative Assessment Report

May 2020

DOCUMENT CONTROL

Approvals

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Terms and Abbreviations

Abbreviation	Explanation
AHP	Analytical Hierarchy Process
BEIS	Department for Business, Energy and Industrial Strategy
CA	Comparative Assessment
dB	Decibels
DP	Decommissioning Programme(s)
DSV	Dive Support Vessel
ENVID	Environmental Identification
FCA	Flotta Catchment Area
FishSAFE	The FishSAFE Information Project and Database
HAZID	Hazard Identification
HazMat	Hazardous Materials
HLV	Heavy Lift Vessel
JNCC	Joint Nature Conservation Committee
m	metres
m^2	square metres
MAH	Major Accident Hazards
MCDA	Multi-Criteria Decision Analysis
MFE	Mass Flow Excavator
MS	Much Stronger
MW	Much Weaker
N	Neutral
NORM	Normally Occurring Radioactive Material
OD	Outside Diameter
OGA	Oil & Gas Authority
OPRED	Offshore Petroleum Regulator for Environment & Decommissioning
ROV	Remotely Operated Vehicle
OSPAR	Oslo Paris
PLL	Potential for Loss of Life
S	Stronger
SEPA	Scottish Environment Protection Agency

Abbreviation	Explanation
SFF	Scottish Fishermen's Federation
SLV	Single Lift Vessel
Te	tonnes
TPa	Tera Pascals
UK	United Kingdom
USV	Underwater Safety Valve
VMS	Very Much Stronger
VMW	Very Much Weaker
W	Weaker
WID	Water Injection Development

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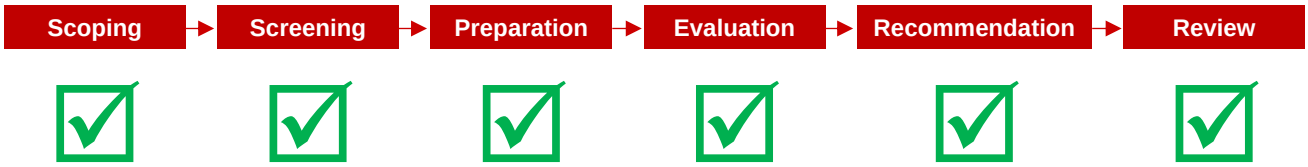
EXECUTIVE SUMMARY

Repsol Sinopec Resources UK has conducted a Comparative Assessment (CA) in support of decommissioning of the Saltire Area subsea infrastructure as described in the Decommissioning Programmes (DP). The following steps from the Oil and Gas UK Guidelines have been completed:



This CA report presents the methodology, decisions which needed to be taken, the preparation works carried out, the outcomes (recommendations) from the internal workshop and the outcomes from the external (with stakeholders) workshop.

The CA for the Subsea Infrastructure of the Saltire Area Decommissioning Project has focused on four decommissioning groups (groups 1, 2, 3 and 4).

The selected decommissioning option for groups 5 and 6 will be subject to a separate assessment and, Groups 7 and 8 were confirmed to be full removal at the CA Scoping and Screening stage, in line with current industry guidance. The outcome of the CA process has made the following recommendations:

Decommissioning Group	Decommissioning Recommendation	Justification
Group 1 – Saltire A to Piper B Bundle	Option 1b - Leave surface laid bundle in situ with ends and spans remediated using rock dump	Most or close to most attractive from Technical and Safety perspective. Less attractive from Environmental and Societal perspective but overall balanced view indicates a small overall preference. Inclusion of economics strengthens preference.
Group 2 – Saltire A to Saltire WID Bundle	Option 1b - Leave surface laid bundle in situ with ends and spans remediated using rock dump	Most or close to most attractive from Technical and Safety perspective. Less attractive from Environmental and Societal perspective but overall balanced view indicates a small overall preference. Inclusion of economics strengthens preference.
Group 3 – Chanter Oil/Condensate Flexible Flowline	Option 2a - Leave currently buried flowline in situ with ends and exposures trenched & buried	Most attractive from Safety, Environmental, Technical and Societal perspectives. Inclusion of economics changes preference to rock cover option but trench and bury option retained to comply with BEIS guidelines that economics should not drive outcome.
Group 4 – Trenched & Buried Umbilicals / Power Cables	Option 2a - Leave currently buried items in situ with ends and exposures trenched & buried	Most attractive from Safety, Environmental, Technical and Societal perspectives. Inclusion of economics retains preference.
Group 5 – Subsea Structures	Full Removal	As per industry guidance
Group 6 – Towhead Umbilicals	Full Removal	As per industry guidance
Group 7 – Spools / Jumpers	Full removal as base case – no CA	As per industry guidance.
Group 8 – Mattresses & Grout Bags	Full removal as base case – no CA Note 1	As per industry guidance.

Note 1: Where mattresses / grout bags cannot be safely recovered due to degradation, these shall be buried in situ if this is deemed appropriate following discussion with OPRED.

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to present the Comparative Assessment (CA) for the Subsea Infrastructure in support of the Saltire Decommissioning Programmes (DPs) **[Ref. 1]**. It is produced in satisfaction of the requirement to perform a CA for subsea equipment as detailed in the BEIS Guidelines **[Ref. 2]** and the Oil & Gas UK Guidelines **[Ref. 3]**. Having read and utilised these guidelines, Repsol Sinopec Resources UK Limit believe that this report fully expresses the requirements to perform a CA for subsea equipment.

It describes the field infrastructure addressed, the decommissioning options considered, the CA methodology used, and the recommendations made during the CA process.

1.2 Background

Repsol Sinopec Resources UK Limited has commenced planning for the decommissioning of the Saltire Area development (a collection of developed fields comprising Saltire, Chanter and Iona) and is undertaking studies to support the preparation of Decommissioning Programmes for these assets through 2018.

The Saltire Area is located in UK block 15/17, approximately 200 kilometres North-East of Aberdeen in 145 metres of water. It forms part of the Flotta Catchment Area (FCA) system. Saltire A is a fixed drilling/production platform, located 7 kilometres South-East of the Piper B platform. Production from Saltire, Chanter and Iona was suspended in August 2014.

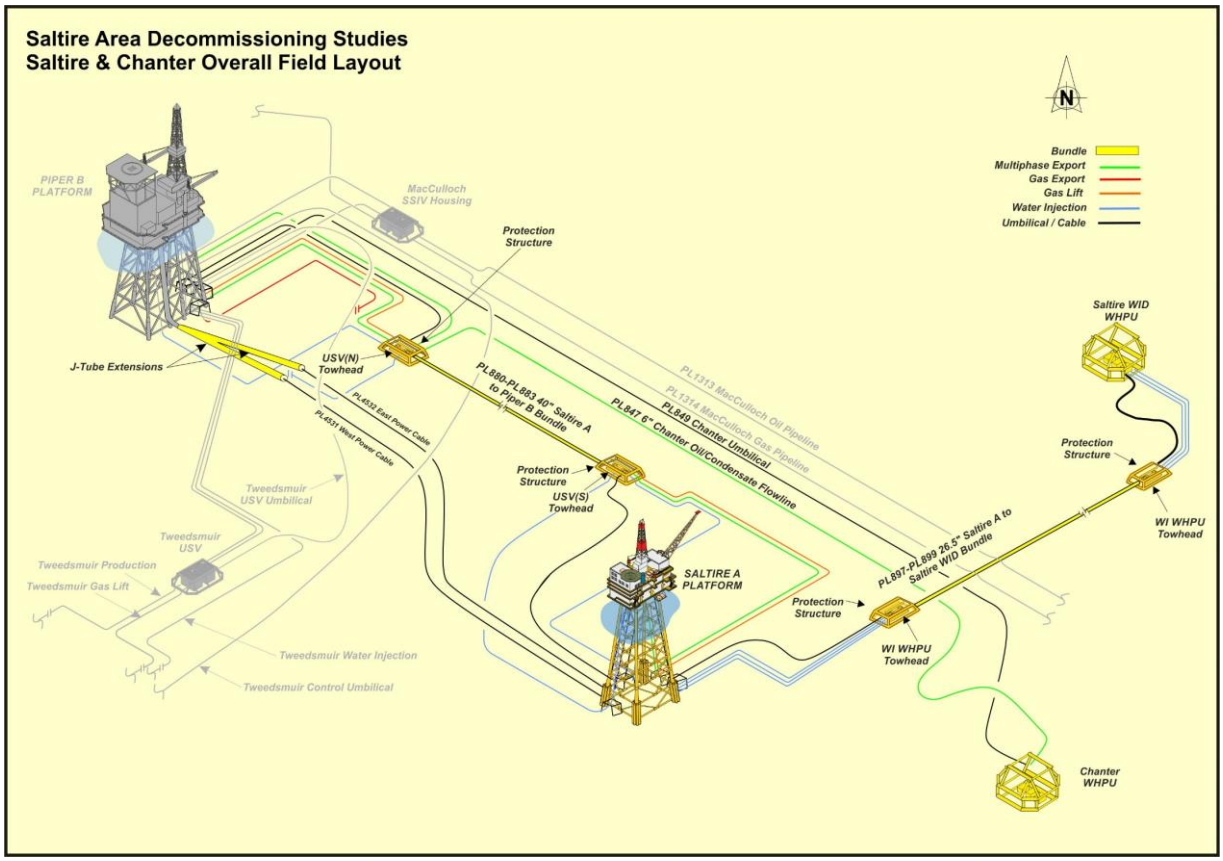
Saltire A is a fixed drilling/production platform, located 7 kilometres South-East of the Piper B platform. Prior to production being suspended, oil and gas from the Saltire, Iona and Chanter fields was exported to Piper B via a 40-inch pipeline bundle containing one 10-inch diameter multiphase export line, an 8-inch diameter gas lift line and two 16-inch diameter lines. One of the 16-inch diameter lines was used for sea water injection (previously gas lift service); the other 16-inch diameter line was previously used for sea water injection. In addition, oil and gas from the Chanter field was also exported to the Piper B platform from a single Chanter subsea well via a 6-inch flexible flowline.

From Piper B, oil was exported through a 30-inch diameter line to the Flotta Terminal facilities in Orkney, while gas was exported to the St Fergus Gas Terminal via a 16-inch diameter gas export line. From 2000, up until the suspension of production, all gas was used for fuel requirements within the Greater Piper Area.

Injection water to support production from the Saltire field was also provided to three subsea wells via the Saltire A to Saltire WID bundle.

Production from Saltire, Chanter and Iona was suspended in August 2014. Formal approval to cease production was requested from the Oil and Gas Authority (OGA) on the 19th of September 2016, with approval being received by Repsol Sinopec Resources UK Limited on the 11th of November 2016. The Saltire Area field layout is presented in Figure 1.1.

Figure 1.1: Saltire Area Field Layout



Full technical details of the Saltire Area subsea infrastructure can be found in the Pipeline Status and Historical Review Report **[Ref. 5]** and the Saltire Area Asset and Waste Inventory Report **[Ref. 6]**.

1.3 Report Structure

This CA Report contains the following sections:

- Section 1 — An introduction to the document and project, including acronyms
- Section 2 — An overview of the CA process and methodology adopted
- Section 3 — A summary of the outcome of the scoping phase.
- Section 4 — An overview of the CA conducted for Group 1 – Saltire A to Piper B Bundle
- Section 5 — An overview of the CA conducted for Group 2 – Saltire A to Saltire WID Bundle
- Section 6 — An overview of the CA conducted for Group 3 – Chanter Oil / Condensate Flexible Flowline
- Section 7 — An overview of the CA conducted for Group 4 – Trenched and Buried Umbilicals / Power Cables
- Section 8 — A discussion of the evaluation conducted and the outcome obtained
- Section 9 — A list of documents and other sources referenced in the document
- Appendix A — An explanation of the evaluation methodology adopted
- Appendix B-E — The detailed CA Evaluation outcomes for the Groups
- Appendix F-I — Datasheets describing technical details associated with the decommissioning options examined

2 METHODOLOGY

2.1 Overview

CA studies are conducted widely in engineering to ensure robust and justified decision making; they are not limited to decommissioning. However, industry guidance on the preferred approach to CA for decommissioning is published by Oil & Gas UK **[Ref. 3]**. As such, CA is a core part of the overall decommissioning planning process being undertaken by Repsol Sinopec Resources UK Limited for the Subsea Infrastructure associated with the Saltire Area Decommissioning Project.

Within the guidelines published by Oil & Gas UK **[Ref. 3]**, seven steps to the CA process are recommended. Table 2.1 provides an introduction to each of these steps, along with a status and commentary to demonstrate the current position for the subsea infrastructure associated with the Saltire Area decommissioning project.

Table 2.1: CA Process Overview and Status

Title	Scope	Status	Commentary
Scoping	Decide on appropriate CA method, confirm criteria, identify boundaries of CA (physical and phase).	✓	Pipeline Status and Historical Review Report **[Ref. 5]** and Asset and Waste Inventory Report **[Ref. 6]** prepared for subsea infrastructure. Battery limits defined; CA methodology and criteria established for Screening and revisited following Screening to ensure appropriate to evaluation phase.
Screening	Consider alternative uses and deselect unfeasible options.	✓	Screening workshops held Quarter 2 2018 with internal project team. Screening outcomes documented in Removal Options Screening Report **[Ref. 7]**.
Preparation	Undertake technical, safety, environmental and other appropriate studies. Undertake stakeholder engagement.	✓	Studies identified during screening phase undertaken to inform the evaluation of the remaining options. The studies completed are detailed in Section 2.4.
Evaluation	Evaluate the options using the chosen evaluation methodology.	✓	Internal workshops held during Quarter 2 2018. Evaluation methodology described in Section 2.5 and outcomes detailed in Sections 4, 5, 6 and 7.
Recommendation	Create recommendation in the form of narrative supported by charts explaining key trade-offs.	✓	The emerging recommendations for the decommissioning options selected are as identified during the Stakeholder Workshop and as detailed in this CA Report.
Review	Review the recommendation with internal and/or external stakeholders.	✓	The Stakeholder Workshop, was held with key external stakeholders (JNCC, SFF, SEPA, BEIS, and OGA) 24th June 2019 prior to formal CA submission to provide an opportunity to review emerging recommendations and incorporate stakeholder feedback.
Submit	Submit to BEIS as part of / alongside Decommissioning Programme.	✓	The CA Report has been submitted in support of the DP.

2.2 Scoping

The scoping phase of the CA process addresses the following elements:

- Boundaries for CA.
- Physical attributes of equipment.
- Decommissioning groups and options.

These are addressed in the following sub-sections.

2.2.1 CA Boundaries

The boundaries (battery limits) adopted by Repsol Sinopec Resources UK Limited for the Subsea Infrastructure of the Saltire Area Decommissioning Project are as follows:

- The subsea riser tie-in flanges at the Saltire A platform.
- Topside umbilical hang-offs at the Saltire A platform.
- The subsea riser tie-in flanges at the Piper B platform.
- Topside umbilical hang-offs at the Piper B platform.

The following equipment is included within the definition of subsea infrastructure:

- All subsea structures including their foundations.
- All rigid and flexible subsea pipelines / flowlines.
- All control and chemical jumpers.
- All spools.
- All umbilicals / cables.
- All mattresses / grout bags and deposits.

2.2.2 Physical Attributes of Equipment

All subsea equipment within the scope of the Saltire Area Field Decommissioning Project is listed in **[Ref. 5]** and **[Ref. 6]** along with the physical attributes that define the equipment. The attributes considered included the following:

- Structures:
    - Type.
    - Weight / size / shape.
    - Materials.
    - Installation method.
    - Integrity issues.
- Pipelines / Flowlines / Spools:
    - Pipeline number.
    - Type (rigid / flexible).
    - Service (gas / oil / water).
    - Material / diameter / wall thickness / coatings / length.
    - Seabed configuration (trenched / buried / surface laid).
    - Details of crossings / mattresses.

- As-left cleanliness / ability to clean lines.
- Integrity issues.

> Umbilicals / Cables / Jumpers:
  - Material / diameter / wall thickness / coatings / length.
  - Seabed configuration (trenched / buried / surface laid).
  - Details of crossings / mattresses.
  - As-left cleanliness / ability to clean lines / chemicals used.
  - Integrity issues.

> Protection & Support:
  - Type.
  - Material.
  - Configuration.
  - Dimensions.
  - Integrity issues.

2.2.3 Decommissioning Groups

Once the equipment items to be decommissioned and their attributes were captured, it was found to be beneficial for the CA process to group similar equipment together. This allows many items to be considered as a single group and can reduce the number of items for consideration, streamlining the process.

For the Subsea Infrastructure of the Saltire Area Decommissioning Project, the decommissioning groups, along with a list of each individual item that makes up the population of those groups, is detailed in full in the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. A brief summary of the decommissioning groups identified is included in Table 3.1.

2.2.4 Decommissioning Options

With the decommissioning groups established, all potential decommissioning options for each of the groups are identified. The base case for all groups is full removal as per the BEIS Guidelines **[Ref. 1]** and it is only those decommissioning groups where default full removal is not considered to be the clear optimum solution that alternative decommissioning options are considered.

Alongside full removal options, the following partial removal scenarios should be considered as specified in BEIS Guidelines **[Ref. 1]** and the Oil & Gas UK report into decommissioning of pipelines in the North Sea **[Ref. 8]**:

> Pipelines:
  - Re-use.
  - Minimal Intervention, i.e. exposed end removal.
  - Minor Intervention, i.e. exposed end / spans / exposure removal.
  - Major Intervention, i.e. full re-trench or rock placement.

2.3 Screening

The CA screening phase considers each feasible decommissioning option against the main criteria, as defined within the Oil & Gas UK Guidelines **[Ref. 3]**.

- Safety
- Environment
- Technical
- Societal
- Economic

For the Saltire Area, the screening phase was carried out during a workshop held in February 2018. The methodology adopted, workshop attendance and outcomes obtained are detailed fully in the Removal Options Screening Report **[Ref. 7]**. The methodology is briefly summarised below:

1. Identify decommissioning groups for full removal.
2. Review proposed decommissioning options for each remaining group.
3. Assess decommissioning options against the main criteria and record assessment and outcome in screening worksheets.
4. Record actions required to support retained decommissioning options.
5. Compile screening report.

The assessment was performed using a coarse, Red / Amber / Green method, as recommended in the Oil & Gas UK Guidelines **[Ref. 3]**. An additional category of 'showstopper', coloured dark grey was used. These categories are described Table 2.2.

Table 2.2: Screening Assessment Categories

Category	Description
Attractive	The option is considered attractive i.e. it has positive attributes in terms of the criterion being assessed.
Acceptable	The option is considered acceptable i.e. its attributes are not positive or negative in terms of the criterion being assessed.
Unattractive	The option is considered unattractive i.e. it has negative attributes in terms of the criterion being assessed.
Showstopper	The option is considered unacceptable. Should an option be assessed as unacceptable against any of the criteria, it is discounted, and no further assessment is required.

The cumulative assessment for each decommissioning option was then captured based on some basic, non-binding, ground rules. These were:

- Three or more criteria assessed as red resulted in the option being screened out (red);
- For similar full removal options, the likely least onerous option was retained (green) with any more onerous option considered as a sub-set of the less onerous option (light grey);
- For similar leave in-situ options, the most onerous option was retained (green) with any less onerous options considered as a sub-set of the more onerous option (light grey).

This approach was considered appropriate to ensure that the worst-case full removal options were compared to the less onerous leave in-situ options. This ensures, during the evaluation phase, that the assessment is not skewed such that leave in-situ options are selected over full removal options.

The outcomes for each group are summarised in Table 4.2, Table 5.2, Table 6.2 and Table 7.2.

2.4 Preparation Phase

During the preparation phase, detailed studies / analyses are conducted to provide information to support the Evaluation phase of the CA. The detailed studies / analyses that may be required are often identified early in the CA process. These studies / analyses are then supplemented by additional studies / analyses identified during the screening phase of the CA.

The studies / analyses conducted during the preparation phase of the CA process for the Saltire Area subsea infrastructure are as follows:

> Technology Review	A report into the current technology readiness level of a wide range of equipment / methods to assist in decommissioning of the Saltire Area infrastructure.
> Decommissioning Method Statements	Detailed method statements were developed for options carried forward to ascertain the activities and resources required to deliver each option.
> Emissions Assessment	Fuel consumption and atmospheric emissions assessment performed for options carried forward based upon activities and resources identified in method statements.
> Environmental Impact Review	Environmental impact reviews were conducted for options carried forward in areas of planned discharges, unplanned discharges and seabed disturbance based on activities and resources identified in method statements.
> HAZID	Hazard identification workshops were held to consider the risks associated with individual activities and subsequently decommissioning options.
> ENVID	An Environment Identification (ENVID) workshop was held to consider the environmental and social issues aspects (emissions, aqueous discharges, disturbance, noise, interference with other sea users, etc.) of the decommissioning options.
> Fishing Intensity Study	A Fishing Intensity Study was conducted to understand the extent of fishing operations in the area and to consider the potential fishing activity post decommissioning plus the potential risks to commercial fisheries that could result from options that leave infrastructure in-situ following decommissioning.

The findings of the studies / analyses are gathered in preparation for the evaluation phase of the CA. The key information obtained from these studies / analyses, used during the evaluation phase are provided in data sheets, included in Appendix F - Appendix I.

2.5 Evaluation Phase

The evaluation phase of the CA is where the remaining decommissioning options for each group are evaluated against each other in order to select the 'most preferred' decommissioning option. This evaluation process is conducted according to the Oil & Gas UK Guidelines **[Ref. 3]** and employs the data obtained during the preparation phase as summarised in the data sheets, included within Appendix F - Appendix I.

The evaluation phase was conducted during a workshop attended by the decommissioning project team. On a group by group basis, each option was scored against sub-criteria defined by the Project. The definition of each sub-criterion is provided within Appendix A.2.

Options were scored against each other on a pair-wise basis, using the qualitative terms – Neutral, Stronger, Much Stronger, Very Much Stronger, Weaker, Much Weaker and Very Much Weaker. Guidance for the application of these terms is provided within Appendix A.3.

This approach enables the assessment team to debate the strengths and weaknesses of each option at the sub-criterion level, which are then combined to provide an overall preference against each option. Where applicable, the resulting emerging recommendation was subjected to sensitivities to test the robustness of the result.

2.5.1 Criteria and Sub-Criteria Weightings

The primary criteria have been weighted neutrally. Given the differing, and sometimes conflicting, considerations that are represented by the criteria, it was considered appropriate that they be weighted equally to one another to avoid favouring any particular aspect or group. However, it was considered acceptable to weight the sub-criteria toward those areas that had higher importance to the overall impact of the proposed decommissioning options on the main criteria. Weightings are applied to relate the evaluated scores against one criterion to the evaluated scores of another criterion. They reflect the fact that the range from 'worst' to 'best' on one criterion might not be equivalent to the range of another criterion. Weightings also allow a single measure of preference to be derived for each option and highlight the criteria that are the key drivers/differentiators.

More detail of the methodology adopted for the evaluation phase of the Saltire Area Decommissioning Project and the sub-criteria weightings is detailed in Appendix A.

2.6 Review

The outcome from the CA process was reviewed with key external stakeholders during quarter 2 2019. Formal minutes from the stakeholder engagements sessions were recorded and all relevant feedback was captured. Details of the queries raised during the sessions and RSRUK's responses to those queries are included in the Decommissioning Programmes document for the Saltire A Topsides and Saltire Area Subsea Infrastructure **[Ref. 1]**.

3 COMPARATIVE ASSESSMENT - SCOPING OUTCOME

3.1 Decommissioning Groups

The subsea infrastructure was arranged into groups. All feasible decommissioning options for each group were considered and those options that were considered to be sufficiently unattractive were screened out, as detailed within the Removal Options Screening Report **[Ref. 7]**. The groups and the requirement for full CA, or otherwise, are summarised within Table 3.1 below.

Table 3.1: Groups and Decommissioning Recommendation

Group	Description	Decommissioning Approach
1	Saltire A to Piper B bundle	Subject to full CA
2	Saltire A to Saltire WID bundle	Subject to full CA
3	Chanter oil/condensate flexible flowline	Subject to full CA
4	Trenched & buried umbilicals / power cables	Subject to full CA
5	Subsea structures	Full removal
6	Towhead umbilicals	Full removal
7	Spools / jumpers	Full removal
8	Mattresses & grout bags Note 1	Full removal

Note 1: Where mattresses / grout bags cannot be safely recovered due to degradation, these shall be buried in-situ if this is deemed to be appropriate following discussion with OPRED.

The remaining subsea infrastructure groups for full comparative assessment are:

- Group 1 – Saltire A to Piper B bundle
- Group 2 – Saltire A to Saltire WID bundle
- Group 3 – Chanter oil/condensate flexible flowline
- Group 4 – Trenched & buried umbilicals / power cables

4 CA OUTCOME – GROUP 1 – SALTIRE A TO PIPER B BUNDLE

4.1 Group Characteristics

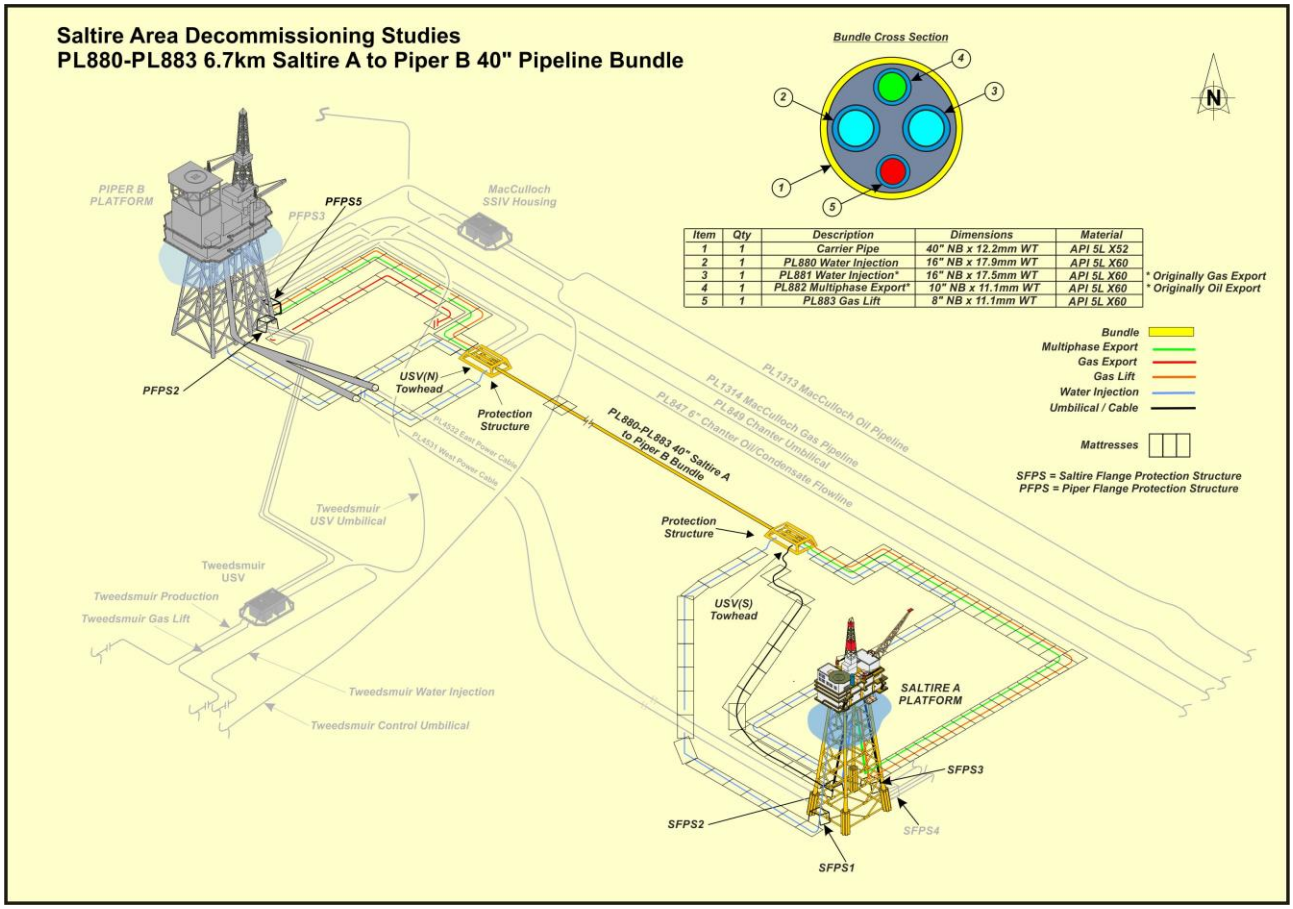
The individual items that make up Group 1 – Saltire A to Piper B Bundle are detailed in full within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. By way of summary, the layout is shown in Figure 4.1 and the key characteristics for Group 1 are presented in Table 4.1:

Table 4.1: Group 1 Items

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL880	16-inch water injection pipeline (failed)	Saltire	16	6,690	5,145
PL881	16-inch water injection pipeline (previously gas export)	Saltire	16		
PL882	10-inch multiphase export pipeline (previously oil export)	Saltire	10		
PL883	8-inch gas lift pipeline	Saltire	8		
-	40-inch carrier pipe	Saltire	40		

Note: For clarity, the above pipelines are configured in a bundle arranged within the 40-inch carrier pipe, which is surface laid.

Figure 4.1: Saltire A to Piper B Bundle (PL880-PL883)



The Saltire A to Piper B Bundle is surface laid and is exposed for over 99% of its length with only one section of burial where it is covered by concrete mattresses/grout bags and crossed by the Tweedsmuir umbilical near the Piper B end of the bundle **[Ref. 5]**.

From the most recent survey data **[Ref. 5]**, the bundle has a number of spans, which would be considered hazardous to other users of the sea, and there is potential for further spans to develop in the future.

4.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 1 – Saltire A to Piper B Bundle are detailed in Table 4.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7].**

Prior to decommissioning, the following activities will be required, regardless of the option selected for the bundle:

- Removal of all associated mattresses and grout bags (over tie-in spools, umbilicals, and at crossings);
- Disconnection of the tie-in spools and umbilicals from the bundle towheads;
- Disconnection of the towheads from the bundle;
- Removal of the tie-in spools and umbilicals;
- Removal of the towheads and towhead protection structures.

Table 4.2: Group 1 Decommissioning Options

Group 1 – Saltire A to Piper B Bundle		
Category	**Option**	**Description**
Leave in-situ (minor intervention)	1a – Do nothing	Perform no activities to remediate the ends or the spans of the bundle. This option was not carried forward as it is unacceptable from a safety and societal perspective.
	1b – Remediate ends and spans only	Rock placement over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to spanning). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at spans) may be adopted.
Leave in-situ (major intervention)	2a – Trench and bury exposures	Removal of bundle appurtenances (ballast chains and vent valves) followed by a trenching vessel equipped with suitable trenching technology trenching and burying the bundle to a target of 0.6 m depth of cover over the top of the bundle carrier pipe.
	2b – Cut and remove exposures	Remove exposed sections of the bundle by cutting into smaller sections and lifting them to the surface prior to removal to shore. As the bundle is fully exposed across the majority of its length, this option is functionally identical to option 3a.
	2c – Rock cover exposures	Cut ends of bundle to enable towhead removal and then perform rock dump to fully bury the bundle along its entire length.
Full removal	3a – Cut and lift	ROV cutting of the bundle into short sections and installing end stops (dependent on cutting method). The bundle sections then rigged and lifted to a construction vessel or alternative transport vessel/barge either directly or via subsea baskets and returned to shore for dismantling and recycling.
	3b – Reverse installation	Remove bundle by re-floating and towing to shore. This option was not carried forward as sufficient integrity of the bundle cannot be confirmed.

4.3 Decommissioning Options for Evaluation

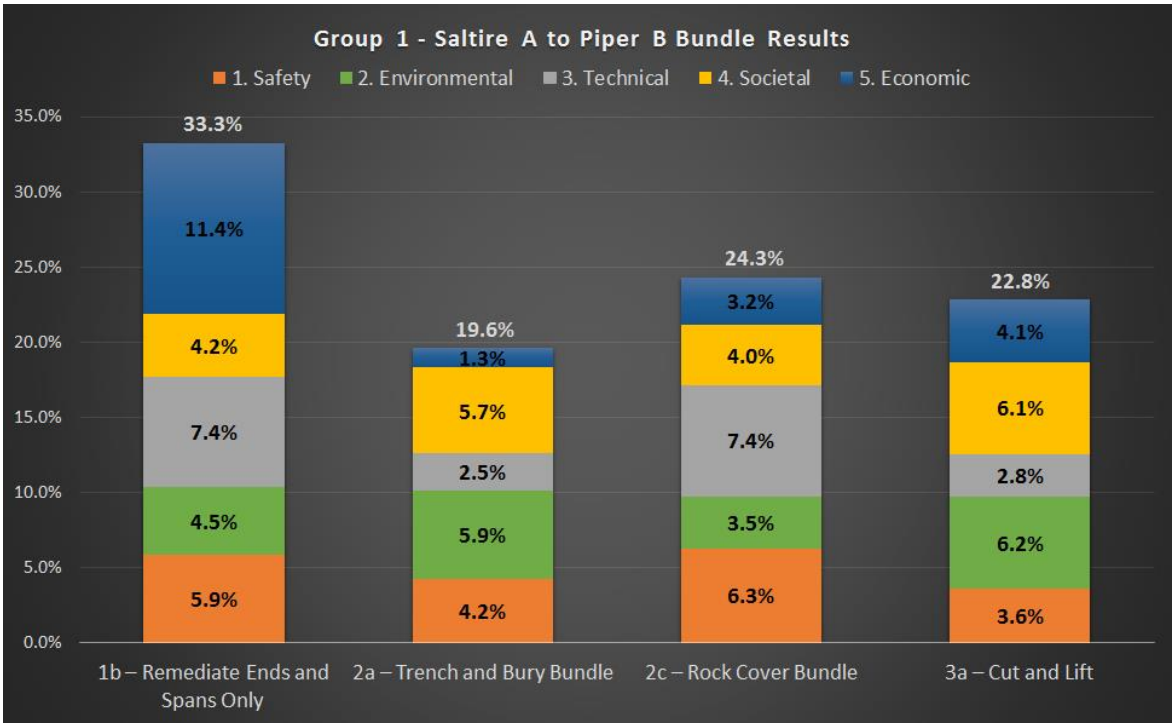
The decommissioning options for Group 1 that remained after screening and were taken forward to the evaluation phase are:

- Leave in-situ (minor intervention):
  - 1b – Remediate ends and spans only.
- Leave in-situ (major intervention):
  - 2a – Trench and bury exposures.
  - 2c – Rock cover exposures.
- Full removal:
  - 3a – Cut and lift.

4.4 Evaluation Summary

Table 4.3: Summary of CA Evaluation for Group 1

Group 1 – Saltire A to Piper B Bundle		
Screening	1a – Do nothing	1b – Remediate ends and spans only
	2a – Trench and bury exposures	2b – Cut and remove exposures
	2c – Rock cover exposures	3a – Cut and lift
	3b – Reverse installation	
Note: See Appendix B for full attributes tables and assessment		
Evaluation	Safety	Option 1b and Option 2c are equally the most preferred options against the Offshore Personnel criterion due to the significantly lower risk exposure from the shorter duration of offshore operations from the reduced number of offshore cut and lift operations when compared to Option 3a (cut and lift). Option 1b and Option 2c are also equally the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3a (cut and lift). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3a is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with Option 2a is very similar as the full line is trenched and buried. **Overall, Option 2c is the preferred option against the Safety criterion.**
	Environment	Option 1b, 2a and 2b are equally preferred against the Impact of Decommissioning Operations Offshore criterion. This is due to the duration of the operations and thus the associated environmental impact being largely similar. Option 3a was marginally less preferred. All options are equally preferred against the Processing of Returned Material criterion as, while there is more material returned to shore under Option 3a (cut and lift), this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the significantly higher quantity of rock required for Option 2c was considered sufficient to express a small preference for the other options. As such, Option 1b, 2a and 3a are equally preferred against the Resource Consumption criterion. Options 1b and 3a marginally preferred from a Seabed Disturbance perspective. This is due to the short-term impact on the seabed environment from trenching and burying / rock dumping associated with Options 2a and 2c. Options 2a and 3a are equally preferred against the Loss of Habitat criterion due to the minimal long-term environmental impact versus the significant impact from either leaving the bundle largely in place on the seabed (Option 1b) or applying full rock cover (Option 2c). **Overall, Option 3a is the preferred option against the Environment criterion driven by its preference against the Loss of Habitat criterion.**

Group 1 – Saltire A to Piper B Bundle		
	Technical	Options 1b and 2c were equally most preferred against all Technical sub-criteria. This reflects the challenges associated with contracting, scheduling and delivering the trenching or cut and lift options of a bundle with a diameter that is beyond the current limit within the industry. **Overall, Options 1b and 2c are assessed as equally preferred against the Technical criterion.**
	Societal	Option 2c is the least preferred from a political perspective due to it resulting in a significant area of new rock dump along the entire length of the bundle. Options 2a and 3a are preferred over Option 1b from a political perspective as they achieve a clear seabed. Option 3a is the preferred option from a fisheries perspective as it achieves a completely clear seabed with no risk of future exposure of the bundle. Option 2a is next preferred as it will provide a clear seabed, albeit with a small potential for the bundle to become unburied in future. Option 2c is preferred over 1b from a fisheries perspective as it is anticipated that the rock dump associated with Option 2c will be entirely overtrawlable and will not provide the small potential net snagging risk associated with Option 1b. From the perspective of socio-economic impact on communities Option 3a is preferred over the other options, which are assessed as neutral to each other, as this represents the best case for job creation / retention. **Overall, Option 3a is the preferred option followed closely by Option 2a.**
	Economic	Option 1b is the most preferred option against the Cost for Decommissioning / Removal Activities criterion due to it be significantly less expensive than any of the other options. Option 3a is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option. **Overall, Option 1b is the preferred option from and economic perspective due to the heavier weighting of short-term costs.**
Summary		If the economic criteria are not included in the assessment, Option 1b is slightly preferred over all other options. Option 1b has been assessed to be a strong option in terms of safety and technical risk and, while it is not as strong for environmental and societal impact, these are not sufficient to offset the strong safety and technical assessment. Once the economic criteria are included, this small overall preference for Option 1b turns into a strong overall preference. **Option 1b – Remediate Ends and Spans Only, is assessed as the overall preferred option and is selected as the preferred decommissioning option for Group 1.** 

5 CA OUTCOME – GROUP 2 – SALTIRE A TO SALTIRE WID BUNDLE

5.1 Group Characteristics

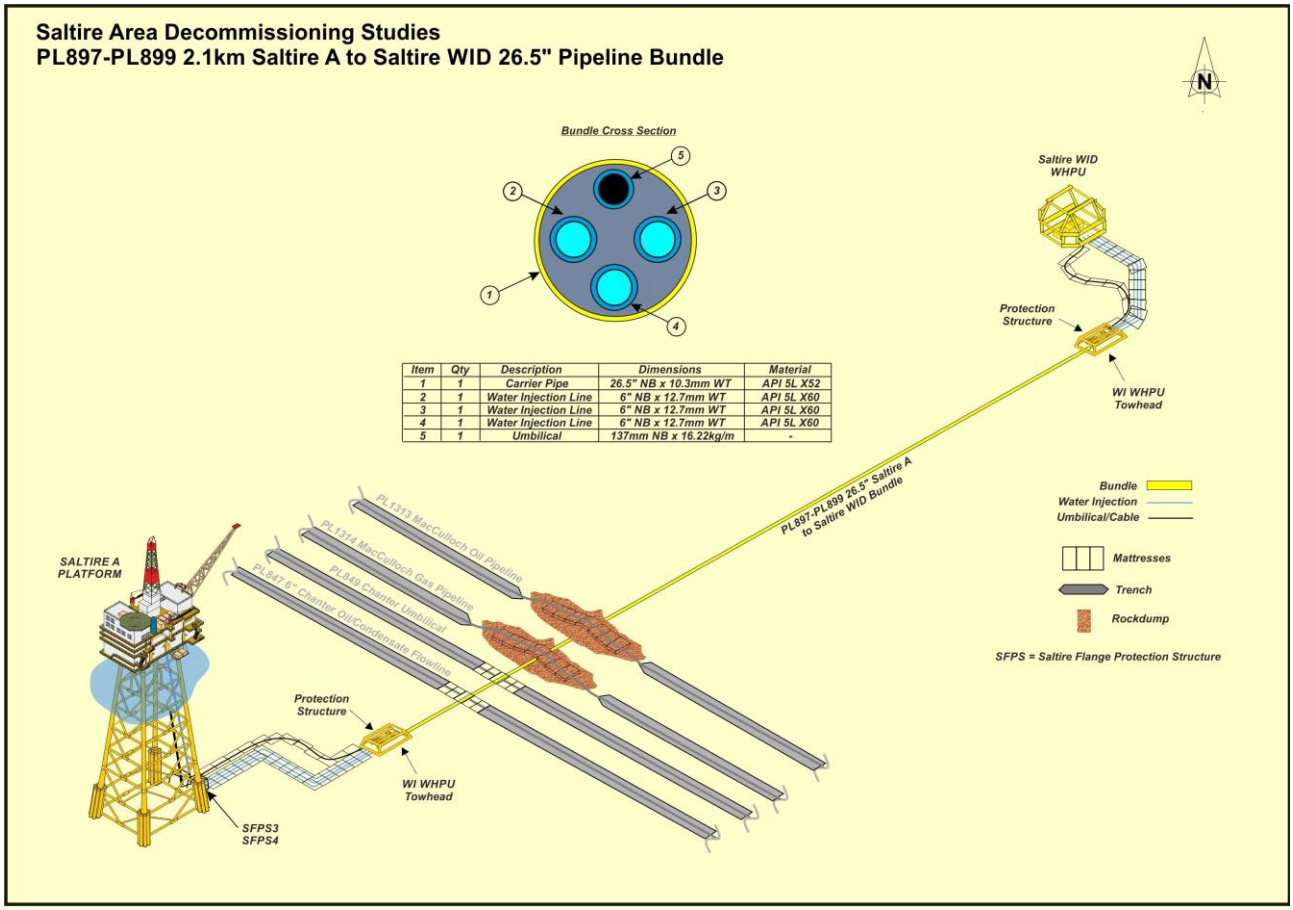
The individual items that make up Group 2 – Saltire A to Saltire WID Bundle are detailed fully within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. By way of summary, the layout is shown in Figure 5.1 and the key characteristics for Group 2 are presented in Table 5.1:

Table 5.1: Group 2 Items

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL897	6-inch water injection pipeline	Saltire	6	2,106	670
PL898	6-inch water injection pipeline	Saltire	6		
PL899	6-inch water injection pipeline	Saltire	6		
PLU4738	Umbilical	Saltire	6		
-	26.5-inch carrier pipe	Saltire	26.5		

Note: For clarity, the above pipelines are configured in a bundle arranged within the 26.5-inch carrier pipe, which is surface laid.

Figure 5.1: Saltire A to Saltire WID Bundle (PL897-PL899)



The Saltire A to Saltire WID Bundle is surface laid and exposed over almost its entire length. It crosses over the buried 6-inch Chanter Oil/Condensate Flexible Flowline (PL847 in Group 3) and the buried 6-inch Chanter Umbilical (PL849 in Group 4) and is crossed by two pipelines associated with the MacCulloch field (PL1313 10-inch MacCulloch Oil Pipeline and PL1314 6-inch MacCulloch Gas Pipeline) **[Ref. 5]**.

Decommissioning of the MacCulloch pipelines is outside the scope of the Saltire Area decommissioning project.

Based on the latest data **[Ref. 5]**, the Saltire A to Saltire WID Bundle has a low number of spans, none of which currently exceed FishSAFE limits (i.e. spans are less than 10 m in length and 0.8 m in height). However, evidence of scour has been identified at numerous locations, which indicates that the bundle may be susceptible to spanning in future if additional scour were to occur **[Ref. 5]**.

5.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 2 – Saltire A to Saltire WID Bundle are detailed in Table 5.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are detailed within the Removal Options Screening Report **[Ref. 7]**.

Prior to decommissioning, the following activities will be required, regardless of the option selected for the bundle:

- Removal of all associated mattresses and grout bags (over tie-in spools, umbilicals, and at crossings);
- Disconnection of the tie-in spools and umbilicals from the bundle towheads;
- Disconnection of the towheads from the bundle;
- Removal of the tie-in spools and umbilicals;
- Removal of the towheads and towhead protection structures.

Table 5.2: Group 2 Decommissioning Options

Group 2 – Saltire A to Saltire WID Bundle		
Category	**Option**	**Description**
Leave in-situ (minor intervention)	1a – Do nothing	Perform no activities to remediate the ends or the spans of the bundle. This option was not carried forward as it is unacceptable from a safety and societal perspective.
	1b – Remediate ends and spans only	Rock placement over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to spanning). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at spans) may be adopted.
Leave in-situ (major intervention)	2a – Trench and bury exposures	Removal of bundle appurtenances (ballast chains and vent valves) followed by a trenching vessel equipped with suitable trenching technology trenching and burying the bundle to a target of 0.6 m depth of cover over the top of the bundle carrier pipe.
	2b – Cut and remove exposures	Remove exposed sections of the bundle by cutting into smaller sections and lifting them to the surface prior to removal to shore. As the bundle is fully exposed across the majority of its length, this option is functionally identical to option 3a.
	2c – Rock cover exposures	Cut ends of bundle to enable towhead removal and then perform rock dump to fully bury the bundle along its entire length.
Full removal	3a – Cut and lift	ROV cutting of the bundle into short sections and installing end stops (dependent on cutting method). The bundle sections then rigged and lifted to a construction vessel or alternative transport vessel/barge either directly or via subsea baskets and returned to shore for dismantling and recycling.
	3b – Reverse installation	Remove bundle by re-floating and towing to shore. This option was not carried forward as sufficient integrity of the bundle cannot be confirmed.

5.3 Decommissioning Options for Evaluation

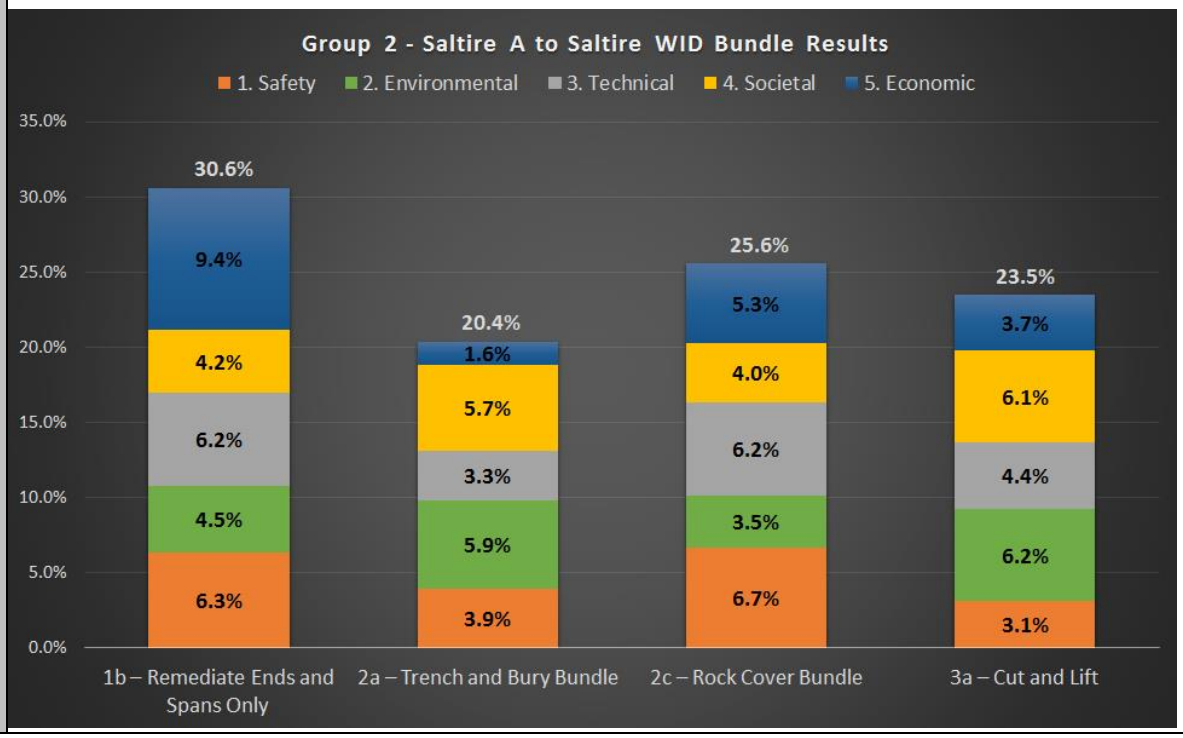
The decommissioning options for Group 2 that remained after screening and were taken forward to the evaluation phase are:

- Leave in-situ (minor intervention):
  - 1b – Remediate ends and spans only.
- Leave in-situ (major intervention):
  - 2a – Trench and bury exposures.
  - 2c – Rock cover exposures.
- Full removal:
  - 3a – Cut and lift.

5.4 Evaluation Summary

Table 5.3: Summary of CA Evaluation for Group 2

Group 2 – Saltire A to Saltire WID Bundle		
Screening	1a – Do nothing	1b – Remediate ends and spans only
	2a – Trench and bury exposures	2b – Cut and remove exposures
	2c – Rock cover exposures	3a – Cut and lift
	3b – Reverse installation	
Note: See Appendix C for full attributes tables and assessment		
Evaluation	Safety	Option 1b and Option 2c are equally the most preferred options against the Offshore Personnel criterion due to the significantly lower risk exposure from the shorter duration of offshore operations from the reduced number of offshore cut and lift operations when compared to Option 3a (cut and lift). Option 1b and Option 2c are also equally the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3a (cut and lift). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3a is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the other options is relatively close given the diameter and length of the bundle. **Overall, Option 2c is the preferred option against the Safety criterion.**
	Environment	Option 1b, 2a and 2b are equally preferred against the Impact of Decommissioning Operations Offshore criterion. This is due to the duration of the operations and thus the associated environmental impact being largely similar. Option 3a was marginally less preferred. All options are equally preferred against the Processing of Returned Material criterion as, while there is more material returned to shore under Option 3a (cut and lift), this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the significantly higher quantity of rock required for Option 2c was considered sufficient to express a small preference for the other options. As such, Options 1b, 2a and 3a are equally preferred against the Resource Consumption criterion. Options 1b and 3a marginally preferred from a Seabed Disturbance perspective. This is due to the short-term impact on the seabed environment from trenching and burying / rock dumping associated with Options 2a and 2c. Options 2a and 3a are equally preferred against the Loss of Habitat criterion due to the minimal long-term environmental impact versus the significant impact from either leaving the bundle largely in place on the seabed (Option 1b) or applying full rock cover (Option 2c). **Overall, Option 3a is the preferred option against the Environment criterion driven by its preference against the Loss of Habitat criterion.**

Group 2 – Saltire A to Saltire WID Bundle		
	Technical	All Options were equally preferred from a Contracting Strategy due to minimal challenges for each option in this area. Options 1b and 2c were equally most preferred against the Technical Maturity and Schedule sub-criteria. This reflects the challenges associated with the extensive works required for the trenching and cut and lift options of a bundle with a diameter that is at the current limit of capability within the industry. **Overall, Options 1b and 2c are assessed as equally preferred against the Technical criterion.**
	Societal	Option 2c is the least preferred from a political perspective due to it resulting in a significant area of new rock dump along the entire length of the bundle. Options 2a and 3a are preferred over Option 1b from a political perspective as they achieve a clear seabed. Option 3a is the preferred option from a fisheries perspective as it achieves a completely clear seabed with no risk of future exposure of the bundle. Option 2a is next preferred as it will provide a clear seabed, albeit with a small potential for the bundle to debury in future. Option 2c is preferred over 1b from a fisheries perspective as it is anticipated that the rock dump associated with Option 2c will be entirely overtrawlable and will not provide the small potential net snagging risk associated with Option 1b. From the perspective of socio-economic impact on communities, Option 3a is preferred over the other options, which are assessed as neutral to each other, as this represents the best case for job creation / retention. **Overall, Option 3a is the preferred option followed closely by Option 2a for the Societal criterion.**
	Economic	Option 1b is the most preferred option against the Cost for Decommissioning / Removal Activities criterion due to it be significantly less expensive than Option 2a and Option 3a and less expensive than Option 2c. Option 3a is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option. **Overall, Option 1b is the preferred option from an economic perspective due to the heavier weighting of short-term costs.**
Summary		If the economic criteria are not included in the assessment, Option 1b is slightly preferred over all other options. Option 1b has been assessed to be a strong option in terms of safety and technical risk and, while it is not as strong for environmental and societal impact, these are not sufficient to offset the strong safety and technical assessment. Once the economic criteria are included, this small overall preference for Option 1b turns into a strong overall preference. **Option 1b – Remediate Ends and Spans Only, is assessed as the overall preferred option and is selected as the preferred decommissioning option for Group 2.** 

6 CA OUTCOME – GROUP 3 – CHANTER OIL/CONDENSATE FLEXIBLE FLOWLINE

6.1 Group Characteristics

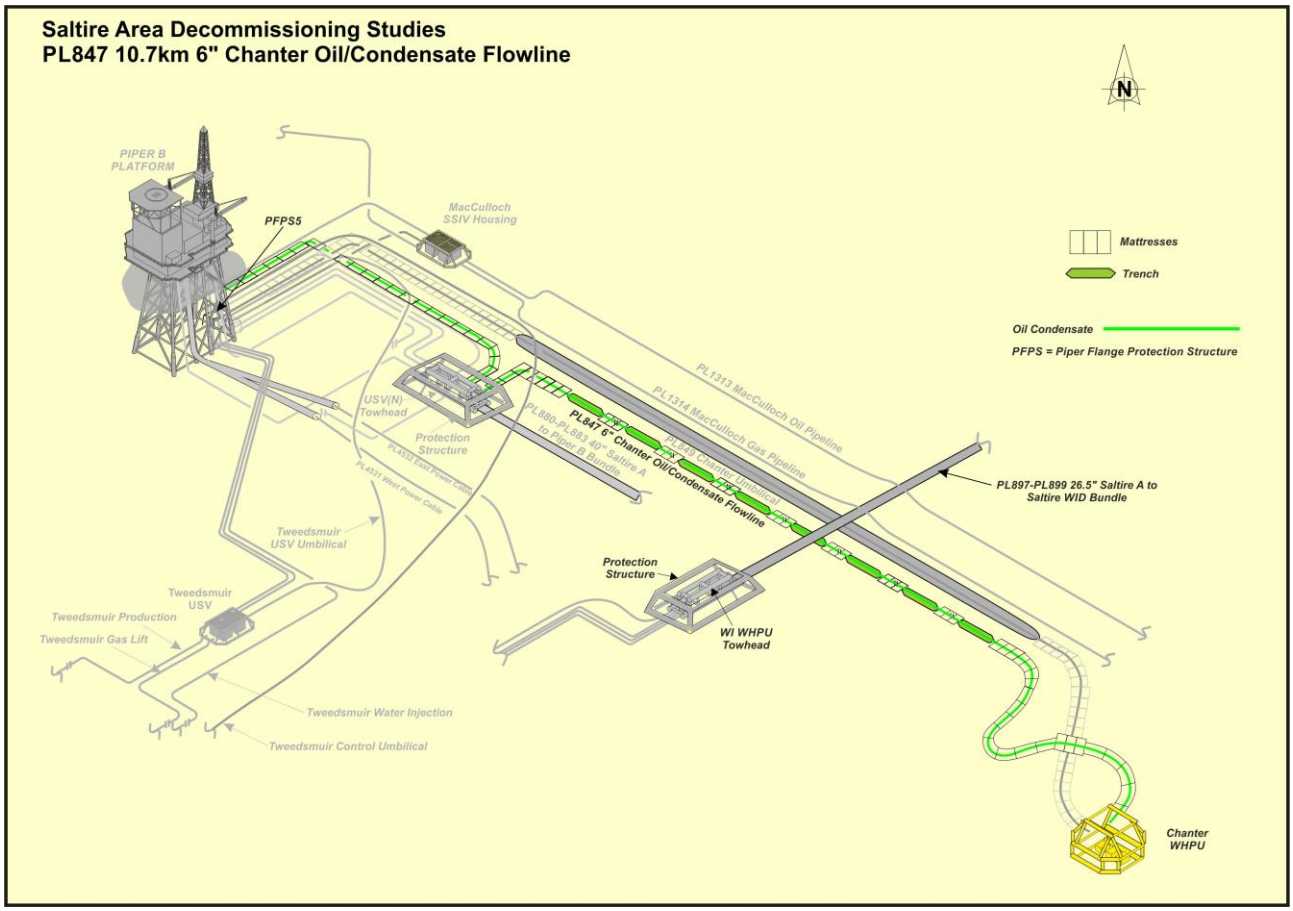
Group 3 – Chanter Oil/Condensate Flexible Flowline consists of a single pipeline that is detailed fully in the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. By way of summary, the layout is shown in Figure 6.1 and the key characteristics for Group 3 are presented in Table 6.1:

Table 6.1: Group 3 Items

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL847	Chanter Oil/Condensate Flexible Flowline	Chanter	10	10,675	988

Note: PL847 is trenched and buried for the majority of its length but comes out of its trench at each of the seven midline connections where it is protected by concrete mattress cover.

Figure 6.1: Chanter Oil/Condensate Flexible Flowline (PL847)



The Chanter Oil/Condensate Flexible Flowline (PL847) is made up of eight separate flexible flowline sections with seven midline connections. The flowline is trenched and buried for the majority of its length but comes out of its trench at each midline connection where it is protected by concrete mattress cover. The flowline connects the Chanter Wellhead Protection Unit (WHPU) via a towhead and connects to the Piper B platform via a separate towhead and a flexible jumper **[Ref. 5]**.

During installation of the flowline, the exposures associated with the seven midline connections were covered with mattresses. The latest survey data shows that mattresses have also been installed at several other locations, likely to cover areas of spanning identified during installation.

A total of 5 spans were reported in the latest survey **[Ref. 5]** with a total length of 15 m. The spans can be classified as follows:

- All spans had lengths less than 5 metres.
- The longest span was also the deepest span, measuring 4.1 m long and 0.5 m deep.
- No spans exceed FishSAFE limits (i.e. all spans are less than 10 m in length and 0.8 m in height).

As identified in Section 5.1, the Chanter Oil/Condensate Flexible Flowline is crossed by the surface laid Saltire A to Saltire WID Bundle.

6.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 3 – Chanter Oil/Condensate Flexible Flowline are detailed in Table 6.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7]**.

Prior to decommissioning, the following activities will be required, regardless of the option selected for the flowline:

- Removal of the Chanter WHPU.
- Removal of all associated mattresses and grout bags (over tie-in spools and exposures).
- Disconnection of the tie-in spools.
- Removal of the tie-in spools.

Table 6.2: Group 3 Decommissioning Options

Group 3 – Chanter Oil/Condensate Flexible Flowline		
Category	**Option**	**Description**
Leave in-situ (minor intervention)	1a – Do nothing	Perform no activities to remediate the ends or the spans of the flowline. This option was not carried forward as it is unacceptable from a safety and societal perspective.
	1b – Remediate ends only	Rock placement or burial of the ends of the flowline with no remediation of the flowline midline connections or spans. This option was not carried forward as it is unacceptable from a safety and societal perspective.
Leave in-situ (major intervention)	2a – Trench and bury exposures	Disconnect and remove the flowline ends with subsequent mobilisation of a trenching vessel to trench and backfill the exposed sections of flowline to a sufficient depth below seabed level.
	2b – Cut and remove exposures	Disconnect and remove the flowline ends then cut and lift any exposed sections of the flowline and perform local dredging to lower the cut flowline ends and cut out sections. It should be noted that alternative strategies (e.g. rock placement on the cut ends) could be adopted for dealing with the flowline ends and cut out sections.
	2c – Rock cover exposures	Disconnect, cut and lift the flowline ends with subsequent mobilisation of a fall pipe vessel for rock placement on exposed ends, mid line connections and at other exposures/spans.
Full removal	3 – Reverse reeling	Deburial operations of flowline (if required) followed by reverse reeling to a recovery vessel. The recovery vessel would connect onto the line and proceed to reverse reel along the route. The recovered line would be returned to shore for disposal.

6.3 Decommissioning Options for Evaluation

The decommissioning options for Group 3 that remained after screening and were taken forward to the evaluation phase are:

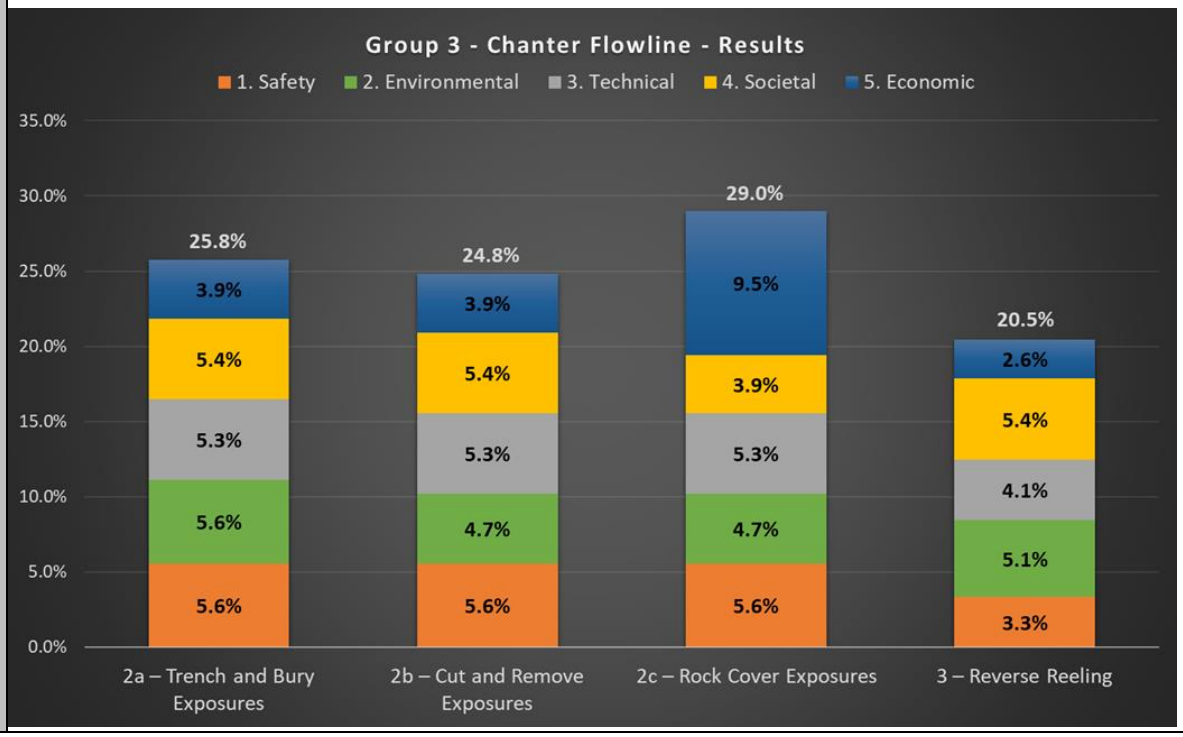
- Leave in-situ (major intervention):
  - 2a – Trench and bury exposures.
  - 2b – Cut and remove exposures.
  - 2c – Rock cover exposures.
- Full removal:
  - 3 – Reverse reeling.

6.4 Evaluation Summary

Table 6.3: Summary of CA Evaluation for Group 3

Group 3 – Chanter Oil/Condensate Flexible Flowline			
Screening	1a – Do nothing	1b – Remediate ends only	2a – Trench and bury exposures
	2b – Cut and remove exposures	2c – Rock cover exposures	3 – Reverse reeling
Note: See Appendix D for full attributes tables and assessment,			
Evaluation – Safety	Option 2a, 2b and 2c are equally the most preferred options against the Offshore Personnel criterion due to the significantly lower risk exposure from the shorter duration of offshore operations from the reduced number of offshore operations when compared to Option 3 (reverse reel). Option 2a, 2b and 2c are also equally the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3 (reverse reel). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3 is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the other options is relatively similar given that all snag hazards would be remediated, and all exposures fully buried or rock covered. **Overall, Options 2a, 2b and 2c are equally preferred against the Safety criterion.**		
Evaluation – Environment	All options are equally preferred against the Impact of Decommissioning Operations Offshore and the Processing of Returned Material criteria as, while there are differences in the operational durations and material returned to shore across the options, with Option 3 being higher, this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the higher quantity of rock required for Option 2b and 2c was considered sufficient to express a small preference for the other options. As such, Option 2a and 3 are equally preferred against the Resource Consumption criterion. Options 2a, 2b and 2c are marginally preferred from a Seabed Disturbance perspective due to the short-term impact on the seabed environment associated with the midline connection compared to the deburial operations associated with reverse reeling the full length (Option 3). Options 2a and 3 are equally preferred against the Loss of Habitat criterion due to the higher long-term impact from rock placement with the other options. **Overall, Option 2a is the preferred option against the Environment criterion.**		

Group 3 – Chanter Oil/Condensate Flexible Flowline		
	Technical	All options were equally preferred against the Contracting Strategy criterion as all options could be delivered by a variety of vendors and thus provide for a flexible contracting strategy. Options 2a, 2b and 2c were equally preferred over Option 3 against the Schedule criterion due to the shorter offshore durations, the largely routine operations and the small potential for integrity failure of the line during reverse reeling. Options 2a, 2b and 2c were also equally preferred over Option 3 against the Technical Maturity criterion due to the routine operations versus the limited track record of reverse reeling. **Overall, Options 2a, 2b and 2c are equally preferred against the Technical criterion.**
	Societal	Options 2a, 2b and 3 are equally most preferred against the Political criterion. Given that the line is trenched and buried along the majority of its length, the addition of rock berms associated with Option 2c was assessed as being the least attractive option. Option 3 achieves the clear seabed aspiration with no potential risk of future deburying of the flowline and is therefore the most preferred option from a political perspective. Options 2a, 2b and 3 are equally most preferred from a fisheries perspective. Option 2c (rock cover), while designed for overtrawlability, presents a series of long rock berms that is less attractive from a commercial fishing operations perspective. From a socio-economic perspective, all options are assessed as being equally preferred as the negative impact from the increase in material being returned for processing under Option 3 is offset by the benefit of additional job creation / retention. **Overall, Options 2a, 2b and 3 are equally preferred against the Societal criterion.**
	Economic	Option 2c is the most preferred option against the Cost for Decommissioning / Removal Activities criterion due to it being less expensive than Option 2a and 2b and significantly less than Option 3. Option 3 is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option. **Overall, Option 2c is the preferred option from an economic perspective due to the heavier weighting of short-term costs.**
Summary		Option 2a is the most or equal most preferred option from a Safety, Environment, Technical and Societal perspectives. Once the economic criterion is included, this small overall preference for Option 2a changes to a preference for Option 2c, driven by the low decommissioning cost. Given the guidance that economic considerations should not be the driving factor for selecting the decommissioning option, **Option 2a – Trench and Bury Exposures, is retained as the overall preferred option and is selected as the preferred decommissioning option for Group 3.**



7 CA OUTCOME – GROUP 4 – TRENCHED & BURIED UMBILICALS / POWER CABLES

7.1 Group Characteristics

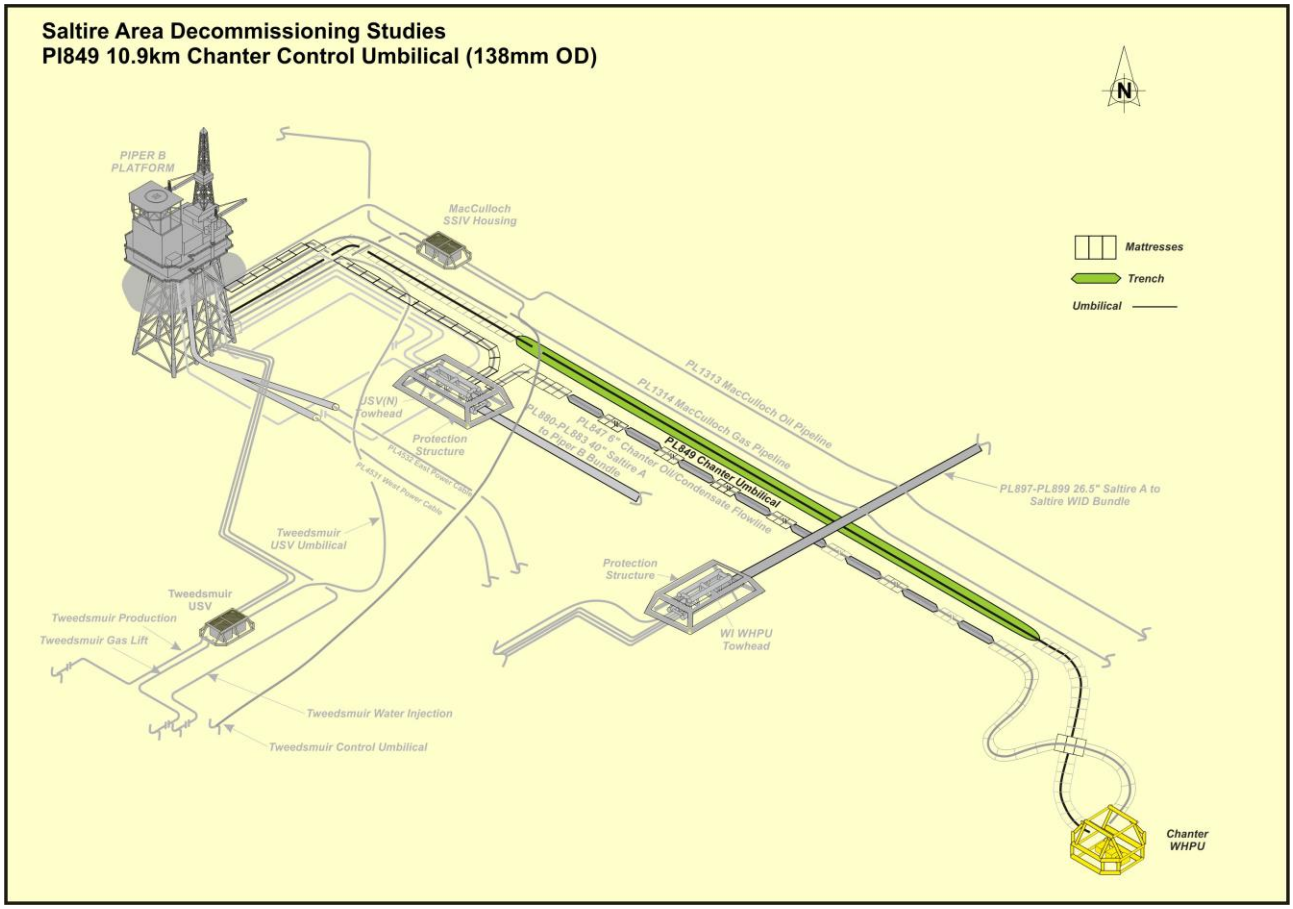
The individual items that make up Group 4 – Trenched & Buried Umbilicals / Power Cables are detailed fully within the Asset and Waste Inventory Report **[Ref. 6]** and the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9]**. By way of summary, the layout is shown in Figure 7.1 and Figure 7.2 and the key characteristics for Group 4 are presented in Table 7.1:

Table 7.1: Group 4 Items

ID	Description	Field	OD (inches)	Length (metres)	Weight (tonnes)
PL849	Chanter umbilical	Chanter	6	10,790	361
PL4531	West power cable	Saltire	5	7,241	260
PL4532	East power cable	Saltire	5	7,263	261

Note: The Chanter Umbilical and East and West Power Cables are trenched and buried along almost their entire lengths.

Figure 7.1: Chanter Umbilical (PL849)



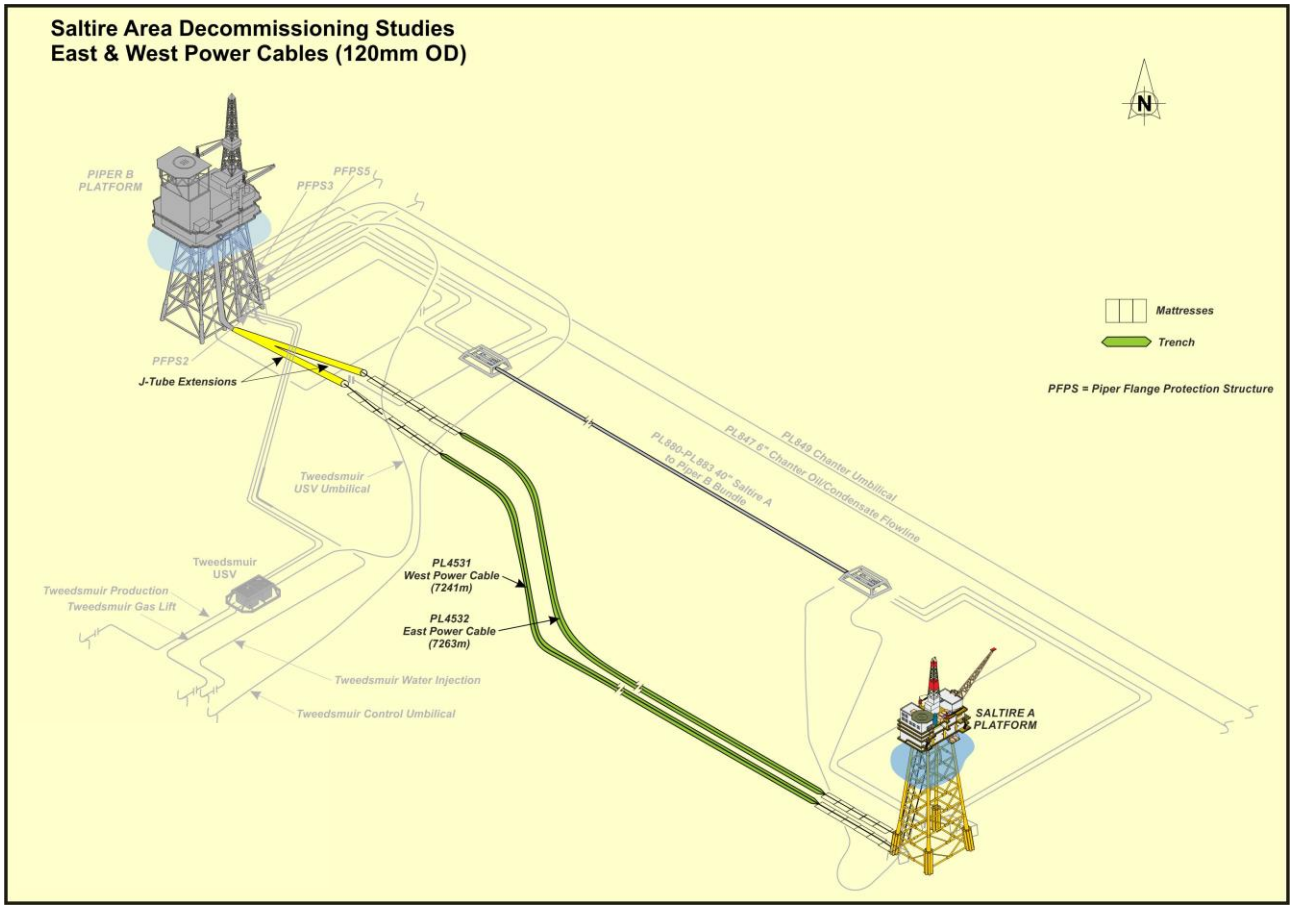
The Chanter Umbilical (PL849) is trenched and buried along almost its entire length, with the ends protected by concrete mattresses. The umbilical is laid from the Chanter WHPU to the Piper B platform **[Ref. 5]**.

A total of 5 spans were reported in the latest survey data **[Ref. 5]** for the Chanter Umbilical with a total length of 15 m. The spans can be classified as follows:

- All span lengths less than 5 metres;
- The longest span was also the deepest span, measuring 4.2 m long and 0.4 m deep.
- No spans exceed FishSAFE limits (i.e. all spans are less than 10 m in length and 0.8 m in height).

As identified in Section 5.1, the Chanter Umibilcal is crossed by the surface laid Saltire A to Saltire WID Bundle. It is also crossed by the Tweedsmuir Control Umbilical local to the Piper B end of the Chanter Umbilical.

Figure 7.2: East (PL4532) & West (PL4531) Power Cables



The East and West Power Cables are laid in parallel and are trenched and buried over almost their entire length between Piper B and Saltire A with concrete mattresses protecting the untrenched ends. At the Piper B end, the cables enter J-tube extensions on their approach to the platform **[Ref. 5]**.

Based on the latest survey data, the East and West Power Cables are considered to be well buried along their entire length, with no spans or exposures. The power cables are crossed by the Tweedsmuir Control Umbilical and the Tweedsmuir USV Umbilical as well as a redundant spool associated with the Saltire A to Piper B Bundle, all local to the Piper B ends of the power cables **[Ref. 5]**.

7.2 Decommissioning Options & Screening Outcome

The decommissioning options identified for Group 4 – Trenched & Buried Umbilicals / Power Cables are detailed in Table 7.2. The colour coding indicates the outcome from the CA Screening process. Green indicating that the option is carried through to evaluation, whereas grey represents options that have been screened out. These findings are fully detailed within the Removal Options Screening Report **[Ref. 7]**.

Prior to decommissioning, the following activities will be required, regardless of the option selected:

- Disconnection and removal of all associated jumpers.
- Removal of all associated mattresses and grout bags (over exposures).

Table 7.2: Group 4 Decommissioning Options

Group 4 – Trenched & Buried Umbilicals / Power Cables		
Category	**Option**	**Description**
Leave in-situ (minor intervention)	1a – Do nothing	Perform no activities to remediate the ends or the spans of the umbilical / power cables. This option was not carried forward as it is unacceptable from a safety and societal perspective.
	1b – Remediate ends only	Rock placement or burial of the ends of the umbilical / power cables with no remediation of spans. This option was not carried forward as it is unacceptable from a safety and societal perspective.
Leave in-situ (major intervention)	2a – Trench and bury exposures	Disconnect and remove the umbilical / power cable ends with subsequent mobilisation of a trenching vessel to trench and backfill the exposed sections of umbilical / power cables to a sufficient depth below seabed level.
	2b – Cut and remove exposures	Disconnect and remove the umbilical / power cable ends then cut and lift any exposed sections of the umbilical / power cables and perform local dredging to lower the cut ends and cut out sections. It should be noted that alternative strategies (e.g. rock placement on the cut ends) could be adopted for dealing with the umbilical / power cable ends and cut out sections.
	2c – Rock cover exposures	Disconnect, cut and lift the umbilical / power cable ends with subsequent mobilisation of a fall pipe vessel for rock placement on exposed ends and at other exposures /spans.
Full removal	3 – Reverse reeling	Deburial operations of umbilical / power cable (if required) followed by reverse reeling to a recovery vessel. The recovery vessel would connect onto the umbilical / power cable and proceed to reverse reel along the route. The recovered umbilical / power cable would be returned to shore for disposal.

7.3 Decommissioning Options for Evaluation

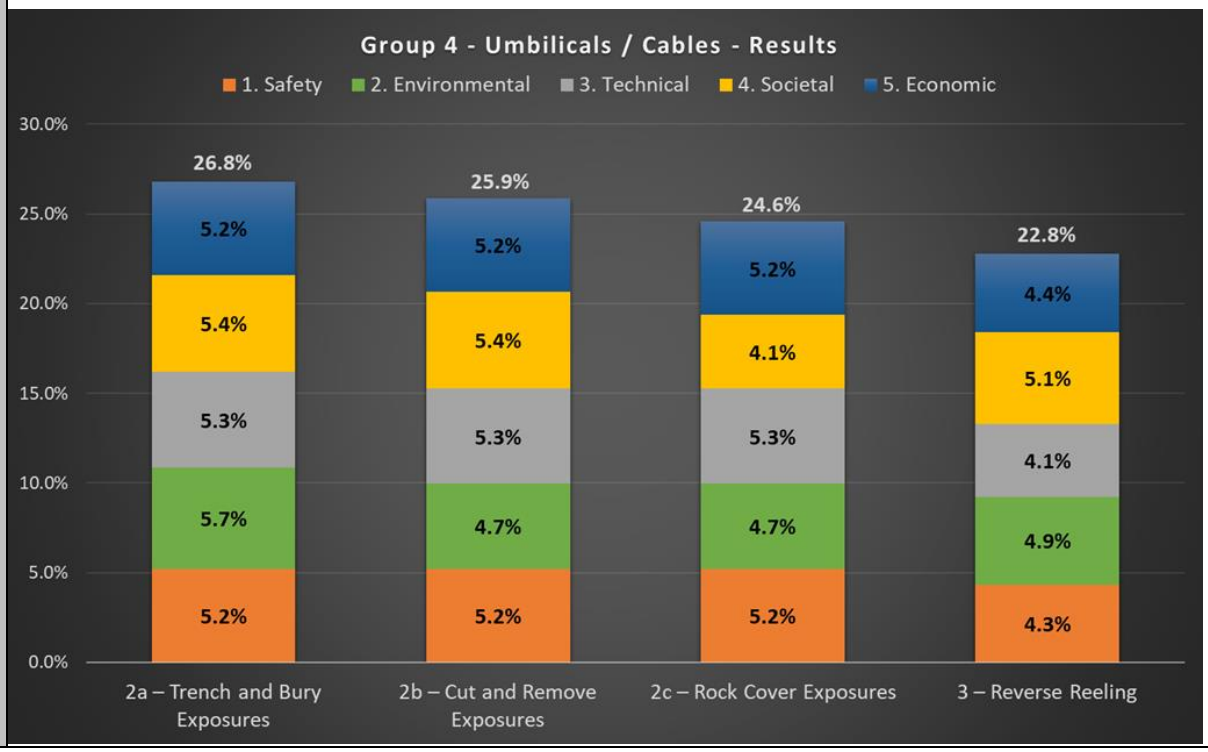
The decommissioning options for Group 4 that remained after screening and were taken forward to the evaluation phase are:

- Leave in-situ (major intervention):
  - 2a – Trench and bury exposures.
  - 2b – Cut and remove exposures.
  - 2c – Rock cover exposures.
- Full removal:
  - 3 – Reverse reeling.

7.4 Evaluation Summary

Table 7.3: Summary of CA Evaluation for Group 4

Group 4 –			
Screening	1a – Do nothing	1b – Remediate ends only	2a – Trench and bury exposures
	2b – Cut and remove exposures	2c – Rock cover exposures	3 – Reverse reeling
Note: See Appendix E for full attributes tables and assessment			
Evaluation – Safety	All options were equally preferred against the Offshore Personnel criterion as the risk exposure was considered largely similar across the options. Reverse reeling would involve slightly more offshore working time, but this was not considered significant enough to move the assessment off neutral. Option 2a, 2b and 2c are the most preferred options against the Onshore Personnel criterion due to the lower risk exposure from handling and processing a lower quantity of material returned to shore when compared to the Option 3 (reverse reel). All options were equally preferred against the Other Users criterion as the risk exposure was considered small and largely similar due to the low number of transits. Option 3 is the most preferred option against the Residual Risk criterion due there being no residual risk exposure associated with the full removal option. It is noted the residual risk associated with the other options is relatively similar given that all snag hazards would be remediated, and all exposures fully buried or rock covered. **Overall, Option 2a, 2b and 2c are equally preferred against the Safety criterion.**		
Evaluation – Environment	Option 2a, 2b, 2c are equally preferred against the Impact of Decommissioning Operations Offshore criterion. This is due to the duration of the operations and thus the associated environmental impact being largely similar. Option 3 was marginally less preferred. All options are equally preferred against the Processing of Returned Material criteria as, while there are differences in the material returned to shore across the options, with Option 3 being higher, this was considered insufficient to express a preference from an environmental perspective. All options were considered similar from a Resource Consumption perspective. However, the higher quantity of rock required for Option 2b and 2c was considered sufficient to express a small preference for the other options. As such, Option 2a and 3 are equally preferred against the Resource Consumption criterion. Options 2a, 2b and 2c are marginally preferred from a Seabed Disturbance perspective due to the short-term impact on the seabed environment from the deburial operations associated with the full length reverse reeling (Option 3). Options 2a and 3 are equally preferred against the Loss of Habitat criterion due to the higher long-term impact from rock placement with the other options. **Overall, Option 2a is the preferred option against the Environment criterion.**		
Evaluation – Technical	All options were equally preferred against the Contracting Strategy criterion as all options could be delivered by a variety of vendors and thus provide for a flexible contracting strategy. Options 2a, 2b and 2c were equally preferred over Option 3 against the Schedule criterion due to the shorter offshore durations, the largely routine operations and the small potential for integrity failure of the line during reverse reeling. Options 2a, 2b and 2c were also equally preferred over Option 3 against the Technical Maturity criterion due to the routine operations versus the limited track record of reverse reeling. **Overall, Options 2a, 2b and 2c are equally preferred against the Technical criterion.**		
Evaluation – Societal	Options 2a, 2b and 3 are equally most preferred against the Political criterion. Given that the line is trenched and buried along the majority of its length, the addition of rock berms associated with Option 2c was assessed as being the least attractive option. Option 3 achieves the clear seabed aspiration with no potential risk of future deburying of the flowline and is therefore the most preferred option from a political perspective. Options 2a, 2b and 3 are equally most preferred from a fisheries perspective. Option 2c (rock cover), while designed for overtrawlability, presents a series of long rock berms that is less attractive from a commercial fishing operations perspective. From a socio-economic perspective, all options are assessed as being equally preferred as the negative impact from the increase in material being returned for processing under Option 3 is offset by the benefit of additional job creation / retention. **Overall, Options 2a, 2b and 3 are equally preferred against the Societal criterion.**		

<table>
<tr><th colspan="3">Group 4 –</th></tr>
<tr><td></td><td>Economic</td><td>Option 2a, 2b and 2c are equally the most preferred options against the Cost for Decommissioning / Removal Activities criterion due to them being marginally less expensive than Option 3.
Option 3 is the most preferred option against the Cost for Long-term Monitoring / Remediation Activities criterion as there are no long-term costs associated with the full removal option.
Overall, Option 3 is the preferred option from an economic perspective due to it being only slightly more expensive than the other options and having no long-term costs.</td></tr>
<tr><td>Summary</td><td colspan="2">Option 2a is the most or equal most preferred option from a Safety, Environment, Technical and Societal perspectives. Once the economic criterion is included, this small overall preference for Option 2a is strengthened changes to a preference for Option 2c, driven by the low decommissioning cost. Given the guidance that economic considerations should not be the driving factor for selecting the decommissioning option,
Option 2a is the most or equal most preferred option from a Safety and Environment perspective. It is less preferred than other options against the Societal criteria, but this is insufficient to offset these preferences. Technically, all options are equally preferred. Once the economic criterion is included, this small overall preference for Option 2a is maintained.
Option 2a – Trench and Bury Exposures, is assessed as the overall preferred option and is selected as the preferred decommissioning option for Group 4.
 
</td></tr>
</table>

8 RECOMMENDATIONS

The outcomes obtained from performing the CA of the decommissioning groups and decommissioning options for the Subsea Infrastructure of the Saltire Area Decommissioning Project are summarised here.

In accordance with the BEIS Guidelines **[Ref. 1]**, there were four groups identified at the scoping stage where full removal was the recommended decommissioning approach without any further consideration. These are:

- Group 5 – Subsea structures
- Group 6 – Towhead umbilicals
- Group 7 – Spools / jumpers
- Group 8 – Mattresses & grout bags [Note 1]

Note 1: It should be noted that, where mattresses and grout bags are found which have deteriorated to a point where it would be unsafe to attempt to recover them, these will be discussed with OPRED and, where agreed, shall be buried in situ to avoid causing future snagging hazards.

The full CA process was applied to the remaining decommissioning groups. Following a balanced assessment of the criteria, a discussion of the relative merits of the decommissioning options is presented along with the recommended decommissioning option with a short description of the steps to deliver the option.

8.1 Group 1 – Saltire A to Piper B Bundle Discussion and Outcome

The Saltire A to Piper B Bundle is a 40-inch, Surface Laid Bundle and as such, Option 2b – Trench and Bury and Option 3a – Cut and Lift were both assessed as being highly technically challenging. This is due to the diameter of the bundle being beyond the limit of current trenching technology and there being no track record for cutting and lifting a bundle of this diameter. These challenges are exacerbated by the increase in technical risk exposure from the extended offshore operations and the limited contracting options presented by novel activities that need technology development to deliver.

This assessment against the Technical criterion was reflected in the assessment against the Safety criterion due, in the main, to the increased risk exposure from the extended offshore work scopes.

It should be noted that these options were assessed as being more attractive against the Environmental criterion, dominated by the lower long-term environmental impact of the trench and bury / cut and lift options. Similarly, the assessment against the Societal criterion showed these options to be preferred. However, cumulatively, these options were shown to be the least attractive overall.

Option 1b – Remediate Ends and Spans Only and Option 2c – Rock Cover Bundle were both assessed as being preferred against the Safety criterion, again due to the reduced risk exposure from the reduced offshore work scopes and onshore handling of returned material. This is also reflected in the assessment against the Technical criterion where, given the surface laid nature of the large diameter bundle, the remediate ends / rock cover options are considered largely routine subsea activities.

These options are less preferred against the Environmental and Societal criteria due to the impact of leaving the bundle in situ leading to long-term alteration of the seabed and having a continued impact on commercial fishing operations. In both cases, the rock cover option was deemed less attractive than the remediate ends option.

Overall, before the Economics criterion is included, there is a small preference for Option 1b – Remediate Ends and Spans Only over Option 2c – Rock Cover Bundle. This position is strengthened significantly once economic considerations are included due to the rock cover option being 5 times more expensive to deliver than the remediate ends only option.

As such, the selected decommissioning for Group 1 – Saltire A to Piper B Bundle is:

- Option 1b – Remediate Ends and Spans Only
    - Following survey of the bundle, protective mattresses and grout bags shall be removed from the tie-in spools, umbilicals and crossings. Tie-in spools shall be disconnected from the bundle towheads and removed. Towheads and towhead protection structures will be disconnected from the bundle and removed.
    - Rock will be placed over the cut ends of the bundle and at free span locations (may also be required at areas susceptible to spanning). It should be noted that alternative strategies (e.g. local dredging to lower cut ends, or grout bag infill at spans) may be adopted.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 1b – Remediate Ends and Spans Only being the preferred method of decommissioning Group 1 – Saltire A to Piper B Bundle.

8.2 Group 2 – Saltire A to Saltire WID Bundle Discussion and Outcome

The Saltire A to Saltire WID Bundle is assessed in a similar fashion to the Saltire A to Saltire B Bundle from a technical perspective with the key difference being the diameter is 27.5-inch rather than 40-inch. This smaller diameter makes the technical challenges associated with trenching the bundle slightly more manageable in that this is at the limit of existing trenching technology rather than beyond it. However, the technical challenges are still relevant given the lack of track record for trenching a bundle of this diameter or performing full removal via cut and lift. Additionally, the technical aspects relating to the offshore schedule and contracting strategy remain.

As would be expected, these technical challenges are again reflected in the assessment against the Safety criterion due to the risk exposure from the extended and challenging offshore work scopes.

As with the 40-inch bundle in Group 1, Option 1b – Remediate Ends and Spans Only and Option 2c – Rock Cover Bundle were both preferred against the Safety criterion, due to the reduced risk exposure from the reduced offshore work scopes and onshore handling of returned material. Again, this is reflected in the assessment against the Technical criterion where, given the surface laid nature of the bundle, the remediate ends / rock cover options are considered largely routine subsea activities.

The Environmental and Societal criteria assessments of the options available for the Saltire A to Saltire WID bundle were similar to those for the Group 1 Saltire A to Piper B bundle in that there was a preference for the trench / cut and lift options over the remediate / rock cover options. In addition, the rock cover option was judged to be less attractive than the remediate ends / spans option for similar reasons as the Group 1 bundle.

Overall, this resulted in all options being assessed as relatively close, with a small preference for Option 1b – Remediate Ends and Spans Only. Once economics were included in the consideration, this preference was strengthened, again due to the lower cost of delivering Option 1b.

As such, the selected decommissioning for Group 2 – Saltire A to Saltire WID Bundle is:

- Option 1b – Remediate Ends and Spans Only
    - Following survey of the bundle, protective mattresses and grout bags shall be removed from the tie-ins, umbilicals and crossings. Tie-in spools shall be disconnected from the bundle towheads and removed. Towheads and towhead protection structures will be disconnected from the bundle and removed.
    - Rock will be placed over the cut ends of the bundle, and at free span locations (may also be required at areas susceptible to spanning). It should be noted that alternative

strategies (e.g. local dredging to lower cut ends, or grout bag infill at spans) may be adopted.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 1b – Remediate Ends and Spans Only being the preferred method of decommissioning Group 2 – Saltire A to Saltire WID Bundle.

8.3 Group 3 – Chanter Oil/Condensate Flexible Flowline Discussion and Outcome

Given that the flexible flowline is trenched and buried along the majority of its length, there are challenges associated with the full removal of this line via reverse reeling. Additionally, the benefits from fully removing an already trenched and buried line are much less pronounced.

As such, reverse reeling was the least preferred option against the Technical and Safety criteria due to the extended offshore work scopes. All other options were considered largely similar.

A key differential between the remaining three options of Option 2a – Trench and Bury Exposures, Option 2b – Cut and Remove Exposures and Option 2c – Rock Cover Exposures is the impact from the rock introduced. The introduction of rock cover was sufficient for Option 2b and Option 2c to be assessed as less preferred than Option 2a against the Environmental criterion due to the long-term seabed impact and Option 2c to be less preferred than Options 2a and 2b due to the impact on commercial fishing operations under the Societal criterion.

Overall, this resulted in Option 2a being the preferred option prior to economic considerations being included. Once economics were included, the preference switched to rock cover, due to the lower cost of delivering the rock cover option. However, given the guidelines from BEIS that economic considerations should not be the driver for the selection of the decommissioning option, the preference for Option 2a is retained.

As such, the selected decommissioning for Group 3 – Chanter Oil/Condensate Flexible Flowline is:

- Option 2a – Trench and Bury Exposures
    - Following survey of the line, protective mattresses and grout bags shall be removed from the pipeline ends and exposures. The Chanter wellhead protection unit will be removed. The on-seabed sections of the uncovered flowline between the flowline trench and the associated subsea structure shall be cut/disconnected and removed.
    - A jet trencher will then be deployed to trench and bury the flowline cut ends and the mid-line exposures to a sufficient depth below seabed level.
    - Rock cover shall be used as back-up should difficulties in performing trenching operations or achieving the sufficient depth of cover below seabed be experienced. In this event, Repsol Sinopec Resources UK Limited would liaise with OPRED.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 2a – Trench and Bury Exposures being the preferred method of decommissioning Group 3 – Chanter Oil/Condensate Flexible Flowline.

8.4 Group 4 – Trenched & Buried Umbilicals / Power Cables Discussion and Outcome

As with the flexible flowline in Group 3, the umbilicals and power cables associated with Group 4 are also trenched and buried along the majority of their length. As such, the assessment and outcomes from Group 3 are reflected in Group 4.

The key difference in the assessment is that the costs for delivering the options is more balanced across the options and therefore, once economic considerations are included, the preference for Option 2a is not altered.

As such, the selected decommissioning for Group 4 – Trenched & Buried Umbilicals / Power Cables is:

- Option 2a – Trench and Bury Exposures
    - Following survey of the umbilicals / cables, protective mattresses and grout bags shall be removed from umbilical / cable ends and exposures. The on-seabed sections of the uncovered umbilicals and cables between the trench terminations and the associated platform J-tube/J-tube extension will then be cut and removed.
    - A jet trencher will then be deployed to trench and bury the exposed ends of the cut umbilicals / cables and any existing areas of exposure to a sufficient depth below seabed level.
    - Rock cover shall be used as back-up should difficulties in performing trenching operations or achieving the sufficient depth of cover below seabed be experienced. In this event, Repsol Sinopec Resources UK Limited would liaise with OPRED.

A range of sensitivities were performed to test the recommendation based upon input from the CA workshop team. None of the sensitivities changed the recommendation for Option 2a – Trench and Bury Exposures being the preferred method of decommissioning Group 4 – Trenched & Buried Umbilicals / Power Cables.

9 REFERENCES

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APPENDIX A EVALUATION METHODOLOGY

Appendix A.1 CA Evaluation Methodology

Repsol Sinopec Resources UK Limited has selected a Multi Criteria Decision Analysis (MCDA) methodology for the evaluation phase of the CA. This methodology uses a pairwise comparison system based on the methodologies of the Analytical Hierarchy Process (AHP) by T.L. Saaty, described in various publications, such as the Analytical Hierarchy Process **[Ref. 10]**. This allows the relative importance of each differentiating criteria to be judged against each other in a qualitative way, supported by quantification where appropriate. The key steps for the evaluation phase of the CA are as follows:

- Define Differentiating Criteria – this was completed as part of the Comparative Assessment Methodology Report **[Ref. 11]** and listed in Appendix A.2.
- Define Options – completed as part of CA Screening.
- Pre-populate worksheets for internal CA workshops – based on all the studies undertaken the worksheets were pre-populated in advance of the internal CA workshops.
- Perform internal CA workshop.
- Discuss attributes of each option against each differentiating criterion – the discussion was recorded 'live' during the workshop in order that informed opinion and experience was factored into the decision-making process.
- Perform scoring (see Appendix A.5).
- Perform sensitivity analyses to test the decision outcomes.
- Export worksheets as a formal record of the workshop attendees' combined opinion on the current preferred options, the 'Emerging Recommendations'.
- Evaluate whether the CA needs to 'recycle' study work (Preparation Phase) to obtain any further information to help inform decision making.
- Discuss Emerging Recommendations with stakeholders.
- Recycle process as required prior to decision on the selected options that will be presented in the Decommissioning Programme and assessed in the Environmental Appraisal.

The sections below describe how the MCDA methodology has been applied.

Appendix A.2 Differentiating Criteria & Approach to Assessment

A key step in setting up the CA was agreeing and defining the appropriate criteria that differentiates between each of the tabled options. As a starting point, the criteria considered for this CA were taken from the Guidelines for Decommissioning of Offshore Oil and Gas Installations and Pipelines **[Ref. 1]**, which are as follows (in no particular order):

- Safety
- Environmental
- Technical
- Societal
- Economic

These differentiating criteria were found to be appropriate for the decommissioning options tabled and were taken forward as the main differentiating criteria for the CA. Additional sub-criteria and definitions were added for clarity and are shown in the Table A.1 alongside the approach used for assessment under each criteria or sub-criteria.

Table A.1: Sub-Criteria Definition

Differentiator	Sub-Criteria	Description	Approach to Assessment
1. Safety	1.1 Personnel Offshore	This sub-criterion considers elements that impact risk to offshore personnel and includes, project team, project vessel crew, diving teams, supply boat crew, and survey vessel crew. It should be noted that crew changes are performed via port calls. Any requirement for handling HazMat / NORM shall also be addressed here.	A HAZID was conducted as a group activity within a workshop format **[Ref. 12]**. There were two separate workshops held, Part 1 and Part 2. Part 1 focused on the different activities taking place within the various Screened options. Hazards associated with the activities were identified and any potential Major Accident Hazards (MAH) were identified. An initial risk scoring was applied to each activity / hazard which was further considered within Part 2. Part 2 focused on each of the options and applied the results from Part 1 to the circumstances of each option to produce a finalised score for each option that is used directly within the CA Evaluation Phase. The results were provided in the Repsol Sinopec Resources UK Risk Matrix format to allow comparison between options. Fishing intensity **[Ref. 13]** and risk assessment studies **[Ref. 14]** were carried out to support the HAZID assessments.
	1.2 Personnel Onshore	This sub-criterion considers elements that impact risk to onshore personnel. Factors such as any requirement for dismantling, disposal operations, material transfer and onshore handling may impact onshore personnel. Any requirement for handling HazMat / NORM shall also be addressed here.	
	1.3 Other Users	This sub-criterion covers the impact associated with the risk to other users. Considers elements such as collision impact whilst performing activities. Users such as fishing vessels, commercial transport vessels, recreational vessels and military vessels are considered.	
	1.4 Residual Risk	This sub-criterion addresses residual **safety** risk to other sea users i.e. fishermen, military vessel crews, commercial vessel crews and passengers, other sea users, that is provided by the option. Issues such as residual snag risk, collision risk, etc. may be considered.	
2. Environmental	2.1 Impact of Decommissioning Operations Offshore	This sub-criterion covers elements such as Noise, Energy & Emissions and Aqueous Discharges. Also to consider discharges and emissions associated with the disturbance of cuttings, use of explosives, etc.	A CA ENVID was conducted as a group activity within a workshop format to identify whether there were any differentiators between the decommissioning options for the jacket, and to determine whether these differences could have a significant environmental or societal impact**.** All aspects identified within the ENVID were tagged against specific related Environmental and Societal sub-criteria with the output of the CA ENVID **[Ref. 15]** being directly fed into the CA process, providing a clear and auditable trail of the assessment.
	2.2 Processing of Returned Materials	This sub-criterion covers the Processing of Returned Materials resulting in Use of Landfill	
	2.3 Resource Consumption	This sub-criterion relates to the resource consumption for carrying out the decommissioning activity (e.g. Rockdump, but not fuel as that is covered above) and Replacement Materials – e.g. steel).	
	2.4 Disturbance	This sub-criterion relates to the Physical Disturbance to the Seabed during Decommissioning Operations (Short Term).	
	2.5 Loss of Habitat	This sub-criterion relates to the Loss of Habitat (Legacy/Long Term).	

Differentiator	Sub-Criteria	Description	Approach to Assessment
3. Technical	3.1 Contracting Strategy	The focus of this sub-criterion is on the risk to the project of whether the contracting strategy is restricted by a particular option (e.g. if the option involves only one possible vendor).	Assessment based on engineering method statements and considers elements such as novelty, risk of failure and availability of technology.
	3.2 Schedule	This sub-criterion relates to the potential technical risk that the schedule required for a particular option may have on the success of the project (e.g. an extended offshore decommissioning campaign running over several seasons), including the potential for significant schedule overruns and the complexity of the overall decommissioning strategy.	
	3.3 Technical Maturity	This sub-criterion relates to the technological "readiness" of an option and the risk that the use of a particular technology (especially if unproven or untested) may have on the success of the project.	
4. Societal	4.1 Regulatory	This sub-criterion addresses the risk to the success of the project from the regulatory implications of each option, including the potential for issues in gaining government approval of the overall project decommissioning programme and the potential for setting a new precedent in decommissioning activities that other operators may be forced to follow.	A qualitative judgement based upon the experience of the CA workshop team members.
	4.2 Impact on Commercial Fisheries	The focus of this sub-criterion is on exclusion zones, inability to fish in areas and if decommissioning will have resulted in a loss of habitat for target species – e.g. through leaving pipelines in place or rock placement)	A CA ENVID was conducted as a group activity within a workshop format to identify whether there were any differentiators between the decommissioning options for the jacket, and to determine whether these differences could have a significant environmental or societal impact**.** All aspects identified within the ENVID were tagged against specific related Environmental and Societal sub-criteria with the output of the CA ENVID **[Ref. 15]** being directly fed into the CA process, providing a clear and auditable trail of the assessment.
	4.3 Socio-economic impact on communities and amenities	This sub-criterion addresses the impact from any near-shore and onshore operations and end-points (dismantling, transporting, treating, recycling, land filling) on the health, wellbeing, standard of living, structure or coherence of communities or amenities; e.g. business or jobs creation, increases in noise, dust or odour pollution during the process which has a negative impact on communities, increased traffic disruption due extra-large transport loads. May be positive or negative Jobs created Establishment of track record Improvements to roads, quaysides etc.).	

Differentiator	Sub-Criteria	Description	Approach to Assessment
5. Economic	5.1 Cost for decommissioning / removal activities	This sub-criterion addresses the total cost of performing the physical decommissioning of the infrastructure. No allowance for time discounting of expenditure is allowed for in this sub-criterion as it is assumed that the decommissioning activities for each option will be carried out over a relatively short timescale (i.e. less than a year).	Quantified in the Pipeline and Subsea Infrastructure Removal Report **[Ref. 9].**
	5.2 Cost for long term monitoring / remediation activities	This sub-criterion addresses the total cost of monitoring any remaining infrastructure following decommissioning plus any potential costs for remediation activities that may be required if the infrastructure degrades. Data should be presented to show the total cost and time discounted cost for monitoring of infrastructure with only the total “as now” cost required for potential remediation activities.	Quantified in the Long Term Monitoring Assessment Report **[Ref. 16]**.

Appendix A.3 Differentiator Weighting

The 5 differentiating main criteria all carry a 20% weighting. That is, all criteria are neutral to each other. The figure below shows the pairwise comparison matrix. Repsol Sinopec Resources UK Limited decided that equal weightings for the main criteria offers the most transparency and a balanced view from all perspectives.

Table A.2: Example Pairwise Comparison Matrix (N = Neutral)

Criteria	1. Safety	2. Environmental	3. Technical	4. Societal	5. Economic	Weighting
1. Safety	N	N	N	N	N	20%
2. Environmental	N	N	N	N	N	20%
3. Technical	N	N	N	N	N	20%
4. Societal	N	N	N	N	N	20%
5. Economic	N	N	N	N	N	20%

Weightings for the differentiating sub-criteria were developed using a pair-wise comparison for the sub-criteria. The pair-wise comparison adopted in this case used phrases such as much stronger, stronger, weaker, much weaker, etc. to make qualitative judgements of the relative impact/importance that each of the sub-criteria would have on the overall comparative assessment decision.

Adopting these phrases rather than the more common numerical 'importance scale' from the Analytical Hierarchy Process (AHP) is often more intuitive and representative of the sentiment of a workshop.

One of the challenges of applying the numerical importance scale historically, is that often when scoring a pair of options against each other as a score of 3, delegates implied the comparison was 3 times better, etc. rather than 'slightly better' as the importance scale suggests.

To manage this, Repsol Sinopec Resources UK Limited chose to apply the principles of the AHP by replacing numbers in the pairwise comparison matrix with a narrative or descriptive approach. This is already programmed into the AHP in the importance scale explanations. It was agreed that three positions from equal (and their reciprocals) would be sufficient for this CA.

These positions were:

Table A.3: Explanation of Phrasing Adopted for Pairwise Comparison

Title	Scope	Relative Preference Ratio
Neutral	Equal Importance, equivalent to 1 in the AHP importance scale.	50 / 50
Stronger (S) / Weaker (W)	Moderate importance of one criteria / option over the other, equivalent to 1.5 in the AHP importance scale.	60 / 40
Much Stronger (MS) / Much Weaker (MW)	Essential / strong importance of one criteria / option over the other equivalent to 5 or 6 in the AHP importance scale.	75 / 25
Very Much Stronger (VMS) / Very Much Weaker (VMW)	Extreme importance of one criteria / option over the other equivalent to 8 or 9 in the AHP importance scale.	90 / 10

The pair-wise comparison process for the differentiating sub-criteria resulted in the following sub-criteria weightings **[Ref. 11]**:

Figure A.1: Weighting of Safety Sub-Criteria

1. Safety	1.1 Personnel Offshore	1.2 Personnel Onshore	1.3 Other Users	1.4 Residual Risk	Weighting
1.1 Personnel Offshore	N	N	MS	S	33.6%
1.2 Personnel Onshore	N	N	MS	S	33.6%
1.3 Other Users	MW	MW	N	W	12.0%
1.4 Residual Risk	W	W	S	N	20.8%

Figure A.2: Weighting of Environmental Sub-Criteria

2. Environmental	2.1 Impact of Decommissioning Operations Offshore	2.2 Processing of Returned Materials	2.3 Resource Consumption	2.4 Disturbance	2.5 Loss of Habitat	Weighting
2.1 Impact of Decommissioning Operations Offshore	N	S	S	W	MW	15.2%
2.2 Processing of Returned Materials	W	N	S	MW	MW	11.3%
2.3 Resource Consumption	W	W	N	MW	MW	9.6%
2.4 Disturbance	S	MS	MS	N	W	27.2%
2.5 Loss of Habitat	MS	MS	MS	S	N	36.7%

Figure A.3: Weighting of Technical Sub-Criteria

3. Technical	3.1 Contracting Strategy	3.2 Schedule	3.3 Technical maturity	Weighting
3.1 Contracting Strategy	N	S	W	30.7%
3.2 Schedule	W	N	MW	18.6%
3.3 Technical maturity	S	MS	N	50.7%

Figure A.4: Weighting of Societal Sub-Criteria

4. Societal	4.1 Regulatory	4.2 Impact on Commercial Fisheries	4.3 Socio-economic impact on communities and amenities	Weighting
4.1 Regulatory	N	S	MS	50.7%
4.2 Impact on Commercial Fisheries	W	N	S	30.7%
4.3 Socio-economic impact on communities and amenities	MW	W	N	18.6%

Figure A.5: Weighting of Economic Sub-Criteria

5. Economic	5.1 Cost for decommissioning / removal activities	5.2 Cost for long term monitoring / remediation activities	Weighting
5.1 Cost for decommissioning / removal activities	N	MS	75.0%
5.2 Cost for long term monitoring / remediation activities	MW	N	25.0%

Based upon the above sub-criteria comparisons and the weighting of 20% applied to each of the main criteria, the weighting for each of the sub-criteria for the overall comparison is as follows:

- Safety – 1.1. Personnel Offshore: 6.72% (i.e. 33.6% of 20%).
- Safety – 1.2 Personnel Onshore: 6.72%.
- Safety – 1.3 Other Users: 2.40%.

- Safety – 1.4 Residual Risk: 4.16%.
- Environmental – 2.1 Impact of Decommissioning Operations Offshore: 3.04%.
- Environmental – 2.2 Processing of Returned Materials: 2.26%.
- Environmental – 2.3 Resource Consumption: 1.92%.
- Environmental – 2.4 Disturbance: 5.44%.
- Environmental – 2.5 Loss of Habitat: 7.34%.
- Technical – 3.1 Contracting Strategy: 6.14%.
- Technical – 3.2 Schedule: 3.72%.
- Technical – 3.3 Technical Maturity: 10.14%.
- Societal – 4.1 Regulatory: 10.14%.
- Societal – 4.2 Impact on Commercial Fisheries: 6.14%.
- Societal – 4.3 Socio-economic Impact on Communities and Amenities: 3.72%.
- Economic – 5.1 Cost for Decommissioning / Removal Activities: 15.00%.
- Economic – 5.2 Cost for Long Term Monitoring / Remediation Activities: 5.00%.

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Appendix A.4 Option Attributes

The next step in the CA process was to describe and discuss the attributes of each option with respect to each of the differentiating criteria. In preparation, all relevant data and information developed during the preparation phase were pre-populated into the attributes table for each option. Appendix B to Appendix E contain the completed Attributes Tables for each subsea infrastructure group.

Any additional discussion around the relative merits of the options was also recorded in the attributes matrix. A summary discussion of why options are considered more or less attractive with respect to each of the differentiating criteria was also recorded.

Appendix A.5 Option Pair-wise Comparison

Once the option attributes were compiled and discussed, a pair-wise comparison was performed for each of the differentiating criteria where the proposed options were compared against each other using the same method as was used to develop the weightings for the sub-criteria weightings.

Using this transposed scoring system made it simpler and, more importantly, more effective at capturing the mind-set and feeling of the attendees at the workshops. Phrases such as 'what are the relative merits of pipeline removal on a project versus rock placement from a safety perspective? Are these Neutral to each other? Are they stronger? If so, how much stronger? If you had to prioritise one over the other, which would it be?' This promoted a collaborative dynamic in the workshop and enabled the collective mind-set of the attendees to be captured. Where there was quantitative data to provide back-up and evidence to support the collective assertions, so much the better.

A summary example of the completed pair-wise comparisons for differentiating criteria versus options are shown below.

Figure A.6: Example Option Pair-wise Comparison

1.1 Personnel Offshore

	2a Leave in Situ Minor Intervention – Trench and Bury Exposures	2b Leave in Situ Minor Intervention – Cut and Remove Exposures	2c Leave in Situ Minor Intervention – Rock Cover Exposures	3 Full Removal – Reverse Reeling	Weighting
2a Leave in Situ Minor Intervention – Trench and Bury Exposures		N	N	MS	30.0%
2b Leave in Situ Minor Intervention – Cut and Remove Exposures	N		N	MS	30.0%
2c Leave in Situ Minor Intervention – Rock Cover Exposures	N	N		MS	30.0%
3 Full Removal – Reverse Reeling	MW	MW	MW		10.0%

4.2 Impact on Commercial Fisheries

	2a Leave in Situ Minor Intervention – Trench and Bury Exposures	2b Leave in Situ Minor Intervention – Cut and Remove Exposures	2c Leave in Situ Minor Intervention – Rock Cover Exposures	3 Full Removal – Reverse Reeling	Weighting
2a Leave in Situ Minor Intervention – Trench and Bury Exposures		N	S	N	27.3%
2b Leave in Situ Minor Intervention – Cut and Remove Exposures	N		S	N	27.3%
2c Leave in Situ Minor Intervention – Rock Cover Exposures	S	S		N	27.3%
3 Full Removal – Reverse Reeling	N	N	N		18.2%

2.1 Impact of Decommissioning Operations Offshore

	2a Leave in Situ Minor Intervention – Trench and Bury Exposures	2b Leave in Situ Minor Intervention – Cut and Remove Exposures	2c Leave in Situ Minor Intervention – Rock Cover Exposures	3 Full Removal – Reverse Reeling	Weighting
2a Leave in Situ Minor Intervention – Trench and Bury Exposures		N	N	S	27.3%
2b Leave in Situ Minor Intervention – Cut and Remove Exposures	N		N	S	27.3%
2c Leave in Situ Minor Intervention – Rock Cover Exposures	N	N		S	27.3%
3 Full Removal – Reverse Reeling	W	W	W		18.2%

5.1 Cost for decommissioning / removal activities

	2a Leave in Situ Minor Intervention – Trench and Bury Exposures	2b Leave in Situ Minor Intervention – Cut and Remove Exposures	2c Leave in Situ Minor Intervention – Rock Cover Exposures	3 Full Removal – Reverse Reeling	Weighting
2a Leave in Situ Minor Intervention – Trench and Bury Exposures		N	N	S	27.3%
2b Leave in Situ Minor Intervention – Cut and Remove Exposures	N		N	S	27.3%
2c Leave in Situ Minor Intervention – Rock Cover Exposures	N	N		S	27.3%
3 Full Removal – Reverse Reeling	W	W	W		18.2%

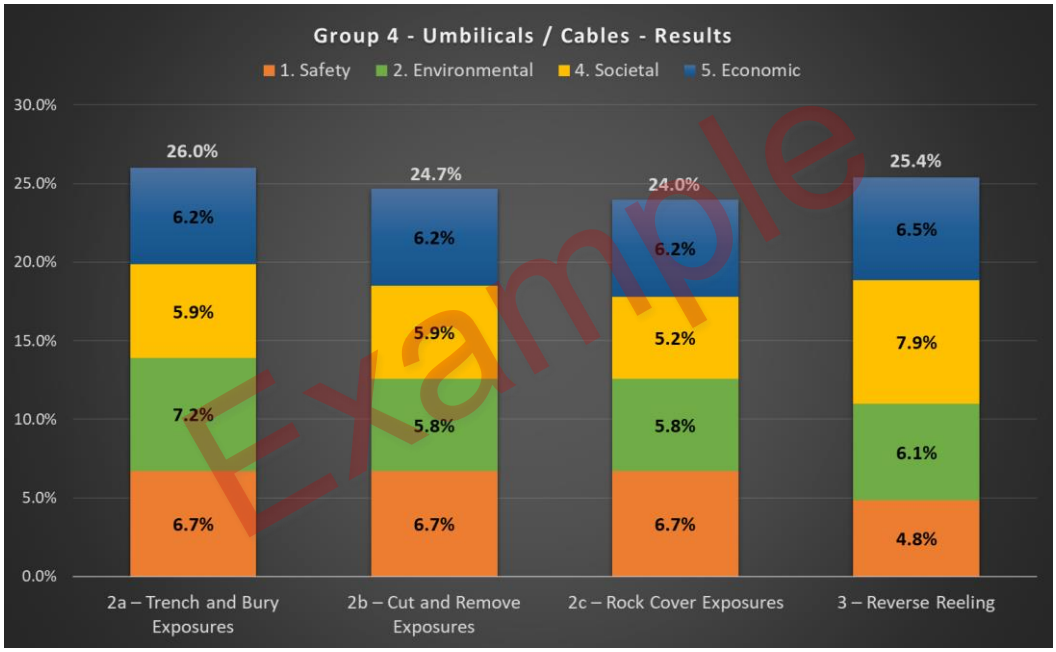
Where all options have been assessed to be neutral for a particular sub-criterion, that sub-criterion has been removed from the final assessment to ensure that differences between options are more clearly represented (although the discussion and justification for neutral assessment has been

retained in the relevant attributes table). Where sub-criteria have been removed from the final assessment, the relative pair-wise comparisons for the remaining sub-criteria have been retained as per the original assessment.

Appendix A.6 Visual Output and Sensitivities

The decision-making tool used the above pair-wise comparisons to automatically generate a visual output indicating the highest scoring option, i.e. the option which represents the most 'successful' solution in terms of its overall contribution to the set of differentiating criteria. At this stage, an opportunity was provided to fine tune the judgements made to ensure that all attendees were happy to endorse the outcome. The visual outputs from each decision point are included in Appendix C. An example of the visual output obtained is shown below:

Figure A.7: A Visual Output Example



The CA output was then stress tested by the workshop attendees by undertaking sensitivity analyses where applicable:

- By applying a modification to the weighting of the criteria – bearing in mind that the base case for this assessment is to have all main criteria equally weighted, and / or
- Modifying the pair-wise comparison of the options against each other within the criteria where appropriate.

These sensitivities helped inform the workshop attendees as to whether a particular aspect was driving a preferred option, or indeed if the preferred option remains the same when the sensitivities were applied.

A variety of sensitivities were conducted, none of which had any material impact on the selected outcome.

APPENDIX B GROUP 1 – DETAILED EVALUATION RESULTS

Appendix B.1 Group 1 Attributes Table

1. Safety – 1.1 Personnel Offshore

1b – Remediate Ends and Spans Only

R = 0
O = 1
Y = 2
G = 2
Total = 5

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4					
3	1				
2	2	1			
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 8
Y = 8
G = 3
Total = 19

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4	2	3	2		
3	1	1			
2	3	4		1	
1					
0					

2c – Rock Cover Bundle

R = 0
O = 1
Y = 2
G = 2
Total = 5

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4					
3	1				
2	2	1			
1					
0					

3a – Cut and Lift

R = 0
O = 11
Y = 5
G = 2
Total = 18

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4		3	4		
3		1	1		
2	1	3	1	2	
1		1			
0					

1b			2a		2c
MS	N	MS	MW	S	MS

Summary

The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
Option 1b is assessed as being much stronger than Option 2a as it has less risk exposure, due to Option 2a requiring more deck handling and diver activity. Option 1b is assessed as being neutral to Option 2c as they have a similar risk exposure. Option 1b is assessed as being much stronger than Option 3a as it has less risk exposure, due to the full removal option having multiple cut and lift operations, including onboarding of cut pipe.
Option 2a is assessed as being much weaker than Option 2c as it has more risk exposure due to requiring more deck handling and diver activity. Option 2b is assessed as being stronger than Option 3a as Option 2b has less risk exposure as there are no cutting, lifting or onboarding operations.
Option 2c is assessed as being much stronger than Option 3a as it has less risk exposure as there are no cutting, lifting or onboarding operations.

Overall, Option 1b and Option 2c are equally preferred options from a risk to Offshore Personnel perspective.

1. Safety – 1.2 Personnel Onshore

1b – Remediate Ends and Spans Only

R = 0
O = 2
Y = 4
G = 0
Total = 6

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	2				
3	1	1			
2				2	
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 5
Y = 5
G = 0
Total = 10

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4		2			
3	2	2			
2			1	2	
1					
0					

2c – Rock Cover Bundle

R = 0
O = 2
Y = 4
G = 0
Total = 6

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	2				
3	1	1			
2				2	
1					
0					

3a – Cut and Lift

R = 1
O = 13
Y = 2
G = 0
Total = 16

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5			1		
4		1	3		
3			5		
2			1	3	1
1				1	
0					

1b			2a		2c
S	N	VMS	W	MS	VMS

Summary

The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows:
Option 1b is assessed as being stronger than Option 2a as Option 2a requires more vessels and interim mobilisations of a DSV and trenching vessel. Option 1b is assessed as being neutral to Option 2c as they have similar risk exposures. Option 1b is assessed as being very much stronger than Option 3a due to the risks associated with handling, transporting and processing large quantities of cut bundle.
Option 2a is assessed as being weaker than Option 2c as it requires more vessels and interim mobilisations of a DSV and trenching vessel. Option 2a is assessed as being much stronger than Option 3a due to the risks associated with handling, transporting and processing large quantities of cut bundle.
Option 2c is assessed as being very much stronger than Option 3a as the risk exposure is very much lower for similar reasons as above.

Overall, Options 1b and 2c are equally preferred options from a risk to Onshore Personnel perspective.

1. Safety – 1.3 Other Users

1b – Remediate Ends and Spans Only

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2c – Rock Cover Bundle

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

3a – Cut and Lift

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

1b			2a		2c
N	N	N	N	N	N

Summary

The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options.

Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels.

1. Safety – 1.4 Residual Risk

1b – Remediate Ends and Spans Only

R = 1
O = 4
Y = 8
G = 0
Total = 13

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4			1	
4	3				
3		2			
2		3			
1					
0					

Comparison: VMW | W | VMW

2a – Trench and Bury Bundle

R = 0
O = 5
Y = 8
G = 0
Total = 13

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

Comparison: S | W

2c – Rock Cover Bundle

R = 0
O = 4
Y = 8
G = 0
Total = 12

a 1 in 3c

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4				
4	3				
3		2			
2		3			
1					
0					

Comparison: MW

3a – Cut and Lift

R = 0
O = 0
Y = 0
G = 0
Total = 0

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4					
3					
2					
1					
0					

Summary

The assessment of the Residual Risk sub-criterion is based on the results of the HAZID for the legacy operations and is as follows:
Option 1b is assessed as being very much weaker than Option 2a as it has a greater potential for snag hazard and highest burden in terms of man-hours exposure to monitor and remediate the remaining equipment. Option 1b is assessed as being weaker than Option 2c for similar reasons, although to a lesser extent. Option 1b is assessed as being very much weaker than Option 3a as there is the potential for a snag hazard versus no residual risk with the full removal option.
Option 2a is assessed as being stronger than Option 2c as the trench and bury option is considered to have a lower potential for snag hazard than the blanket rock cover option. Option 2a is assessed as being weaker than Option 3a as there is the potential for a snag hazard versus no residual risk with the full removal option.
Option 2c is assessed as being much weaker than Option 3a for similar reasons.

Overall, Option 3a is the preferred option from a Residual Risk perspective.

2. Environmental – 2.1 Impact of Decommissioning Operations Offshore

1b – Remediate Ends and Spans Only

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

614 tonnes CO^2
194 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

Comparison: N | N | S

2a – Trench and Bury Bundle

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

4430 tonnes of CO^2
1398 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

Comparison: N | S

2c – Rock Cover Bundle

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

1494 tonnes of CO^2
471 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

Comparison: S

3a – Cut and Lift

Planned
R = 0
Y = 0
G = 7
B = 1
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	1	0	0
1	1	3	0	2
0	0	1	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

9167 tonnes of CO^2
2892 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

Summary

The assessment of the Impact of Decommissioning Operations Offshore sub-criterion is based on the results of the ENVID as follows:
Option 1b is assessed as being neutral to Option 2a and Option 2c as the ENVID matrices are the same. Option 1b is assessed as being stronger than Option 3a, as whilst the matrices are similar, the higher CO^2 emissions and fuel use are considered sufficient to express a preference.
Option 2a is assessed as being neutral to Option 2c as the matrices are the same. Option 2a is assessed as being stronger than Option 3a as, whilst the matrices are similar, the higher CO^2 emissions and fuel use are considered sufficient to express a preference.
Option 2c is assessed as being much stronger than Option 3a for similar reasons.

Overall, Option 1b, 2a and 2c are all equally preferred options from an Environmental - Impact of Decommissioning Operations Offshore perspective.

2. Environmental – 2.2 Processing of Returned Materials

1b – Remediate Ends and Spans Only

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

Comparison: N | N | N

2a – Trench and Bury Bundle

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

Comparison: N | N

2c – Rock Cover Bundle

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

Comparison: N

3a – Cut and Lift

R = 0
Y = 0
G = 1
B = 0
Tot = 1

5150 tonnes returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

Summary

The assessment of the Processing of Returned Materials sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral against each other as the processing of returned materials is similar for all options.

Overall, all options are equally preferred from an Environmental - Processing of Returned Materials perspective. Note: The bundle is constructed of mainly recycled materials, so neutral across all options.

2. Environmental — 2.3 Resource Consumption

	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
	R = 0 Y = 0 G = 3 B = 0 Tot = 3 1700 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 200 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 155000 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 0 tonnes of rockdump

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	3	0	0	0
0	0	0	0	0

	1b	2a	2c	3a
	N	S	N	W

Summary

The assessment of the Resource Consumption sub-criterion is based on the results of the ENVID and is as follows:
Option 1b is assessed as being neutral to Option 2a and Option 3a as they have similar resource consumptions. Option 1b is assessed as being stronger the Option 2c as, whist the ENVID matrices are the same, this assessment reflects the large quantity of rock required for Option 2c to cover the bundle.
Option 2a is assessed as being stronger than Option 2c, again due to the rock required for Option 2c. Option 2a is assessed as being neutral to Option 3a as they have similar resource consumptions.
Option 2c is assessed as being weaker than Option 3a, again due the large amount of rock required to cover the bundle.

Overall, Option 1b, 2a and 3a are all equally preferred options from a Resource Consumption perspective.

2. Environmental — 2.4 Disturbance

	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	1	0	0
0	0	0	0	0

	1b	2a	2c	3a
	S	S	N	W	W

Summary

The assessment of the Seabed Disturbance (short-term impact) sub-criterion is as follows:
Option 1b is assessed as being stronger than Option 2a and Option 2c as there is less short-term seabed disturbance compared to trenching or rock placement of the entire line. Option 1b is assessed as being neutral to Option 3a due as the seabed disturbance associated with the cut and lift of the surface laid bundle is considered minimal.
Option 2a is assessed as being neutral to Option 2c as the impact from trenching and rock placement of the line is considered similar. Option 2a is assessed as being weaker than Option 3a the impact from trenching is higher than cut and lift of the surface laid bundle.
Option 2c is assessed as being weaker than Option 3a as the impact of cut and lift operations are expected to be lower than rock placement.

Overall, Option 1b and Option 3a are equally preferred options from a Seabed Disturbance perspective.

2. Environmental — 2.5 Loss of Habitat

	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
	R = 0 Y = 1 G = 0 B = 0 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1	R = 0 Y = 1 G = 0 B = 0 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	1	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0

	1b	2a	2c	3a
	MW	S	MW	MS	N	MW

Summary

The assessment of the Loss of Habitat (legacy / long-term) sub-criterion is as follows:
Option 1b is assessed as being much weaker than Option 2a as the bundle will remain on the seabed with Option 1b and therefore the original habitat will be altered for the long-term, whereas the original habitat will recover post trench and bury under Option 2a. Option 1b is assessed as being stronger than Option 2c as blanket rock cover will impact a larger area of seabed than spot rock cover, which permanently alters the original habitat. Option 1b is assessed as being much weaker than Option 3a as the bundle will remain on the seabed with Option 1b and therefore the original habitat will be altered for the long-term, whereas the original habitat will recover post cut and lift operations under Option 3a.
Option 2a is assessed as being much stronger than than Option 2c as the rock cover will permanently alter the habitat over a large area. Option 2a is assessed as being neutral to Option 3a as both options will have no long-term impact / loss of habitat.
Option 2c is assessed as being much weaker Option 3a as there will be no long-term impact / loss of habitat associated with the full removal option versus large area of permanently altered habitat from the rock placement.

Overall, Option 2a and Option 3a are equally preferred options from a Loss of Habitat perspective.

		1b – Remediate Ends and Spans Only			2a – Trench and Bury Bundle		2c – Rock Cover Bundle	3a – Cut and Lift
3. Technical	3.1 Contracting Strategy	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.			Suitable trenching / backfill equipment available but bundle outside diameter is at the limit of current technology, therefore likely to be limited flexibility in terms of contracting strategy.		Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.	The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so may be more challenging to have flexible contracting strategy.
		MS	**N**	**MS**	**MW**	**N**	**MS**	
	Summary	The assessment of the Contracting Strategy sub-criterion is as follows: Option 1b is assessed as being much stronger than Option 2a due to the outer diameter of the bundle being at the limit of current trenching technology and therefore likely to have fewer options / less flexibility in terms of contracting strategy. Option 1b is assessed as being neutral to Option 2c as both options consist of similar, largely routine activities which are likely to have more options / greater flexibility in terms of contracting strategy. Option 1b is assessed as being much stronger than Option 3a as, at the time of the assessment, cut and lift of a bundle has not been performed and options / flexibility in terms of contracting strategy are likely to be limited. Option 2a is assessed as being much weaker than Option 2c, due to the outer diameter of the bundle being at the limit of current trenching technology and therefore likely to have fewer options / less flexibility in terms of contracting strategy. Option 2a is assessed as being neutral to Option 3a as they both consist of similar, largely routine activities which are likely to have more options / greater flexibility in terms of contracting strategy. Option 2c is assessed as being much stronger than Option 3a as at the time of the assessment, cut and lift of a bundle has not been performed and contracting options / flexibility are likely to be limited. Overall, Option 1b and Option 2c are equally preferred from a Contracting Strategy perspective.						
3. Technical	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 20 days.			High chance of multi-pass trenching being required to achieve sufficient trench depth. High risk of failure to achieve trench depth resulting in additional time for alternative method, e.g. rock dump. In field time of 87 days.		No particular technological factors or major risk factors that could extend schedule. In field time of 43 days.	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is scope for over-runs. Current estimate of in-field time is 124 days. Potential for over-runs may be offset by efficiency gains from repeat lifting.
		MS	**N**	**S**	**MW**	**W**	**S**	
	Summary	The assessment of the Schedule sub-criterion is as follows: Option 1b is assessed as being much stronger than Option 2a as the outer diameter of the bundle is at the limit of current trenching technology which means there is a high probabiltiy of additional trenching passes being required or alternative remedation measures being required in the event trenching does not acheive the required burial depth. Option 1b is assessed as being neutral to Option 2c as they both consist of similar, routine activities over similar durations. Option 1b is assessed as being stronger than Option 3a as, at the time of the assessment, cut and lift of a bundle has not been performed, therefore there is a greater likelihood of schedule over-runs than for routine operations. Option 2a is assessed as being much weaker than Option 2c due to over-runs from trenching versus routine operations. Option 2a is assessed as being weaker than Option 3a as the trench and bury operations at the limit of the outside diameter of the bundle are considered more likely to encounter schedule over-runs than the cut and lift operations. Option 2c is assessed as being stronger than Option 3a as these are routine operations versus cut and lift of a bundle which, at the time of the assessment, has never been performed and is therefore more likley to experience schedule over-runs. Overall, Option 1b and Option 2c are equally preferred from a Schedule perspective.						
3. Technical	3.3 Technical maturity	Established methods and technology. Fully mature.			This is a routine subsea operation but there is no track record of trenching large diameter bundles. Bundle is at the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in these areas.		Established methods and technology. Fully mature.	No track record for cut, lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support. Low technical maturity.
		MS	**N**	**MS**	**MW**	**N**	**MS**	
	Summary	The assessment of the Technical Maturity sub-criterion is as follows: Option 1b is assessed as being much stronger than Option 2a due to routine operations versus no track record of trenching large diameter bundles. Option 1b is assessed as being neutral to Option 2c as they both consist of similar, routine activities. Option 1b is assessed as being much stronger than Option 3a due to routine operations versus cut and lift of a bundle which has never been performed. Option 2a is assessed as being much weaker than Option 2c due to no track record of trenching large diameter bundles versus routine operations. Option 2a is assessed as being neutral to Option 3a as neither option have been performed before and therefore have similarly low technical maturity. Option 2c is assessed as being much stronger than Option 3a due to routine operations versus no track record of performing cut and lift of bundles. Overall, Option 1b and Option 2c are equally preferred from a Technical Maturity perspective.						
4. Societal	4.1 Regulatory	Seabed would be left with rock dump of spans, exposures and ends.			If successful, would leave a clear seabed. However high risk of not achieving required depth of cover requiring additional material (e.g. rock dump).		Seabed would be left with rock dump over entire bundle length.	Full removal would leave a clear seabed and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.
		W	**S**	**W**	**S**	**N**	**W**	
	Summary	The assessment of the Political sub-criterion is as follows: Option 1b is assessed as being weaker than Option 2a and Option 3a as the bundle will be left exposed, compared to leaving a clear seabed with the trench & bury and cut & lift options. Option 1b is assessed as being stronger than Option 2c due to the bubdle remainig in situ, albeit rock dumped. Option 2a is assessed as being stronger than Option 2c as it would leave a clear seabed. Option 2a is assessed as being neutral to Option 3a as they both result in a clear seabed. Option 2c is assessed as being weaker than Option 3a as it does not result in a clear seabed. Overall, Option 2a and Option 3a are equally preferred options from a Political perspective.						

4. Societal

4.2 Impact on Commercial Fisheries

	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
	Minimal area of natural seabed lost. Remediation is intended to mitigate snag hazard.	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.	Significant area of natural seabed permanently lost.	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.
Planned	R = 0 Y = 1 G = 0 B = 0 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1
Unplanned	R = 1 Y = 0 G = 1 Tot = 2	R = 0 Y = 0 G = 2 Tot = 2	R = 0 Y = 0 G = 2 Tot = 2	R = 0 Y = 0 G = 1 Tot = 1

1b – Remediate Ends and Spans Only

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	1	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	1	0
4	0	0	0
3	0	0	0
2	1	0	0
1	0	0	0

2a – Trench and Bury Bundle

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	1	0	0
1	1	0	0

2c – Rock Cover Bundle

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
0	0	0	0	0
1	0	0	0	0
2	0	0	0	0
3	0	1	0	0
4	0	0	0	0
5	0	0	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	2	0	0
1	0	0	0

3a – Cut and Lift

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

W	W	W	S	N	W	

Summary

The assessment of the Impact on Commercial Fisheries sub-criterion is as follows:
Option 1b is assessed as being weaker than Option 2a, Option 2c and Option 3a as, whilst the snag hazards are mitigated with rock cover, the bundle is left exposed on the seabed which can result in a commercial impact to fishing operations from net snagging / loss.
Option 2a is assessed as being stronger than Option 2c as the trench and bury option provides a clear seabed thus returning the area for fishing operations versus the rock cover option where the continuous rock berm can impact fishing operations. Option 2a is assessed as neutral to Option 3a, as both options leave a clear seabed, effectively returning the area for fishing operations.
Option 2c is assessed as being weaker than Option 3a for similar reasons as above.

Overall, Option 2a and Option 3a are equally preferred options from an Impact on Commercial Fisheries perspective.

4.3 Socio-economic impact on communities and amenities

	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
	Minimal impact on communities and amenities as no material returned to shore.	Minimal impact on communities and amenities as minimal material returned to shore.	Minimal impact on communities and amenities as no material returned to shore.	Medium benefit to communities as bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.
Planned	R = 0 Y = 0 G = 7 B = 6 Tot = 13	R = 0 Y = 0 G = 7 B = 6 Tot = 13	R = 0 Y = 0 G = 7 B = 6 Tot = 13	R = 0 Y = 0 G = 12 B = 1 Tot = 13
Unplanned	R = 0 Y = 0 G = 0 Tot = 0	R = 0 Y = 0 G = 0 Tot = 0	R = 0 Y = 0 G = 0 Tot = 0	R = 0 Y = 0 G = 1 Tot = 1

1b – Remediate Ends and Spans Only

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	**0**	0	0
2	0	0	0	0
1	**6**	0	0	**1**
0	**6**	0	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

2a – Trench and Bury Bundle

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	**6**	0	0	**1**
0	**6**	**0**	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

2c – Rock Cover Bundle

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	**0**	0	0
2	0	0	0	0
1	**6**	0	0	**1**
0	**6**	0	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

3a – Cut and Lift

Magnitude \ Sensitivity	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	**1**	0	0	0
1	**10**	0	0	**1**
0	**1**	**0**	0	0

Likelihood \ Impact Significance	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	**1**	0	0
2	0	0	0
1	0	0	0

N	N	W	N	W	W	

Summary

The assessment of the Socio-economic sub-criterion is as follows:
Option 1b is assessed as being neutral to Option 2a and Option 2c as they result in similar levels of job creation / retention and material returned to shore for processing. Option 1b is assessed as being weaker than Option 3a as there is significantly more job creation / retention associated with Option 3a.
Option 2a is assessed as being neutral to Option 2c and weaker than Option 3a for similar reasons as above.
Option 2c is assessed as being weaker than Option 3a, again for similar reasons as above.

Overall, Option 3a is the preferred option from a Socio-economic impact on communities and amenities perspective.

		1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
5. Economic	5.1 Cost for decommissioning / removal activities	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £1.9 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £19.7 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £10.0 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £17.4 million.
		VMS VMS VMS	MW N	MS	
	Summary	The assessment of the Cost for decommissioning sub-criterion is as follows: Option 1b is assessed as being very much stronger than Option 2a as it is more than 10 times lower. Option 1b is assessed as being much stronger than Option 2c as it is around 5 times lower. Option 1b is assessed as being very much stronger than Option 3a as it is also around 10 times lower. Option 2a is assessed as being weaker than Option 2c as it is around double the cost. Option 2a is assessed as being neutral to Option 3a as the costs are similar. Option 2c is assessed as being stronger than Option 3a as the costs are around half. Overall, Option 1b is the preferred option from a total cost of decommissioning perspective.			
5. Economic	5.2 Cost for long term monitoring / remediation activities	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £10.0 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £9.4 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.2 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £5.0 million	There are no long-term costs associated with this full removal option.
		N MW VMW	MW VMW	MW	
	Summary	The assessment of the Cost for long term monitoring / remediation sub-criterion is as follows: Option 1b is assessed as being neutral to Option 2a due to the long term costs being similar. Option 1b is assessed as being much weaker than Option 2c as the long-term costs are £5 million higher. Option 1b is assessed as being very much weaker that Option 3a as there are no long-term costs associated with the full removal option. Option 2a is assessed as being much weaker than Option 2c as the long-term costs are £5 million higher. Option 2a is assessed as being very much weaker that Option 3a as there are no long-term costs associated with the full removal option. Option 2c is assessed as being much weaker than Option 3a as there are no long-term costs associated with the full removal options. Overall, Option 3a is the preferred option from a cost for long term monitoring / remediation perspective.			

Appendix B.2 Group 1 Pair-wise Comparison Matrices - Safety

1.1 Personnel Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	MW	S	13.8%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	W	MW	N	11.3%

1.2 Personnel Onshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	N	VMS	37.1%
2a – Trench and Bury Bundle	W	N	W	MS	20.8%
2c – Rock Cover Bundle	N	S	N	VMS	37.1%
3a – Cut and Lift	VMW	MW	VMW	N	4.9%

1.3 Other Users	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

1.4 Residual Risk	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	VMW	W	VMW	5.7%
2a – Trench and Bury Bundle	VMS	N	S	W	32.6%
2c – Rock Cover Bundle	S	W	N	MW	14.3%
3a – Cut and Lift	VMS	S	MS	N	47.5%

Appendix B.3 Group 1 Pair-wise Comparison Matrices - Environment

2.1 Impact of Decommissioning Operations Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	S	27.3%
2a – Trench and Bury Bundle	N	N	N	S	27.3%
2c – Rock Cover Bundle	N	N	N	S	27.3%
3a – Cut and Lift	W	W	W	N	18.2%

2.2 Processing of Returned Materials	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

2.3 Resource Consumption	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	S	N	27.3%
2a – Trench and Bury Bundle	N	N	S	N	27.3%
2c – Rock Cover Bundle	W	W	N	W	18.2%
3a – Cut and Lift	N	N	S	N	27.3%

2.4 Disturbance	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	S	N	30.0%
2a – Trench and Bury Bundle	W	N	N	W	20.0%
2c – Rock Cover Bundle	W	N	N	W	20.0%
3a – Cut and Lift	N	S	S	N	30.0%

2.5 Loss of Habitat	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MW	S	MW	13.8%
2a – Trench and Bury Bundle	MS	N	MS	N	37.5%
2c – Rock Cover Bundle	W	MW	N	MW	11.3%
3a – Cut and Lift	MS	N	MS	N	37.5%

Appendix B.4 Group 1 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	MW	N	12.5%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	N	MW	N	12.5%

3.2 Schedule	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	S	33.6%
2a – Trench and Bury Bundle	MW	N	MW	W	12.0%
2c – Rock Cover Bundle	N	MS	N	S	33.6%
3a – Cut and Lift	W	S	W	N	20.8%

3.3 Technical maturity	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	MW	N	12.5%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	N	MW	N	12.5%

Appendix B.5 Group 1 Pair-wise Comparison Matrices – Societal

4.1 Regulatory	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	W	S	W	22.1%
2a – Trench and Bury Bundle	S	N	S	N	29.9%
2c – Rock Cover Bundle	W	W	N	W	18.0%
3a – Cut and Lift	S	N	S	N	29.9%

4.2 Impact on Commercial Fisheries	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	W	W	W	18.0%
2a – Trench and Bury Bundle	S	N	S	N	29.9%
2c – Rock Cover Bundle	S	W	N	W	22.1%
3a – Cut and Lift	S	N	S	N	29.9%

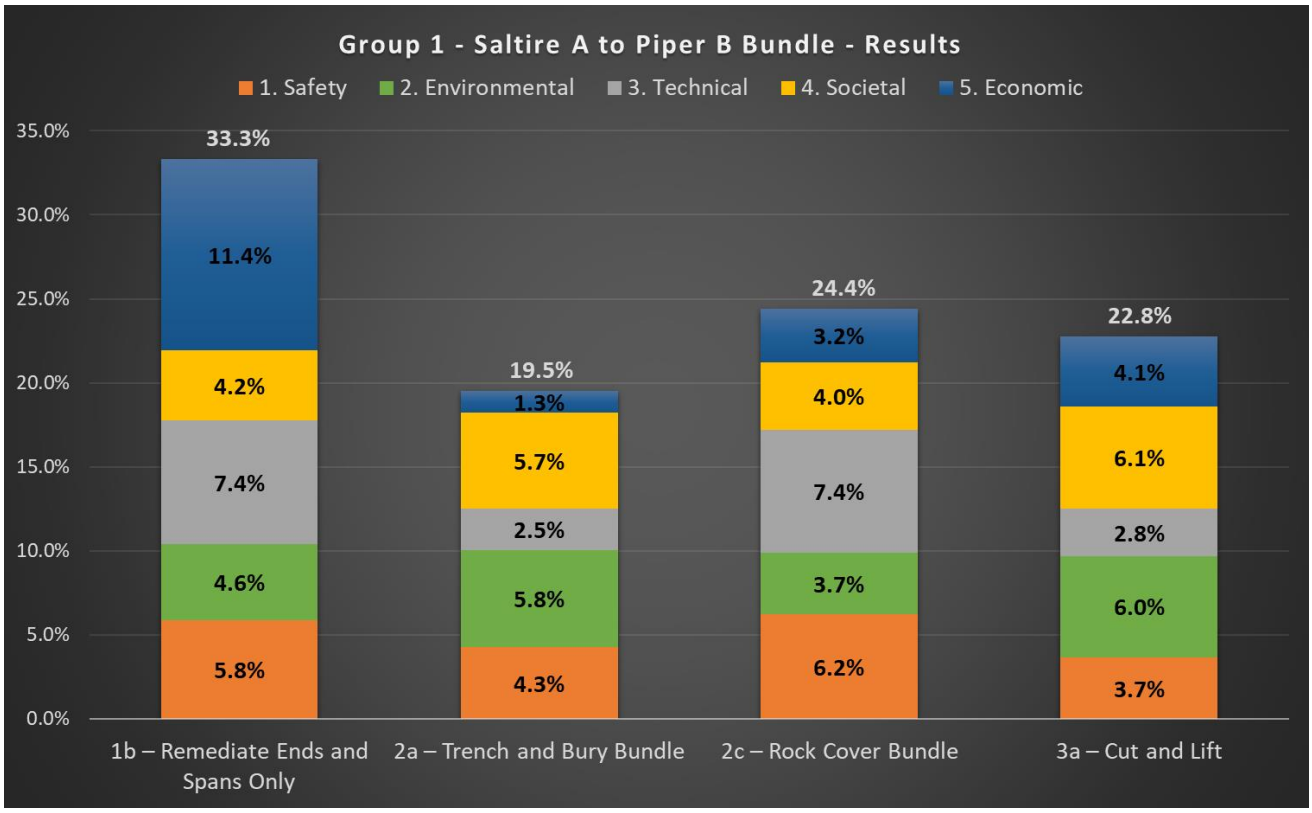
4.3 Socio-economic impact on communities and amenities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	W	22.2%
2a – Trench and Bury Bundle	N	N	N	W	22.2%
2c – Rock Cover Bundle	N	N	N	W	22.2%
3a – Cut and Lift	S	S	S	N	33.3%

Appendix B.6 Group 1 Pair-wise Comparison Matrices – Economic

5.1 Cost for decommissioning / removal activities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	VMS	VMS	VMS	73.5%
2a – Trench and Bury Bundle	VMW	N	MW	N	6.2%
2c – Rock Cover Bundle	VMW	MS	N	MS	14.1%
3a – Cut and Lift	VMW	N	MW	N	6.2%

5.2 Cost for long term monitoring / remediation activities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	MW	VMW	7.1%
2a – Trench and Bury Bundle	N	N	MW	VMW	7.1%
2c – Rock Cover Bundle	MS	MS	N	MW	21.4%
3a – Cut and Lift	VMS	VMS	MS	N	64.3%

Appendix B.7 Group 1 Results Chart



APPENDIX C GROUP 2 – DETAILED EVALUATION RESULTS

Appendix C.1 Group 2 Attributes Table

1. Safety – 1.1 Personnel Offshore

1b – Remediate Ends and Spans Only

R = 0
O = 1
Y = 2
G = 2
Total = 5

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4					
3	1				
2	2	1			
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 8
Y = 8
G = 3
Total = 19

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4	2	3	2		
3	1	1			
2	3	4		1	
1					
0					

2c – Rock Cover Bundle

R = 0
O = 1
Y = 2
G = 2
Total = 5

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4					
3	1				
2	2	1			
1					
0					

3a – Cut and Lift

R = 0
O = 10
Y = 6
G = 4
Total = 20

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4		4	2		
3	1	1	1		
2	3	3	1	2	
1		1			
0					

1b – Remediate Ends and Spans Only			2a – Trench and Bury Bundle		2c – Rock Cover Bundle
MS	N	MS	MW	S	MS

Summary

The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
Option 1b is assessed as being much stronger than Option 2a as it has less risk exposure, due to Option 2a requiring more deck handling and diver activity. Option 1b is assessed as being neutral with Option 2c as they have a similar risk exposure. Option 1b is assessed as being much stronger than Option 3a as it has less risk exposure, due to the full removal option having multiple cut and lift operations, including onboarding of cut pipe.
Option 2a is assessed as being much weaker than Option 2c as it has more risk exposure due to requiring more deck handling and diver activity. Option 2b is assessed as being stronger than Option 3a as it has less risk exposure as there are no cutting, lifting or onboarding operations.
Option 2c is assessed as being much stronger than Option 3a as it has less risk exposure as there are no cutting, lifting or onboarding operations.

Overall, Option 1b and Option 2c are equally preferred options from a risk to Offshore Personnel perspective.

1. Safety – 1.2 Personnel Onshore

1b – Remediate Ends and Spans Only

R = 0
O = 2
Y = 4
G = 0
Total = 6

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	2				
3	1	1			
2				2	
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 5
Y = 5
G = 0
Total = 10

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4		2			
3	2	2			
2			1	2	
1					
0					

2c – Rock Cover Bundle

R = 0
O = 2
Y = 4
G = 0
Total = 6

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	2				
3	1	1			
2				2	
1					
0					

3a – Cut and Lift

R = 1
O = 13
Y = 2
G = 0
Total = 16

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5			1		
4		1	3		
3			5		
2			1	3	1
1				1	
0					

1b – Remediate Ends and Spans Only			2a – Trench and Bury Bundle		2c – Rock Cover Bundle
S	N	VMS	W	MS	VMS

Summary

The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows:
Option 1b is assessed as being stronger than Option 2a due to Option 2a requiring more vessels and interim mobilisation of a trenching vessel. Option 1b is assessed as being neutral to Option 2c as they have similar risk exposures. Option 1b is assessed as being very much stronger than Option 3a due to the risks associated with handling, transporting and processing large quantities of cut bundle.
Option 2a is assessed as being weaker than Option 2c due to requiring more vessels and interim mobilisation of a trenching vessel. Option 2a is assessed as being much stronger than Option 3a due to the risks associated with handling, transporting and processing large quantities of cut bundle.
Option 2c is assessed as being very much stronger than Option 3a as the risk exposure is very much lower for similar reasons as above.

Overall, Options 1b and 2c are equally preferred options from a risk to Onshore Personnel perspective.

1. Safety – 1.3 Other Users

1b – Remediate Ends and Spans Only

R = 0
O = 2
Y = 2
G = 0
Total = 2

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 2
Y = 2
G = 0
Total = 2

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2c – Rock Cover Bundle

R = 0
O = 2
Y = 2
G = 0
Total = 2

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

3a – Cut and Lift

R = 0
O = 2
Y = 2
G = 0
Total = 2

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

1b – Remediate Ends and Spans Only			2a – Trench and Bury Bundle		2c – Rock Cover Bundle
N	N	N	N	N	N

Summary

The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options.

Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels.

1. Safety – 1.4 Residual Risk

1b – Remediate Ends and Spans Only

R = 1
O = 4
Y = 8
G = 0
Total = 13

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4			1	
4	3				
3		2			
2		3			
1					
0					

2a – Trench and Bury Bundle

R = 0
O = 5
Y = 8
G = 0
Total = 13

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

2c – Rock Cover Bundle

R = 0
O = 4
Y = 8
G = 0
Total = 12

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4				
4	3				
3		2			
2		3			
1					
0					

3a – Cut and Lift

R = 0
O = 0
Y = 0
G = 0
Total = 0

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4					
3					
2					
1					
0					

1b vs 2a	1b vs 2c	1b vs 3a	2a vs 2c	2a vs 3a	2c vs 3a
W	W	MW	S	W	W

Summary

The assessment of the Residual Risk sub-criterion is based on the results of the HAZID for the legacy operations and is as follows:
Option 1b is assessed as being weaker than Option 2a as there is greater potential for snag hazard with bundle left in situ and highest burden in terms of man-hours exposure to monitor and remediate the remaining equipment. Option 1b is assessed as being weaker than Option 2c for similar reasons, although to a lesser extent. Option 1b is assessed as being much weaker than Option 3a as there is the potential for a snag hazard versus no residual risk with the full removal option.
Option 2a is assessed as being stronger than Option 2c as the trench and bury option is considered to have a lower potential for snag hazard than the blanket rock cover option. Option 2a is assessed as being weaker than Option 3a as there is the potential for a snag hazard versus no residual risk with the full removal option.
Option 2c is assessed as being weaker than Option 3a for similar reasons.

Overall, Option 3a is the preferred option from a Residual Risk perspective.

2. Environmental – 2.1 Impact of Decommissioning Operations Offshore

1b – Remediate Ends and Spans Only

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

559 tonnes of CO^2
176 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

2a – Trench and Bury Bundle

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

2710 tonnes of CO^2
855 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

2c – Rock Cover Bundle

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

614 tonnes of CO^2
194 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

3a – Cut and Lift

Planned
R = 0
Y = 0
G = 7
B = 1
Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	1	0	0
1	1	3	0	2
0	0	1	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

3861 tonnes fo CO^2
1218 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

1b vs 2a	1b vs 2c	1b vs 3a	2a vs 2c	2a vs 3a	2c vs 3a
N	N	S	N	S	S

Summary

The assessment of the Impact of Decommissioning Operations Offshore sub-criterion is based on the results of the ENVID as follows:
Option 1b is assessed as being neutral to Option 2a and Option 2c as the ENVID matrices are the same. Option 1b is assessed as being stronger than Option 3a, as whilst the matrices are similar, the higher CO^2 emissions and fuel use are considered sufficient to express a preference.
Option 2a is assessed as being neutral to Option 2c as the matrices are the same. Option 2a is assessed as being stronger than Option 3a as, whilst the matrices are similar, the higher CO^2 emissions and fuel use are considered sufficient to express a preference.
Option 2c is assessed as being much stronger than Option 3a for similar reasons.

Overall, Option 1b, 2a and 2c are all equally preferred options from an Environmental - Impact of Decommissioning Operations Offshore perspective.

2. Environmental – 2.2 Processing of Returned Materials

1b – Remediate Ends and Spans Only

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

2a – Trench and Bury Bundle

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

2c – Rock Cover Bundle

R = 0
Y = 0
G = 1
B = 0
Tot = 1

Minimal material returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

3a – Cut and Lift

R = 0
Y = 0
G = 1
B = 0
Tot = 1

670 tonnes returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

1b vs 2a	1b vs 2c	1b vs 3a	2a vs 2c	2a vs 3a	2c vs 3a
N	N	N	N	N	N

Summary

The assessment of the Processing of Returned Materials sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral against each other as the processing of returned materials is similar for all options.

Overall, all options are equally preferred from an Environmental - Processing of Returned Materials perspective. Note: The bundle is constructed of mainly recycled materials, so neutral across all options.

		1b – Remediate Ends and Spans Only					2a – Trench and Bury Bundle					2c – Rock Cover Bundle					3a – Cut and Lift				
2. Environmental	2.3 Resource Consumption	R = 0 Y = 0 G = 3 B = 0 Tot = 3 300 tonnes of rockdump	Magnitude	Sensitivity				R = 0 Y = 0 G = 3 B = 0 Tot = 3 4500 tonnes of rockdump	Magnitude	Sensitivity				R = 0 Y = 0 G = 3 B = 0 Tot = 3 31000 tonnes of rockdump	Magnitude	Sensitivity				R = 0 Y = 0 G = 3 B = 0 Tot = 3 300 tonnes of rockdump	Magnitude	Sensitivity			
				Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High
				1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
			5	0	0	0	0		5	0	0	0	0		5	0	0	0	0		5	0	0	0	0
			4	0	0	0	0		4	0	0	0	0		4	0	0	0	0		4	0	0	0	0
			3	0	0	0	0		3	0	0	0	0		3	0	0	0	0		3	0	0	0	0
			2	0	0	0	0		2	0	0	0	0		2	1	0	0	0		2	0	0	0	0
			1	3	0	0	0		1	3	0	0	0		1	2	0	0	0		1	3	0	0	0
			0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0
		N	S	N				S	N					W											
Summary		The assessment of the Resource Consumption sub-criterion is based on the results of the ENVID and is as follows: Option 1b is assessed as being neutral to Option 2a and Option 3a as they have similar resource consumptions. Option 1b is assessed as being stronger the Option 2c as, whist the ENVID matrices are the same, this assessment reflects the large quantity of rock required for Option 2c to cover the bundle. Option 2a is assessed as being stronger than Option 2c, again due to the rock required for Option 2c. Option 2a is assessed as being neutral to Option 3a as they have similar resource consumptions. Option 2c is assessed as being weaker than Option 3a, again due the large amount of rock required to cover the bundle. Overall, Option 1b, 2a and 3a are all equally preferred options from a Resource Consumption perspective.																				
2. Environmental	2.4 Disturbance	R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 0 G = 1 B = 0 Tot = 1	Magnitude	Sensitivity			
				Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High
				1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
			5	0	0	0	0		5	0	0	0	0		5	0	0	0	0		5	0	0	0	0
			4	0	0	0	0		4	0	0	0	0		4	0	0	0	0		4	0	0	0	0
			3	0	0	0	0		3	0	0	0	0		3	0	0	0	0		3	0	0	0	0
			2	0	0	0	0		2	0	1	0	0		2	0	1	0	0		2	0	0	0	0
			1	0	1	0	0		1	0	0	0	0		1	0	0	0	0		1	0	1	0	0
			0	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	0	0	0	0
		S	S	N				N	W					W											
Summary		The assessment of the Seabed Disturbance (short-term impact) sub-criterion is as follows: Option 1b is assessed as being stronger than Option 2a and Option 2c as there is less short-term seabed disturbance compared to trenching or rock placment of the entire line. Option 1b is assessed as being neutral to Option 3a due as the seabed disturbance associated with the cut and lift of the surface laid bundle is considered minimal. Option 2a is assessed as being neutral to Option 2c as the impact from trenching and rock placement of the line is considered similar. Option 2a is assessed as being weaker than Option 3a the impact from trenching is higher than cut and lift of the surface laid bundle. Option 2c is assessed as being weaker than Option 3a as the impact of cut and lift operations are expected to be lower than rock placement. Overall, Option 1b and Option 3a are equally preferred options from a Seabed Disturbance perspective.																				
2. Environmental	2.5 Loss of Habitat	R = 0 Y = 1 G = 0 B = 0 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 0 G = 0 B = 1 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 1 G = 0 B = 0 Tot = 1	Magnitude	Sensitivity				R = 0 Y = 0 G = 0 B = 1 Tot = 1	Magnitude	Sensitivity			
				Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High			Low	Medium	High	Very High
				1	2	3	4			1	2	3	4			1	2	3	4			1	2	3	4
			5	0	0	0	0		5	0	0	0	0		5	0	0	0	0		5	0	0	0	0
			4	0	0	0	0		4	0	0	0	0		4	0	0	0	0		4	0	0	0	0
			3	0	1	0	0		3	0	0	0	0		3	0	1	0	0		3	0	0	0	0
			2	0	0	0	0		2	0	0	0	0		2	0	0	0	0		2	0	0	0	0
			1	0	0	0	0		1	0	0	0	0		1	0	0	0	0		1	0	0	0	0
			0	0	0	0	0		0	0	1	0	0		0	0	0	0	0		0	0	1	0	0
		MW	S	MW				MS	N					MW											
Summary		The assessment of the Loss of Habitat (legacy / long-term) sub-criterion is as follows: Option 1b is assessed as being much weaker than Option 2a as the bundle will remain on the seabed with Option 1b and therefore the original habitat will be altered for the long-term, whereas the original habitat will recover post trench and bury under Option 2a. Option 1b is assessed as being stronger than Option 2c as blanket rock cover will impact a larger area of seabed than spot rock cover, which permanently alters the original habitat. Option 1b is assessed as being much weaker than Option 3a as the bundle will remain on the seabed with Option 1b and therefore the original habitat will be altered for the long-term, whereas the original habitat will recover post cut and lift operations under Option 3a. Option 2a is assessed as being much stronger than than Option 2c as the rock cover will permanently alter the habitat over a large area. Option 2a is assessed as being neutral to Option 3a as both options will have no long-term impact / loss of habitat. Option 2c is assessed as being much weaker Option 3a as there will be no long-term impact / loss of habitat associated with the full removal option versus large area of permanently altered habitat from the rock placement. Overall, Option 2a and 3a are equally preferred options from a Loss of Habitat perspective.																				
3. Technical	3.1 Contracting Strategy	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.						Suitable trenching/backfill equipment available. Bundle outside diameter is within but approaching the limits of current technology therefore flexibility may be somewhat limited in terms of contracting strategy.						Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.						The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so it is likely that, if such a technology is developed, it will be single source.					
		N	N	N				N	N					N											
Summary		The assessment of the Contracting Strategy sub-criterion is as follows: All options are assessed as being neutral against each other as, whilst there are challenges associated with the trencing / cut and lift options, these are unlikley to influence the contracting strategy. Overall, all options are equally preferred from a Contracting Strategy perspective.																				

		1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift
3. Technical	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 19 days.	High chance of multi-pass trenching being required to achieve sufficient trench depth. Moderate risk of failure to achieve trench depth resulting in additional time for alternative method, e.g. rock dump. In field time of 47 days.	No particular technological factors or major risk factors that could extend schedule. In field time of 20 days.	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is major scope for overruns. Current estimate of in-field time is 65 days.
		MS / N / S	MW / W	S	
	Summary	The assessment of the Contracting Strategy sub-criterion is as follows: Option 1b is assessed as being much stronger than Option 2a, due to the bundle being at the limit of current trenching technology in terms of outer diameter, there is a high probabiltiy of additional trenching passes being required and potential for alternative remedation measures in the event trenching does not acheive the required burial depth. Option 1b is assessed as being neutral with Option 2c as they both consist of similar activities. Option 1b is assessed as being stronger than Option 3a as cut and lift has not been performed to date for a bundle, therefore there is a greater likelihood of schedule over-runs. Option 2a is assessed as being much weaker than Option 2c due to over-runs from trenching versus routine operations. Option 2a is assessed as being weaker than Option 3a as the trench and bury option is considered more likely to encounter schedule over-runs than the cut and lift operations. Option 2c is assessed as being stronger than Option 3a as these are routine operations versus cut and lift of a bundle which, at the time of the assessment, has never been performed and is therefore more likley to experience schedule over-runs. Overall, Option 1b and Option 2c are equally preferred from a Schedule perspective.			
3. Technical	3.3 Technical maturity	Established methods and technology. Fully mature.	This is a routine subsea operation but has no track record of trenching large diameter bundles. However, bundle is within the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.	Established methods and technology. Fully mature.	No track record for lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support Low technical maturity. Likely to be hydraulic shears for cutting.
		S / N / S	W / W	S	
	Summary	The assessment of the Technical Maturity sub-criterion is as follows: Option 1b is assessed as being stronger than Option 2a, due to the technical challenges / lack of track record of trenching or cut and lift of large diameter bundles. Option 1b is assessed as being neutral to Option 2c as they both consist of similar activities. Option 2a is assessed as being weaker than Option 2c and Option 3a due to the the technical challenges / lack of track record of trenching or cut and lift of large diameter bundles. Option 2c is assessed as being stronger than Option 3a as cut and lift has not been performed to date for a bundle, and therefore has a lower technical maturity. Overall, Option 1b and Option 2c are equally preferred from a Technical Maturity perspective.			
4. Societal	4.1 Regulatory	Seabed would be left with rock dump of spans, exposures and ends.	If successful, would leave a clear seabed. Moderate risk of not achieving required depth of cover requiring additional material (e.g. rock dump)	Seabed would be left with rock dump over entire bundle length.	Full removal would leave a clear seabed and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.
		W / S / W	S / N	W	
	Summary	The assessment of the Political sub-criterion is as follows: Option 1b is assessed as being weaker than Option 2a and Option 3a as the bundle will be left exposed, compared to leaving a clear seabed with the trench & bury and cut & lift options. Option 1b is assessed as being stronger than Option 2c due to the bubdle remainig in situ, albeit rock dumped. Option 2a is assessed as being stronger than Option 2c as it would leave a clear seabed. Option 2a is assessed as being neutral to Option 3a as they both result in a clear seabed. Option 2c is assessed as being weaker than Option 3a as it does not result in a clear seabed. Overall, Option 2a and Option 3a are equally preferred options from a Political perspective.			

4. Societal

4.2 Impact on Commercial Fisheries

1b – Remediate Ends and Spans Only

Minimal area of natural seabed lost. Remediation is intended to mitigate snag hazard.

Planned
R = 0
Y = 1
G = 0
B = 0
Tot = 1

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	1	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Unplanned
R = 1
Y = 0
G = 1
Tot = 2

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	1	0
4	0	0	0
3	0	0	0
2	1	0	0
1	0	0	0

2a – Trench and Bury Bundle

Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.

Planned
R = 0
Y = 0
G = 0
B = 1
Tot = 1

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Unplanned
R = 0
Y = 0
G = 2
Tot = 2

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	1	0	0
1	1	0	0

2c – Rock Cover Bundle

Significant area of natural seabed permanently lost.

Planned
R = 0
Y = 1
G = 0
B = 0
Tot = 1

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	1	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 2
Tot = 2

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	1	1	0
1	0	0	0

3a – Cut and Lift

Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.

Planned
R = 0
Y = 0
G = 0
B = 1
Tot = 1

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

1b			2a		2c
W	W	W	S	N	W

Summary

The assessment of the Impact on Commercial Fisheries sub-criterion is as follows:
Option 1b is assessed as being weaker than Option 2a, Option 2c and Option 3a as, whilst the snag hazards are mitigated with rock cover, the bundle is left exposed on the seabed which can result in a commercial impact to fishing operations from net snagging / loss.
Option 2a is assessed as being stronger than Option 2c as the trench and bury option provides a clear seabed thus returning the area for fishing operations versus the rock cover option where the continuous rock berm can impact fishing operations. Option 2a is assessed as neutral to Option 3a, as both options leave a clear seabed, effectively returning the area for fishing operations.
Option 2c is assessed as being weaker than Option 3a for similar reasons as above.

Overall, Option 2a and Option 3a are equally preferred options from an Impact on Commercial Fisheries perspective.

4. Societal

4.3 Socio-economic impact on communities and amenities

1b – Remediate Ends and Spans Only

Minimal impact on communities and amenities as no material returned to shore.

Planned
R = 0
Y = 0
G = 7
B = 6
Tot = 13

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	6	0	0	1
0	6	0	0	0

Unplanned
R = 0
Y = 0
G = 0
Tot = 0

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

2a – Trench and Bury Bundle

Minimal impact on communities and amenities as minimal material returned to shore.

Planned
R = 0
Y = 0
G = 7
B = 6
Tot = 13

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	6	0	0	1
0	6	0	0	0

Unplanned
R = 0
Y = 0
G = 0
Tot = 0

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

2c – Rock Cover Bundle

Minimal impact on communities and amenities as no material returned to shore.

Planned
R = 0
Y = 0
G = 7
B = 6
Tot = 13

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	6	0	0	1
0	6	0	0	0

Unplanned
R = 0
Y = 0
G = 0
Tot = 0

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	0	0	0
2	0	0	0
1	0	0	0

3a – Cut and Lift

Medium benefit to communities as bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.

Planned
R = 0
Y = 0
G = 12
B = 1
Tot = 13

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	1	0	0	0
1	10	0	0	1
0	1	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

1b			2a		2c
N	N	W	N	W	W

Summary

The assessment of the Socio-economic sub-criterion is as follows:
Option 1b is assessed as being neutral to Option 2a and Option 2c as they result in similar levels of job creation / retention and material returned to shore for processing. Option 1b is assessed as being weaker than Option 3a as there is significantly more job creation / retention associated with Option 3a.
Option 2a is assessed as being neutral to Option 2c and weaker than Option 3a for similar reasons as above.
Option 2c is assessed as being weaker than Option 3a, again for similar reasons as above.

Overall, Option 3a is the preferred option from a Socio-economic impact on communities and amenities perspective.

		1b – Remediate Ends and Spans Only			2a – Trench and Bury Bundle		2c – Rock Cover Bundle	3a – Cut and Lift
5. Economic	5.1 Cost for decommissioning / removal activities	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £1.8 million.			The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £8.9 million.		The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £2.8 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £7.5 million.
		VMS	**S**	**VMS**	**MW**	**W**	**MS**	
	Summary	The assessment of the Cost for decommissioning sub-criterion is as follows: Option 1b is assessed as being very much stronger than Option 2a and Option 3a due to the significant reduction in total decommissioning cost. Option 1b is assessed as being stronger than Option 2c as the costs are slightly lower. Option 2a is assessed as being much weaker than Option 2c due to the significantly higher cost. Option 2a is also assessed as being weaker than Option 3a as the costs ate slightly higher. Option 2c is assessed as being much stronger than Option 3a as the costs are much lower. Overall, Option 1b is the preferred options from a total cost of decommissioning perspective.							
5. Economic	5.2 Cost for long term monitoring / remediation activities	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.0 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £2.8 million			The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.0 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £4.5 million		The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £2.8 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £1.4 million	There are no long-term costs associated with this full removal option.
		S	**W**	**MW**	**MW**	**MW**	**MW**	
	Summary	The assessment of the Cost for long term monitoring / remediation sub-criterion is as follows: Option 1b is assessed as being stronger than Option 2a due to the significant reduction in total net present cost. Option 1b is assessed as being neutral with Option 2c due to their similar net present cost. Option 1b is assessed as being stronger than Option 3a due to the reduction in total net present cost. Option 2a is assessed as being much weaker than Option 2c and Option 3a due to the increased net present cost. Option 2c is assessed as being stronger than Option 3a due to its lower net present cost. Overall, Option 3a is the preferred options from a cost for long term monitoring / remediation perspective.							

Appendix C.2 Group 2 Pair-wise Comparison Matrices – Safety

1.1 Personnel Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	MS	37.5%
2a – Trench and Bury Bundle	MW	N	MW	S	13.8%
2c – Rock Cover Bundle	N	MS	N	MS	37.5%
3a – Cut and Lift	MW	W	MW	N	11.3%

1.2 Personnel Onshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	N	VMS	37.1%
2a – Trench and Bury Bundle	W	N	W	MS	20.8%
2c – Rock Cover Bundle	N	S	N	VMS	37.1%
3a – Cut and Lift	VMW	MW	VMW	N	4.9%

1.3 Other Users	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

1.4 Residual Risk	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	W	W	MW	14.6%
2a – Trench and Bury Bundle	S	N	S	W	26.1%
2c – Rock Cover Bundle	S	W	N	W	21.3%
3a – Cut and Lift	MS	S	S	N	38.0%

Appendix C.3 Group 2 Pair-wise Comparison Matrices – Environment

2.1 Impact of Decommissioning Operations Offshore	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	S	27.3%
2a – Trench and Bury Bundle	N	N	N	S	27.3%
2c – Rock Cover Bundle	N	N	N	S	27.3%
3a – Cut and Lift	W	W	W	N	18.2%

2.2 Processing of Returned Materials	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

2.3 Resource Consumption	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	S	N	27.3%
2a – Trench and Bury Bundle	N	N	S	N	27.3%
2c – Rock Cover Bundle	W	W	N	W	18.2%
3a – Cut and Lift	N	N	S	N	27.3%

2.4 Disturbance	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	S	N	30.0%
2a – Trench and Bury Bundle	W	N	N	W	20.0%
2c – Rock Cover Bundle	W	N	N	W	20.0%
3a – Cut and Lift	N	S	S	N	30.0%

2.5 Loss of Habitat	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MW	S	MW	13.8%
2a – Trench and Bury Bundle	MS	N	MS	N	37.5%
2c – Rock Cover Bundle	W	MW	N	MW	11.3%
3a – Cut and Lift	MS	N	MS	N	37.5%

Appendix C.4 Group 2 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	N	25.0%
2a – Trench and Bury Bundle	N	N	N	N	25.0%
2c – Rock Cover Bundle	N	N	N	N	25.0%
3a – Cut and Lift	N	N	N	N	25.0%

3.2 Schedule	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	MS	N	S	33.6%
2a – Trench and Bury Bundle	MW	N	MW	W	12.0%
2c – Rock Cover Bundle	N	MS	N	S	33.6%
3a – Cut and Lift	W	S	W	N	20.8%

3.3 Technical maturity	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	N	S	29.9%
2a – Trench and Bury Bundle	W	N	W	W	18.0%
2c – Rock Cover Bundle	N	S	N	S	29.9%
3a – Cut and Lift	W	S	W	N	22.1%

Appendix C.5 Group 2 Pair-wise Comparison Matrices – Societal

4.1 Regulatory	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	W	S	W	22.1%
2a – Trench and Bury Bundle	S	N	S	N	29.9%
2c – Rock Cover Bundle	W	W	N	W	18.0%
3a – Cut and Lift	S	N	S	N	29.9%

4.2 Impact on Commercial Fisheries	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	W	W	W	18.0%
2a – Trench and Bury Bundle	S	N	S	N	29.9%
2c – Rock Cover Bundle	S	W	N	W	22.1%
3a – Cut and Lift	S	N	S	N	29.9%

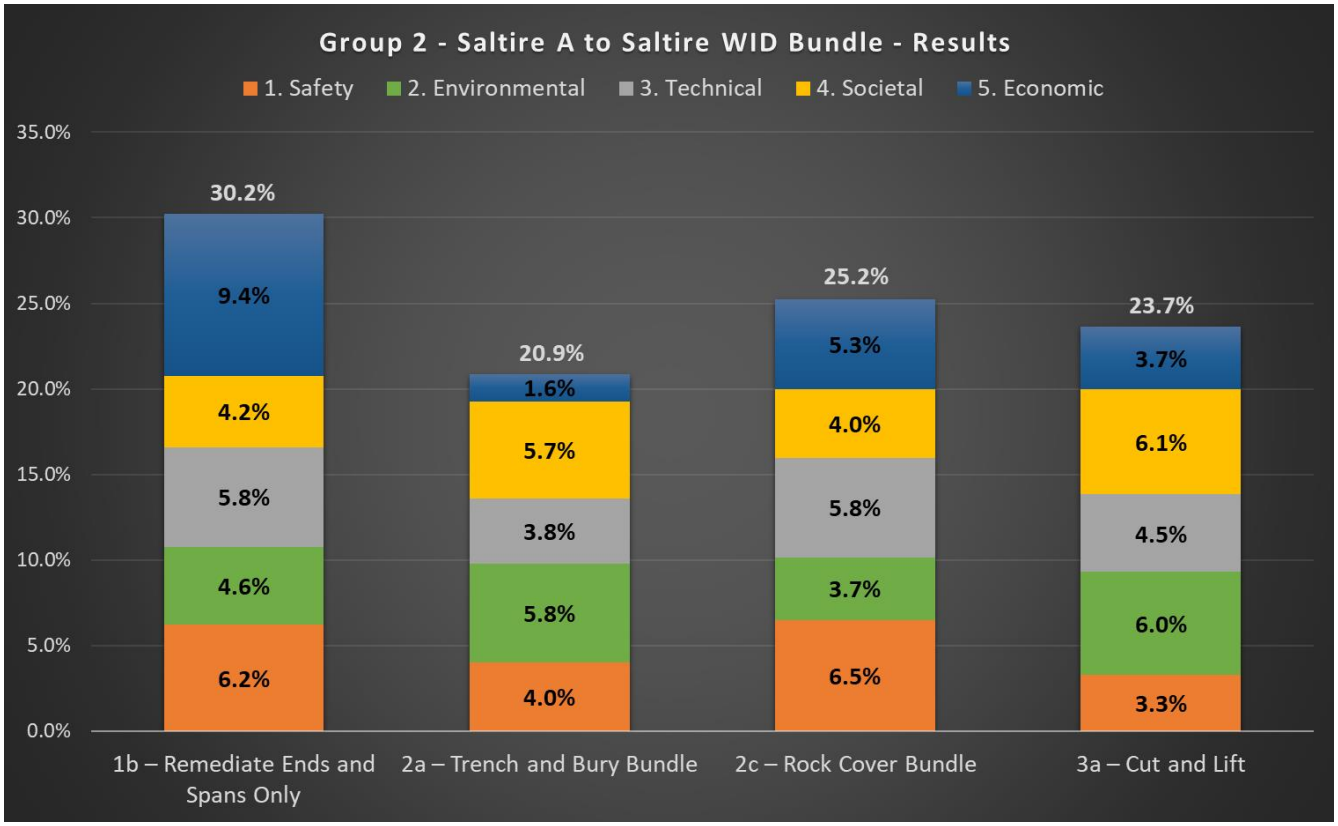
4.3 Socio-economic impact on communities and amenities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	N	N	W	22.2%
2a – Trench and Bury Bundle	N	N	N	W	22.2%
2c – Rock Cover Bundle	N	N	N	W	22.2%
3a – Cut and Lift	S	S	S	N	33.3%

Appendix C.6 Group 2 Pair-wise Comparison Matrices – Economic

5.1 Cost for decommissioning / removal activities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	VMS	S	VMS	57.6%
2a – Trench and Bury Bundle	VMW	N	MW	W	6.9%
2c – Rock Cover Bundle	W	MS	N	MS	27.1%
3a – Cut and Lift	VMW	S	MW	N	8.4%

5.2 Cost for long term monitoring / remediation activities	1b – Remediate Ends and Spans Only	2a – Trench and Bury Bundle	2c – Rock Cover Bundle	3a – Cut and Lift	Weighting
1b – Remediate Ends and Spans Only	N	S	W	MW	16.3%
2a – Trench and Bury Bundle	W	N	MW	MW	11.2%
2c – Rock Cover Bundle	S	MS	N	MW	23.7%
3a – Cut and Lift	MS	MS	MS	N	48.8%

Appendix C.7 Group 2 Results Chart



APPENDIX D GROUP 3 – DETAILED EVALUATION RESULTS

Appendix D.1 Group 3 Attributes Table

1. Safety – 1.1 Personnel Offshore

2a – Trench and Bury Exposures

R = 0
O = 9
Y = 8
G = 1
Total = 18

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4	2		4		
3		1	2		
2	1	3	1	2	
1			1		
0					

2b – Cut and Remove Exposures

R = 0
O = 7
Y = 6
G = 3
Total = 16

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4			3		
3	1	1	2		
2	3	2	1	1	
1			1		
0					

2c – Rock Cover Exposures

R = 0
O = 7
Y = 6
G = 3
Total = 16

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	1				
4			3		
3	1	1	2		
2	3	2	1	1	
1			1		
0					

3 – Reverse Reeling

R = 0
O = 14
Y = 13
G = 1
Total = 28

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4		5	4		
3		5	2		
2	1	4	3	1	
1			1		
0					

2a				2b			2c	
N	N	MS		N	MS		MS	

Summary

The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c as the risk exposure is similar. Option 2a is assessed as being much stronger than Option 3 as it has a lower risk exposure than reverse reeling due to pipe being on the deck under tension and significantly more deck working.
Option 2b is assessed as being neutral to Option 2c as the risk exposure is similar. Option 2b is assessed as being much stronger than Option 3 as it has a lower risk exposure than reverse reeling due to pipe being on the deck under tension and significantly more deck working.
Option 2c is assessed as being much stronger than Option 3 for similar reasons.

Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Offshore Personnel perspective.

1. Safety – 1.2 Personnel Onshore

2a – Trench and Bury Exposures

R = 0
O = 2
Y =11
G = 2
Total = 15

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	4				
3	2	3			
2	1		2	2	
1		1			
0					

2b – Cut and Remove Exposures

R = 0
O = 2
Y =11
G = 2
Total = 15

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	4				
3	2	3			
2	1		2	2	
1		1			
0					

2c – Rock Cover Exposures

R = 0
O = 2
Y =11
G = 2
Total = 15

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4	4				
3	3	2			
2	1		2	2	
1		1			
0					

3 – Reverse Reeling

R = 0
O = 9
Y = 6
G = 0
Total = 15

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5		1			
4	2	1			
3		2	3		
2		1		3	1
1				1	
0					

2a				2b			2c	
N	N	MS		N	MS		MS	

Summary

The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c due to the onshore handling requirements of returned material being largely similar. Option 2a is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of pipe to be handled, transported and recycled for Option 3.
Option 2b is assessed as being neutral to Option 2c as the onshore handling requirements are similar. Option 2b is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of pipe recovered for Option 3.
Option 2c is assessed as being much stronger than Option 3 as the risk exposure is lower for similar reasons as above.

Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Onshore Personnel perspective.

1. Safety – 1.3 Other Users

2a – Trench and Bury Exposures

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2b – Cut and Remove Exposures

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2c – Rock Cover Exposures

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

3 – Reverse Reeling

R = 0
O = 2
Y = 0
G = 0
Total = 2

Severity	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	2				
4					
3					
2					
1					
0					

2a				2b			2c	
N	N	N		N	N		N	

Summary

The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options.

Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels.

1. Safety

1.4 Residual Risk

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 O = 5 Y = 8 G = 0 Total = 13	R = 0 O = 5 Y = 8 G = 0 Total = 13	R = 0 O = 5 Y = 8 G = 0 Total = 13	R = 0 O = 0 Y = 0 G = 0 Total = 0

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
N	N	N	W
N	N	W	
W	W		

Summary

The assessment of the Residual Risk sub-criterion is based on the results of the HAZID for the legacy operations and is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c as they all have similar risk profiles (all involve leaving the flowline in-situ and remediating exposures/spans). Option 2a is assessed as being weaker than Option 3, as Option 3 has no residual risk due to the flowline being fully recovered.
Option 2b is assessed as being neutral to Option 2c as they have similar risk profiles, as above. Option 2b is assessed as being weaker than Option 3 for the same reasons as above.
Option 2c is assessed as being weaker than Option 3 for the same reasons as above.

Overall, Option 3 is the preferred option from a Residual Risk perspective.

2. Environmental

2.1 Impact of Decommissioning Operations Offshore

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	Planned R = 0 Y = 0 G = 8 B = 0 Tot = 8	Planned R = 0 Y = 0 G = 8 B = 0 Tot = 8	Planned R = 0 Y = 0 G = 8 B = 0 Tot = 8	Planned R = 0 Y = 0 G = 7 B = 1 Tot = 8

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	Unplanned R = 0 Y = 0 G = 1 Tot = 1 1134 tonnes of CO2 358 tonnes of fuel	Unplanned R = 0 Y = 0 G = 1 Tot = 1 1155 tonnes of CO2 364 tonnes of fuel	Unplanned R = 0 Y = 0 G = 1 Tot = 1 970 tonnes of CO2 306 tonnes of fuel	Unplanned R = 0 Y = 0 G = 1 Tot = 1 2326 tonnes of CO2 734 tonnes of fuel

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
N	N	N	N
N	N	N	
N	N		

Summary

The assessment of the Impact of Decommissioning Operations Offshore sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral against each other as the environmental impact due to offshore operations is similar for all options.

Overall, all options are equally preferred from an Environmental - Impact of Decommissioning Operations Offshore perspective.

2.2 Processing of Returned Materials

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 Y = 0 G = 1 B = 0 Tot = 1 Minimal returned	R = 0 Y = 0 G = 1 B = 0 Tot = 1 Less than 10 tonnes returned	R = 0 Y = 0 G = 1 B = 0 Tot = 1 Less than 10 tonnes returned	R = 0 Y = 0 G = 1 B = 0 Tot = 1 875 tonnes returned

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
N	N	N	N
N	N	N	
N	N		

Summary

The assessment of the Processing of Returned Materials sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral to each other as the processing of returned materials is similar for all options.

Overall, all options are equally preferred from an Environmental - Processing of Returned Materials perspective.

2. Environmental — 2.3 Resource Consumption

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 Y = 0 G = 3 B = 0 Tot = 3 Minimal rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 1900 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 1900 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 Minimal rockdump

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	3	0	0	0
0	0	0	0	0

2a			2b		2c	3
S	S	N	N	W	W	

Summary

The assessment of the Resource Consumption sub-criterion is based on the results of the ENVID as follows:
Option 2a is assessed as being stronger than Option 2b and Option 2c as there is sufficient rockdump required to express a small preference. Option 2a is assessed as being neutral to Option 3 as both require minimal rockdump.
Option 2b is assessed as being neutral to Option 2c as the rock required is the same. Option 2b is assessed as being weaker than Option 3 as there is sufficient rockdump required to express a small preference.
Option 2c is assessed as being weaker than Option 3 for similar reasons.

Overall, Option 2a and Option 3 are equally preferred from an Environmental - Resource Consumption perspective.

2. Environmental — 2.4 Disturbance

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	1	0	0
0	0	0	0	0

2a			2b		2c	3
N	N	S	N	S	S	

Summary

The assessment of the Seabed Disturbance (short-term impact) sub-criterion is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c as they both involve limited seabed disturbance. Option 2a is assessed as being stronger than Option 3, as Option 3 will involve seabed disturbance along the entire flowline route from the deburial operations.
Option 2b is assessed as being neutral to Option 2c as the seabed disturbance is limited and similar. Option 2b is assessed as being stronger than Option 3 again due to the seabed disturbance from the deburial operations.
Option 2c is assessed as being stronger than Option 3 for similar reasons.

Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a Seabed Disturbance perspective.

2. Environmental — 2.5 Loss of Habitat

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 Y = 0 G = 0 B = 1 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1	R = 0 Y = 0 G = 1 B = 0 Tot = 1	R = 0 Y = 0 G = 0 B = 1 Tot = 1

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

2a			2b		2c	3
S	S	N	N	W	W	

Summary

The assessment of the Loss of Habitat (legacy / long-term) sub-criterion is as follows:
Option 2a is assessed as being stronger than Option 2b and Option 2c as the permanent habit change from the rock placement is the same for Option 2b and Option 2c and very limited with Option 2a. Option 2a is assessed as being neutral to Option 3 as there is limited rock placement associated with both.
Option 2b is assessed as being neutral to Option 2c as the permanent habit change from the rock placement is the same. Option 2b is assessed as being weaker than Option 3 there is more habitat impact from the greater rock placement.
Option 2c is assessed as being weaker Option 3 for similar reasons.

Overall, Option 2a and Option 3 are equally preferred options from a Loss of Habitat perspective.

3. Technical — 3.1 Contracting Strategy

2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
Established technology with a wide range of vendors. Flexible contracting strategy.	Established technology with a wide range of vendors. Flexible contracting strategy.	Established technology with a wide range of vendors. Flexible contracting strategy.	Reel vessel of suitable capacity required. Vessels are generally available from a number of vendors. Reasonably flexible contracting strategy.

2a			2b		2c	3
N	N	N	N	N	N	

Summary

The assessment of the Contracting Strategy sub-criterion is as follows:
All options are assessed as being neutral against each other, with the differences between options not deemed significant enough to express a preference.

Overall, all options are equally preferred from a Contracting Strategy perspective.

		2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
3. Technical	3.2 Schedule	In field time of 30 days. No particular technology or major operation risk factors.	In field time of 30 days. No particular technology or major operation risk factors.	In field time of 27 days. No particular technology or major operation risk factors.	In field time of 40 days. Potential for extension to schedule due to possible failure of pipeline during reverse reeling. This is considered to have a low likelihood due to short operational duration and likelihood of integrity failure of line being low as line deburied prior to reverse reeling.
		N N S	N S	S	
	Summary	The assessment of the Schedule sub-criterion is as follows: Options 2a, 2b and 2c are assessed as being neutral against each other as the infield durations are similar and the operations are considered largely routine. All options are assessed as stronger than Option 3 due to the longer duration of infield operations associated with option 3 and small potential for pipeline integrity failure during reverse reeling. Overall, Options 2a, 2b and 2c are equally preferred from a Schedule perspective.			
3. Technical	3.3 Technical maturity	Risk of failure of achieving 0.6 m depth of cover, which would require additional rockdump in that area. While suitable trenching equipment does exist, it isn't proven for this particular activity. Jet trenching likely to make this achievable.	Technically mature. Standard subsea operations.	Technically mature. Standard subsea operations.	Reel installation of pipelines is a standard subsea operation but there is a limited track record of reverse reeling for removal of pipeline in the UKCS. There may small challenges related to reverse reeling the mid-line flanges.
		N N S	N S	S	
	Summary	The assessment of the Technical Maturity sub-criterion is as follows: Options 2a, 2b and 2c are assessed as being neutral against each other as the operations are considered largely routine. All options are assessed as stronger than Option 3 due to the limited track record of reverse reeling and potential challenges associated with reverse reeling the mid-line flanges. Overall, Options 2a, 2b and 2c are equally preferred from a Technical Maturity perspective.			
4. Societal	4.1 Regulatory	Given that the line is trenched and buried along the majority of its length, there is likley to be little political impact from this option despite it being left in situ.	Given that the line is trenched and buried along the majority of its length, there is likley to be little political impact from this option despite it being left in situ. Assume that jet trench burial is possible.	Given that the line is trenched and buried along the majority of its length, to select an option where there is significant roxk introduced is likely to have a small negative political impact.	Whilst this option has the advantage that pipeline is fully removed, the positive political impact of this was deemed insufficient to express a significant preference.
		N S N	S N	W	
	Summary	The assessment of the Political sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b and Option 3 as the political impact is deemed similar. Option 2a is assessed as being stronger than Option 2c as rock dumping a trenched and buried line is deemed likely to have a negative politcal impact. Option 2b is assessed as being stronger than Option 2c as rock dumping a trenched and buried line is deemed likely to have a negative politcal impact. Option 2b is assessed as being neutral to Option 3 as Option 3 as the political impact is deemed similar. Option 2c is assessed as being weaker than Option 3 as rock dumping a trenched and buried line is deemed likely to have a negative politcal impact. Overall, Options 2a, 2b and 3 are equally preferred from a Political perspective.			
4. Societal	4.2 Impact on Commercial Fisheries	Modest area of natural seabed temporarily disturbed, area would recover to natural condition. Low impact. Planned R = 0 Y = 0 G = 0 B = 1 Tot = 1 Unplanned R = 0 Y = 0 G = 2 Tot = 2	Limited area of natural seabed disturbed, lost. Planned R = 0 Y = 0 G = 0 B = 1 Tot = 1 Unplanned R = 0 Y = 0 G = 2 Tot = 2	Limited area of natural seabed disturbed, lost. Planned R = 0 Y = 1 G = 0 B = 0 Tot = 1 Unplanned R = 0 Y = 0 G = 2 Tot = 2	Significant area of seabed temporarily disturbed, but this will revert to natural condition over time and there would be no impact on fisheries after this time. Planned R = 0 Y = 0 G = 0 B = 1 Tot = 1 Unplanned R = 0 Y = 0 G = 1 Tot = 1

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	0	0	0
2	2	0	0
1	0	0	0

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	0	0	0
2	2	0	0
1	0	0	0

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	1	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	1	0	0
1	0	0	0

Magnitude	Sensitivity: Low (1)	Medium (2)	High (3)	Very High (4)
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

Likelihood	Impact Significance: Low (1)	Moderate (2)	High (3)
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

	N S N	S N W
Summary	The assessment of the Impact on Commercial Fisheries sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b and Option 3 as there will be minimal impact on commercial fishing operations as essentially these options provide a clear seabed. Option 2a is assessed as being stronger than Option 2c due to the small areas of seabed lost due to rock placement. Option 2b is assessed as being stronger than Option 2c as there is small areas of seabed lost due to rock placement. Option 2b is assessed as being neutral to Option 3 as there will be minimal impact on commercial fishing operations as essentially these options provide a clear seabed. Option 2c is assessed as being weaker than Option 3 as there is small areas of seabed lost due to rock placement. Overall, Option 2a, Option 2b and Option 3 are equally preferred options from an Impact on Commercial Fisheries perspective.	

		2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
4. Societal	4.3 Socio-economic impact on communities and amenities	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity (Low / Medium / High / Very High): 5: 0 / 0 / 0 / 0 4: 0 / 0 / 0 / 0 3: 0 / 0 / 0 / 0 2: 0 / 0 / 0 / 0 1: 6 / 0 / 0 / 1 0: 6 / 0 / 0 / 0 Unplanned R = 0 Y = 0 G = 0 Tot = 0 Likelihood / Impact Significance (Low / Moderate / High): 5: 0 / 0 / 0 4: 0 / 0 / 0 3: 0 / 0 / 0 2: 0 / 0 / 0 1: 0 / 0 / 0	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity (Low / Medium / High / Very High): 5: 0 / 0 / 0 / 0 4: 0 / 0 / 0 / 0 3: 0 / 0 / 0 / 0 2: 0 / 0 / 0 / 0 1: 6 / 0 / 0 / 1 0: 6 / 0 / 0 / 0 Unplanned R = 0 Y = 0 G = 1 Tot = 1 Likelihood / Impact Significance (Low / Moderate / High): 5: 0 / 0 / 0 4: 0 / 0 / 0 3: 1 / 0 / 0 2: 0 / 0 / 0 1: 0 / 0 / 0	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity (Low / Medium / High / Very High): 5: 0 / 0 / 0 / 0 4: 0 / 0 / 0 / 0 3: 0 / 0 / 0 / 0 2: 0 / 0 / 0 / 0 1: 6 / 0 / 0 / 1 0: 6 / 0 / 0 / 0 Unplanned R = 0 Y = 0 G = 0 Tot = 0 Likelihood / Impact Significance (Low / Moderate / High): 5: 0 / 0 / 0 4: 0 / 0 / 0 3: 0 / 0 / 0 2: 0 / 0 / 0 1: 0 / 0 / 0	Medium impact on communities and amenities as full pipeline would be returned to shore for dismantling / recycling. Planned R = 0 Y = 0 G = 12 B = 1 Tot = 13 Magnitude / Sensitivity (Low / Medium / High / Very High): 5: 0 / 0 / 0 / 0 4: 0 / 0 / 0 / 0 3: 0 / 0 / 0 / 0 2: 0 / 0 / 0 / 0 1: 11 / 0 / 0 / 1 0: 1 / 0 / 0 / 0 Unplanned R = 0 Y = 0 G = 1 Tot = 1 Likelihood / Impact Significance (Low / Moderate / High): 5: 0 / 0 / 0 4: 0 / 0 / 0 3: 1 / 0 / 0 2: 0 / 0 / 0 1: 0 / 0 / 0
		N / N / N	N / N	N	
	Summary	The assessment of the Socio-economic sub-criterion is as follows: All options are assessed as being neutral against each other, with the differences between options not deemed significant enough to express a preference. Overall, all options are equally preferred from an impact on communities and amenities perspective.			
5. Economic	5.1 Cost for decommissioning / removal activities	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decommissioning Cost: £4.8 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decommissioning Cost: £4.1 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decommissioning Cost: £2.0 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decommissioning Cost: £9.1 million.
		N / MW / MS	MW / MS	VMS	
	Summary	The assessment of the Cost for decommissioning sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b as the costs are largely similar. Option 2a is assessed as being much weaker than Option 2c as the costs are more than double. Option 2a is assessed as being much stronger than Option 3 as the costs are around half. Option 2b is assessed as being much weaker than to Option 2c as the costs are around double. Option 2b is assessed as being much stronger than Option 3 as the costs are around half. Option 2c is assessed as being very much stronger than Option 3 as the costs are more than four times lower. Overall, Option 2c is the preferred option from a total cost of decommissioning perspective.			
5. Economic	5.2 Cost for long term monitoring / remediation activities	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.3 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £2.4 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.3 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £1.0 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £3.3 million Survey & Monitoring NPC: £0.5 million Remediation Cost: £1.7 million	There are no long-term costs associated with this full removal option.
		N / N / W	N / W	W	
	Summary	The assessment of the Cost for long term monitoring / remediation sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b and Option 2c as the long-term costs are largely similar. Option 2a is assessed as being weaker than Option 3 as there are no long-term costs associated with the full removal option. Option 2b is assessed as being neutral to Option 2c as the long-term costs are largely similar. Option 2b is assessed as being weaker than Option 3 as there are no long-term costs associated with the full removal option. Option 2c is assessed as being much than Option 3 for the same reason. Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a cost for long term monitoring / remediation perspective.			

Appendix D.2 Group 3 Pair-wise Comparison Matrices – Safety

1.1 Personnel Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	MS	30.0%
2b – Cut and Remove Exposures	N	N	N	MS	30.0%
2c – Rock Cover Exposures	N	N	N	MS	30.0%
3 – Reverse Reeling	MW	MW	MW	N	10.0%

1.2 Personnel Onshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	MS	30.0%
2b – Cut and Remove Exposures	N	N	N	MS	30.0%
2c – Rock Cover Exposures	N	N	N	MS	30.0%
3 – Reverse Reeling	MW	MW	MW	N	10.0%

1.3 Other Users	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

1.4 Residual Risk	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	W	22.2%
2b – Cut and Remove Exposures	N	N	N	W	22.2%
2c – Rock Cover Exposures	N	N	N	W	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%

Appendix D.3 Group 3 Pair-wise Comparison Matrices – Environment

2.1 Impact of Decommissioning Operations Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

2.2 Processing of Returned Materials	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

2.3 Resource Consumption	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	S	S	N	30.0%
2b – Cut and Remove Exposures	W	N	N	W	20.0%
2c – Rock Cover Exposures	W	N	N	W	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

2.4 Disturbance	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

2.5 Loss of Habitat	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	S	S	N	30.0%
2b – Cut and Remove Exposures	W	N	N	W	20.0%
2c – Rock Cover Exposures	W	N	N	W	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

Appendix D.4 Group 3 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

3.2 Schedule	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

3.3 Technical maturity	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

Appendix D.5 Group 3 Pair-wise Comparison Matrices – Societal

4.1 Regulatory	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	S	N	27.3%
2b – Cut and Remove Exposures	N	N	S	N	27.3%
2c – Rock Cover Exposures	W	W	N	W	18.2%
3 – Reverse Reeling	N	N	S	N	27.3%

4.2 Impact on Commercial Fisheries	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	S	N	27.3%
2b – Cut and Remove Exposures	N	N	S	N	27.3%
2c – Rock Cover Exposures	W	W	N	W	18.2%
3 – Reverse Reeling	N	N	S	N	27.3%

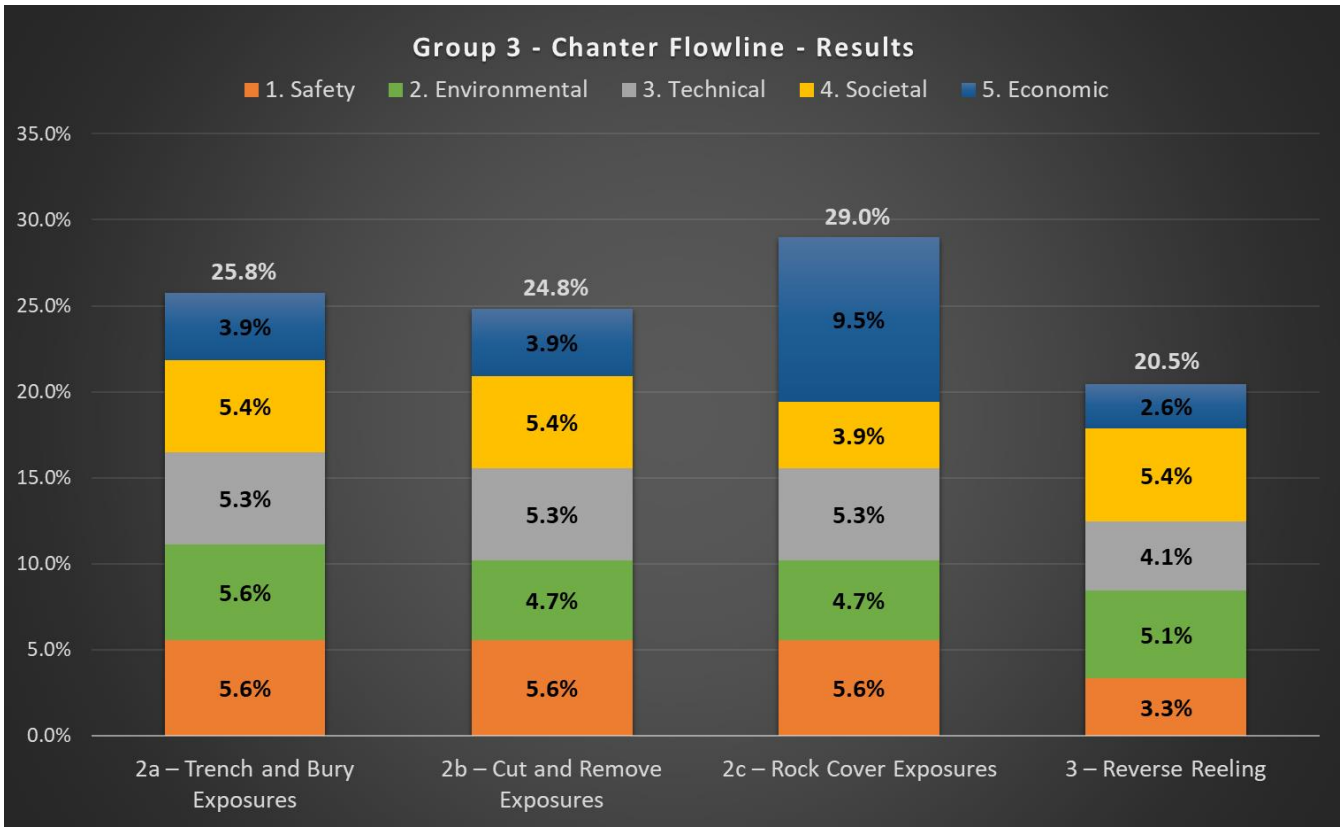
4.3 Socio-economic impact on communities and amenities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

Appendix D.6 Group 3 Pair-wise Comparison Matrices – Economic

5.1 Cost for decommissioning / removal activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	MW	MS	18.8%
2b – Cut and Remove Exposures	N	N	MW	MS	18.8%
2c – Rock Cover Exposures	MS	MS	N	VMS	56.3%
3 – Reverse Reeling	MW	MW	VMW	N	6.3%

5.2 Cost for long term monitoring / remediation activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	W	22.2%
2b – Cut and Remove Exposures	N	N	N	W	22.2%
2c – Rock Cover Exposures	N	N	N	W	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%

Appendix D.7 Group 3 Results Chart



APPENDIX E GROUP 4 – DETAILED EVALUATION RESULTS

Appendix E.1 Group 4 Attributes Table

1. Safety — 1.1 Personnel Offshore

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 O = 9 Y = 8 G = 1 Total = 18	R = 0 O = 7 Y = 5 G = 3 Total = 15	R = 0 O = 7 Y = 5 G = 3 Total = 15	R = 0 O = 8 Y = 9 G = 1 Total = 18

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
2a – Trench and Bury Exposures					
5	1				
4	2		4		
3		1	2		
2	1	3	1	2	
1			1		
0					
2b – Cut and Remove Exposures					
5	1				
4			3		
3	1	1	2		
2	3	2	1	1	
1					
0					
2c – Rock Cover Exposures					
5	1				
4			3		
3	1	1	2		
2	3	2	1	1	
1					
0					
3 – Reverse Reeling					
5	2				
4		5	1		
3		4			
2	1	3	2		
1					
0					

N	N	N	N	N	N

Summary

The assessment of the Personnel Offshore sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
All options are assessed as being neutral against each other as the risk exposure is considered similar for all options due to less risk associated with reverse reeling small diameter umbillicals and cables.

Overall, all options are equally preferred from a risk to Offshore Personnel perspective.

1. Safety — 1.2 Personnel Onshore

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 O = 2 Y = 11 G = 2 Total = 15	R = 0 O = 2 Y =11 G = 2 Total = 15	R = 0 O = 2 Y = 11 G = 2 Total = 15	R = 0 O = 9 Y = 6 G = 0 Total = 15

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
2a – Trench and Bury Exposures					
5					
4	4				
3	2	3			
2	1		2	2	
1		1			
0					
2b – Cut and Remove Exposures					
5					
4	4				
3	2	3			
2	1		2	2	
1		1			
0					
2c – Rock Cover Exposures					
5					
4	4				
3	3	2			
2	1		2	2	
1		1			
0					
3 – Reverse Reeling					
5		1			
4	2	1			
3		2	3		
2		1		3	1
1				1	
0					

N	N	MS	N	MS	MS

Summary

The assessment of the Personnel Onshore sub-criterion is based on the results of the HAZID for the various onshore operations for each option and is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c due to the onshore handling requirements of returned material being largely similar. Option 2a is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of umbilical / cable to be handled, transported and recycled for Option 3.
Option 2b is assessed as being neutral to Option 2c as the onshore handling requirements are similar. Option 2b is assessed as being much stronger than Option 3 as the risk exposure is lower due to the large quantity of umbilical / cable recovered for Option 3.
Option 2c is assessed as being much stronger than Option 3 as the risk exposure is lower for similar reasons as above.

Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a risk to Onshore Personnel perspective.

1. Safety — 1.3 Other Users

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
	R = 0 O = 2 Y = 0 G = 0 Total = 2	R = 0 O = 2 Y = 0 G = 0 Total = 2	R = 0 O = 2 Y = 0 G = 0 Total = 2	R = 0 O = 2 Y = 0 G = 0 Total = 2

Severity	Likelihood: Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
2a – Trench and Bury Exposures					
5	2				
4					
3					
2					
1					
0					
2b – Cut and Remove Exposures					
5	2				
4					
3					
2					
1					
0					
2c – Rock Cover Exposures					
5	2				
4					
3					
2					
1					
0					
3 – Reverse Reeling					
5	2				
4					
3					
2					
1					
0					

N	N	N	N	N	N

Summary

The assessment of the Other Users sub-criterion is based on the results of the HAZID for the various offshore operations for each option and is as follows:
All options are assessed as being neutral against each other as the risk exposure to Other Users from on-site and transit operations is similar for all options.

Overall, all options are equally preferred from a risk to Other Users perspective. Note: HAZID concluded that the risk profile would be the same for all options as any collision with a vessel is highly unlikely based on the equipment used by all vessels.

1. Safety

1.4 Residual Risk

2a – Trench and Bury Exposures

R = 0
O = 5
Y = 8
G = 0
Total = 13

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

N	N	W

2b – Cut and Remove Exposures

R = 0
O = 5
Y = 8
G = 0
Total = 13

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

N	W

2c – Rock Cover Exposures

R = 0
O = 5
Y = 8
G = 0
Total = 13

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5	4	1			
4	3				
3		2			
2		3			
1					
0					

W

3 – Reverse Reeling

R = 0
O = 0
Y = 0
G = 0
Total = 0

Severity	Likelihood				
	Very Unlikely (A)	Unlikely (B)	Possible (C)	Likely (D)	Very Likely (E)
5					
4					
3					
2					
1					
0					

Summary

The assessment of the Residual Risk sub-criterion is based on the results of the HAZID for the legacy operations and is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c, as they all have similar risk profiles (all involve leaving the lines in-situ and remediating exposures/spans). Option 2a is assessed as being weaker than Option 3, as Option 3 has no residual risk due to the lines being fully recovered.
Option 2b is assessed as being neutral to Option 2c as they have similar risk profiles, as above. Option 2b is assessed as being weaker than Option 3 for the same reasons as above.
Option 2c is assessed as being weaker than Option 3 for the same reasons as above.

Overall, Option 3 is the preferred option from a Residual Risk perspective.

2. Environmental

2.1 Impact of Decommissioning Operations Offshore

2a – Trench and Bury Exposures

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

1566 tonnes of CO2
494 tonnes of fuel

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

N	N	S

2b – Cut and Remove Exposures

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

1512 tonnes of CO2
477 tonnes of fuel

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

N	S

2c – Rock Cover Exposures

Planned
R = 0
Y = 0
G = 8
B = 0
Tot = 8

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	5	0	2
0	0	0	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

1512 tonnes of CO2
477 tonnes of fuel

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

S

3 – Reverse Reeling

Planned
R = 0
Y = 0
G = 7
B = 1
Tot = 8

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	1	4	0	2
0	0	1	0	0

Unplanned
R = 0
Y = 0
G = 1
Tot = 1

3595 tonnes of CO2
1134 tonnes of fuel

Likelihood	Impact Significance		
	Low	Moderate	High
	1	2	3
5	0	0	0
4	0	0	0
3	1	0	0
2	0	0	0
1	0	0	0

Summary

The assessment of the Impact of Decommissioning Operations Offshore sub-criterion is based on the results of the ENVID as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c as the impacts are largely similar. Option 2a is assessed as being stronger than Option 3 as the higher CO2 emissions / fuel use was considered sufficient to express a small preference.
Option 2b is assessed as being neutral to Option 2c as as the impacts are largely similar. Option 2b is assessed as being stronger than Option 3 as the higher CO2 emissions / fuel use was considered sufficient to express a small preference.
Option 2c is assessed as being stronger than Option 3 for similar reasons.

Overall, Option 2a, Option 2b and Option 2c are equally preferred from an Environmental - Impact of Decommissioning Operations Offshore perspective.

2.2 Processing of Returned Materials

2a – Trench and Bury Exposures

R = 0
Y = 0
G = 1
B = 0
Tot = 1

51 tonnes recovered

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

N	N	N

2b – Cut and Remove Exposures

R = 0
Y = 0
G = 1
B = 0
Tot = 1

52 tonnes recovered

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

N	N

2c – Rock Cover Exposures

R = 0
Y = 0
G = 1
B = 0
Tot = 1

51 tonnes recovered

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

N

3 – Reverse Reeling

R = 0
Y = 0
G = 1
B = 0
Tot = 1

547 tonnes recovered

Magnitude	Sensitivity			
	Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	1
0	0	0	0	0

Summary

The assessment of the Processing of Returned Materials sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral to each other as the processing of returned materials is similar for all options with the impact from the higher quantity associated with Option 3 being insufficient to express a preference.

Overall, all options are equally preferred from an Environmental - Processing of Returned Materials perspective.

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
2. Environmental – 2.3 Resource Consumption	R = 0 Y = 0 G = 3 B = 0 Tot = 3 Minimal rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 800 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 800 tonnes of rockdump	R = 0 Y = 0 G = 3 B = 0 Tot = 3 Minimal rockdump

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	3	0	0	0
0	0	0	0	0

S	**S**	**N**		**N**	**W**		**W**					

Summary

The assessment of the Resource Consumption sub-criterion is based on the results of the ENVID as follows:
All options are assessed as being neutral against each other as the resource consumption is similar for all options.

Overall, all options are equally preferred from an Environmental - Resource Consumption perspective.

2. Environmental – 2.4 Disturbance

R = 0, Y = 0, G = 1, B = 0, Tot = 1

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	1	0	0
0	0	0	0	0

N	**N**	**S**		**N**	**S**		**S**					

Summary

The assessment of the Seabed Disturbance (short-term impact) sub-criterion is as follows:
Option 2a is assessed as being neutral to Option 2b and Option 2c as they both involve limited seabed disturbance. Option 2a is assessed as being stronger than Option 3, as Option 3 will involve seabed disturbance along the entire umbilical / cable route from the deburial operations.
Option 2b is assessed as being neutral to Option 2c as the seabed disturbance is limited and similar. Option 2b is assessed as being stronger than Option 3 again due to the seabed disturbance from the deburial operations.
Option 2c is assessed as being stronger than Option 3 for similar reasons.

Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a Seabed Disturbance perspective.

2. Environmental – 2.5 Loss of Habitat

R = 0, Y = 0, G = 0, B = 1, Tot = 1

Magnitude	Sensitivity: Low	Medium	High	Very High
	1	2	3	4
5	0	0	0	0
4	0	0	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	1	0	0

S	**S**	**N**		**N**	**W**		**W**					

Summary

The assessment of the Loss of Habitat (legacy / long-term) sub-criterion is as follows:
Option 2a is assessed as being stronger than Option 2b and Option 2c as the permanent habit change from the rock placement is the same for Option 2b and Option 2c and very limited with Option 2a. Option 2a is assessed as being neutral to Option 3 as there is limited rock placement associated with both.
Option 2b is assessed as being neutral to Option 2c as the permanent habit change from the rock placement is the same. Option 2b is assessed as being weaker than Option 3 there is more habitat impact from the greater rock placement.
Option 2c is assessed as being weaker Option 3 for similar reasons.

Overall, Option 2a and Option 3 are equally preferred options from a Loss of Habitat perspective.

	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
3. Technical – 3.1 Contracting Strategy	Established technology with a wide range of vendors. Flexible contracting strategy.	Established technology with a wide range of vendors. Flexible contracting strategy.	Established technology with a wide range of vendors. Flexible contracting strategy.	Reel vessel of suitable capacity required. Vessels are generally available from a number of vendors. Reasonably flexible contracting strategy.

N	**N**	**N**		**N**	**N**		**N**					

Summary

The assessment of the Contracting Strategy sub-criterion is as follows:
All options are assessed as being neutral against each other, with the differences between options not deemed significant enough to express a preference.

Overall, all options are equally preferred from a Contracting Strategy perspective.

		2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling
4. Societal	4.3 Socio-economic impact on communities and amenities	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity: Low 1, Medium 2, High 3, Very High 4 5: 0 0 0 0 4: 0 0 0 0 3: 0 0 0 0 2: 0 0 0 0 1: 6 0 0 1 0: 6 0 0 0 Unplanned R = 0 Y = 0 G = 0 Tot = 0 Likelihood / Impact Significance: Low 1, Moderate 2, High 3 5: 0 0 0 4: 0 0 0 3: 0 0 0 2: 0 0 0 1: 0 0 0	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity: Low 1, Medium 2, High 3, Very High 4 5: 0 0 0 0 4: 0 0 0 0 3: 0 0 0 0 2: 0 0 0 0 1: 6 0 0 1 0: 6 0 0 0 Unplanned R = 0 Y = 0 G = 1 Tot = 1 Likelihood / Impact Significance: Low 1, Moderate 2, High 3 5: 0 0 0 4: 0 0 0 3: 1 0 0 2: 0 0 0 1: 0 0 0	Low impact on communities and amenities as minimal material returned to shore. Planned R = 0 Y = 0 G = 7 B = 6 Tot = 13 Magnitude / Sensitivity: Low 1, Medium 2, High 3, Very High 4 5: 0 0 0 0 4: 0 0 0 0 3: 0 0 0 0 2: 0 0 0 0 1: 6 0 0 1 0: 6 0 0 0 Unplanned R = 0 Y = 0 G = 0 Tot = 0 Likelihood / Impact Significance: Low 1, Moderate 2, High 3 5: 0 0 0 4: 0 0 0 3: 0 0 0 2: 0 0 0 1: 0 0 0	Medium impact on communities and amenities as full cable/umbilical would be returned to shore for dismantling/recycling. Planned R = 0 Y = 0 G = 12 B = 1 Tot = 13 Magnitude / Sensitivity: Low 1, Medium 2, High 3, Very High 4 5: 0 0 0 0 4: 0 0 0 0 3: 0 0 0 0 2: 0 0 0 0 1: 11 0 0 1 0: 1 0 0 0 Unplanned R = 0 Y = 0 G = 1 Tot = 1 Likelihood / Impact Significance: Low 1, Moderate 2, High 3 5: 0 0 0 4: 0 0 0 3: 1 0 0 2: 0 0 0 1: 0 0 0
		N N N	N N	N	
	Summary	The assessment of the Socio-economic sub-criterion is as follows: All options are assessed as being neutral against each other, with the differences between options not deemed significant enough to express a preference. Overall, all options are equally preferred from an impact on communities and amenities perspective.			
5. Economic	5.1 Cost for decommissioning / removal activities	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £6.3 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £5.5 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £5.5 million.	The decommissioning cost including contingency but excluding long term liabilities for this option is: Decomissioning Cost: £7.7 million.
		N N S	N S	S	
	Summary	The assessment of the Cost for decommissioning sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b and Option 2c as the costs are largely similar. Option 2a is assessed as being stronger than Option 3 as the costs are sufficiently lower to express a preference. Option 2b is assessed as being neutral to Option 2c as the costs are largely similar. Option 2b is assessed as being stronger than Option 3 as the costs are sufficiently lower to express a preference. Option 2c is assessed as being stronger than Option 3 for teh same reason. Overall, Option 2a, Option 2b and Option 2c are equally preferred from a total cost of decommissioning perspective.			
5. Economic	5.2 Cost for long term monitoring / remediation	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £6.5 million Survey & Monitoring NPC: £1.0 million Remediation Cost: £1.6 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £6.5 million Survey & Monitoring NPC: £1.0 million Remediation Cost: £1.4 million	The long-term costs included survey & monitoring costs (in both total and Net Present Cost (NPC) terms) and potential future remediation costs for this option are: Survey & Monitoring Cost: £6.5 million Survey & Monitoring NPC: £1.0 million Remediation Cost: £1.4 million	There are no long-term costs associated with this full removal option.
		N N W	N W	W	
	Summary	The assessment of the Cost for long term monitoring / remediation sub-criterion is as follows: Option 2a is assessed as being neutral to Option 2b and Option 2c as the long-term costs are largely similar. Option 2a is assessed as being weaker than Option 3 as there are no long-term costs associated with the full removal option. Option 2b is assessed as being neutral to Option 2c as the long-term costs are largely similar. Option 2b is assessed as being weaker than Option 3 as there are no long-term costs associated with the full removal option. Option 2c is assessed as being weaker than Option 3 for the same reason. Overall, Option 2a, Option 2b and Option 2c are equally preferred options from a cost for long term monitoring / remediation perspective.			

Appendix E.2 Group 4 Pair-wise Comparison Matrices – Safety

1.1 Personnel Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

1.2 Personnel Onshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	MS	30.0%
2b – Cut and Remove Exposures	N	N	N	MS	30.0%
2c – Rock Cover Exposures	N	N	N	MS	30.0%
3 – Reverse Reeling	MW	MW	MW	N	10.0%

1.3 Other Users	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

1.4 Residual Risk	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	W	22.2%
2b – Cut and Remove Exposures	N	N	N	W	22.2%
2c – Rock Cover Exposures	N	N	N	W	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%

Appendix E.3 Group 4 Pair-wise Comparison Matrices – Environment

2.1 Impact of Decommissioning Operations Offshore	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

2.2 Processing of Returned Materials	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

2.3 Resource Consumption	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	S	S	N	30.0%
2b – Cut and Remove Exposures	W	N	N	W	20.0%
2c – Rock Cover Exposures	W	N	N	W	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

2.4 Disturbance	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

2.5 Loss of Habitat	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	S	S	N	30.0%
2b – Cut and Remove Exposures	W	N	N	W	20.0%
2c – Rock Cover Exposures	W	N	N	W	20.0%
3 – Reverse Reeling	N	S	S	N	30.0%

Appendix E.4 Group 4 Pair-wise Comparison Matrices – Technical

3.1 Contracting Strategy	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

3.2 Schedule	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

3.3 Technical maturity	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

Appendix E.5 Group 4 Pair-wise Comparison Matrices – Societal

4.1 Regulatory	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	S	N	27.5%
2b – Cut and Remove Exposures	N	N	N	S	27.5%
2c – Rock Cover Exposures	W	N	N	W	20.3%
3 – Reverse Reeling	N	W	S	N	24.8%

4.2 Impact on Commercial Fisheries	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	S	N	27.3%
2b – Cut and Remove Exposures	N	N	S	N	27.3%
2c – Rock Cover Exposures	W	W	N	W	18.2%
3 – Reverse Reeling	N	N	S	N	27.3%

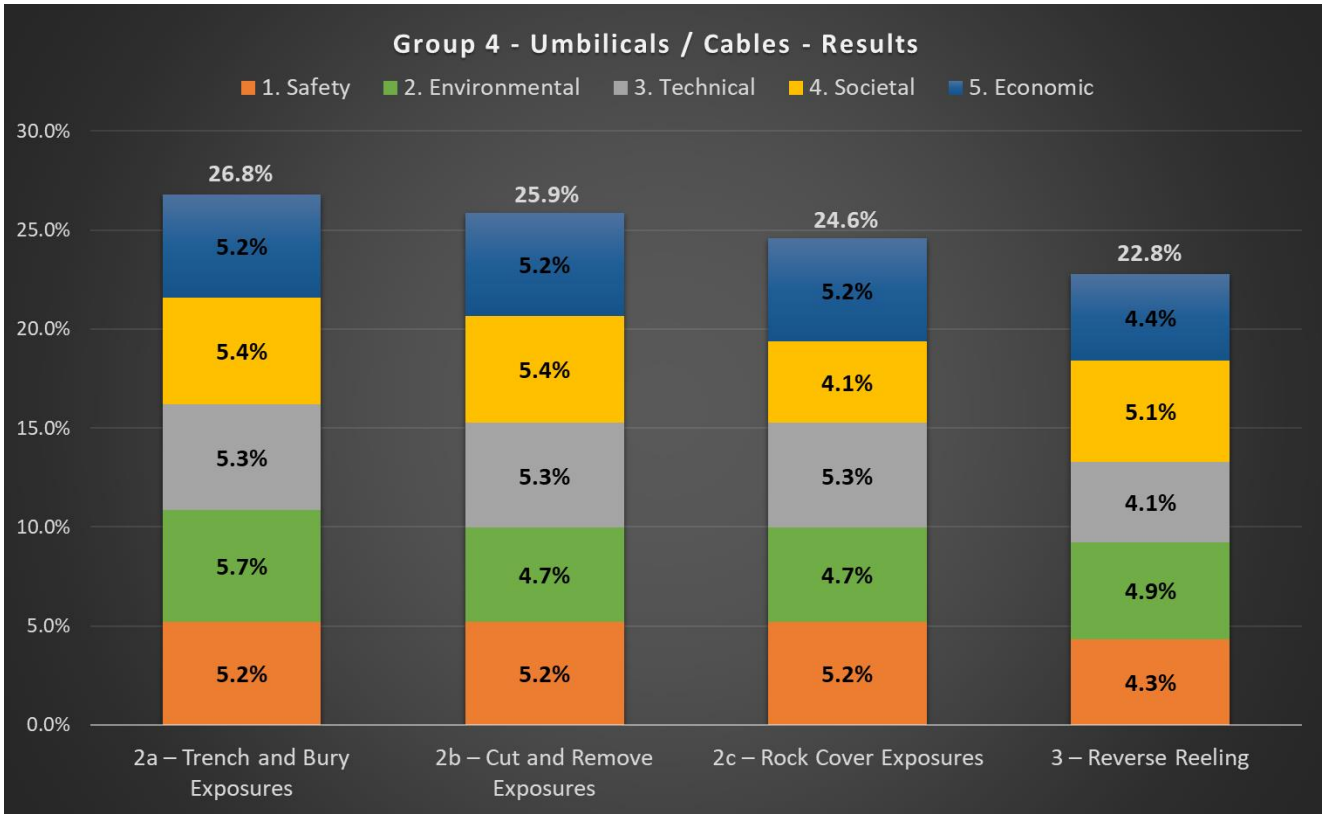
4.3 Socio-economic impact on communities and amenities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	N	25.0%
2b – Cut and Remove Exposures	N	N	N	N	25.0%
2c – Rock Cover Exposures	N	N	N	N	25.0%
3 – Reverse Reeling	N	N	N	N	25.0%

Appendix E.6 Group 4 Pair-wise Comparison Matrices – Economic

5.1 Cost for decommissioning / removal activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	S	27.3%
2b – Cut and Remove Exposures	N	N	N	S	27.3%
2c – Rock Cover Exposures	N	N	N	S	27.3%
3 – Reverse Reeling	W	W	W	N	18.2%

5.2 Cost for long term monitoring / remediation activities	2a – Trench and Bury Exposures	2b – Cut and Remove Exposures	2c – Rock Cover Exposures	3 – Reverse Reeling	Weighting
2a – Trench and Bury Exposures	N	N	N	W	22.2%
2b – Cut and Remove Exposures	N	N	N	W	22.2%
2c – Rock Cover Exposures	N	N	N	W	22.2%
3 – Reverse Reeling	S	S	S	N	33.3%

Appendix E.7 Group 4 Results Chart



APPENDIX F GROUP 1 – SALTIRE A TO PIPER B BUNDLE – OPTION DATASHEETS

Appendix F.1 Option 1b - Minor Intervention - Remediate Ends and Spans Only

Area	**Saltire**
Decision / Group	**Group 1: Saltire A to Piper B Bundle**
Option	**Option 1b: Leave in Situ – Remediate Ends and Spans Only**
Sequence of Works	Perform as-found survey Rockdump cut ends and spans to remove snagging hazard Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	116	Man Hours	10,848	
Diver Requirement	Number	0	Man Hours	0	
Onshore Personnel	Number	10	Man Hours	1,952	
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	20	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report		
	2.2 Processing of Returned Materials	Refer to ENVID Report		
	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	0	0	N/A
	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	6	Rock Placement
	Survey Vessel	1	9	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	0	0	N/A
Energy Use	**Fuel**	**CO_2**	**NOx**	**SO_2**
	193.6 Te	613.6 Te	11.4 Te	2.3 Te
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**		
	10,335 Te	Not Evaluated		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Rockdumping	850	1700Te of rockdump	
	MFE	N/A	N/A	
	Trenching	N/A	N/A	
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	0.0	0
		Remaining	5111.5	6,637
	Coatings	Recovered	0.0	0
		Remaining	14.8	6,637
	Aluminium Alloy	Recovered	0.0	N/A
		Remaining	18.4	N/A
Residuals	**Type**	**Left In-Situ**	**Returned**	
	LSA Scale	N/A	N/A	
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	
	Control Fluids	N/A	N/A	

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.
	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 20 days.
	3.3 Technical Maturity	TRL 7. Established methods and technology. Fully mature.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Seabed would be left with rock dump of spans, exposures and ends.
	4.2 Impact on Fisheries	Minimal area of natural seabed disturbed.
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£1.92M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**High**	Bundle is left in situ and exposed.

Appendix F.2 Option 2a - Major Intervention - Trench and Bury Exposures

Area	**Saltire**
Decision / Group	**Group 1: Saltire A to Piper B Bundle**
Option	**Option 2a: Leave in Situ Major Intervention – Trench and Bury Exposures**
Sequence of Works	Perform as-found survey Prepare for trenching (remove vent valves and ballast chains) Trench and backfill pipeline Rockdump end transitions Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	212	Man Hours	65,232	
Diver Requirement	Number	6	Man Hours	8,208	
Onshore Personnel	Number	10	Man Hours	16,360	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	87	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	57	Subsea Works	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	5	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	1	11	Trench / Backfill	
Energy Use	**Fuel**	**CO_2**	**NOx**	**SO_2**	
	1397.6 Te	4430.3 Te	82.5 Te	16.8 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	14,152 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	100	200Te of rockdump		
	MFE	N/A	N/A		
	Trenching	6637	Trenching Spread		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	0.0	0	
		Remaining	5111.5	6,637	
	Coatings	Recovered	0.0	0	
		Remaining	14.8	6,637	
	Aluminium Alloy	Recovered	0.0	N/A	
		Remaining	18.4	N/A	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Suitable trenching/backfill equipment available but bundle outside diameter is at the limit of current technology, therefore likely to be limited flexibility in terms of contracting strategy.
	3.2 Schedule	High chance of multi-pass trenching being required to achieve sufficient trench depth. High risk of failure to achieve trench depth resulting in additional time for alternative method, e.g. rock dump. In field time of 87 days.
	3.3 Technical Maturity	TRL 5. This is a routine subsea operation but has no track record of trenching large diameter bundle, and bundle is at the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	If successful, would leave a clear seabed. However high risk of not achieving required depth of cover requiring additional material (e.g. rockdump)
	4.2 Impact on Fisheries	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£19.68M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Bundle is left in situ buried below seabed and not exposed.

Appendix F.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	**Saltire**
Decision / Group	**Group 1: Saltire A to Piper B Bundle**
Option	**Option 2c: Leave in Situ Major Intervention – Rock Cover Exposures**
Sequence of Works	Perform as-found survey Blanket rockdump bundle Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	116	Man Hours	16,368	
Diver Requirement	Number	0	Man Hours	0	
Onshore Personnel	Number	10	Man Hours	8,208	
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	43	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Safety Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	0	0	N/A	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	29	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	471.3 Te	1494.1 Te	27.8 Te	5.7 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	11,216 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	77737	154700Te of rockdump		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	0.0	0	
		Remaining	5111.5	6,637	
	Coatings	Recovered	0.0	0	
		Remaining	14.8	6,637	
	Aluminium Alloy	Recovered	0.0	N/A	
		Remaining	18.4	N/A	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.
	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 43 days.
	3.3 Technical Maturity	TRL 7. Established methods and technology. Fully mature.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Seabed would be left with rock dump over entire bundle length.
	4.2 Impact on Fisheries	Significant area of natural seabed permanently disturbed.
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£10.01M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Bundle is left in situ covered by rock and not exposed.

Appendix F.4 Option 3 - Full Removal - Cut and Lift

Area	**Saltire**
Decision / Group	**Group 1: Saltire A to Piper B Bundle**
Option	**Option 3a: Full Removal – Cut and Lift**
Sequence of Works	Perform as-found survey Cut pipe in to 24m lengths using hydraulic shears Recover pipeline sections to pipehaul barge Rockdump cut ends at crossing location Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL880-PL883	Surface Laid Bundle	Steel	40	6,637	5145	Surface Laid & Exposed

SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	268	Man Hours	90,240	
Diver Requirement	Number	6	Man Hours	4,176	
Onshore Personnel	Number	16	Man Hours	24,928	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	124	
Potential for High Consequence Events	Refer to HAZID Report				

ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	1	29	Material Transport	
	CSV	1	52	Subsea Works	
	DSV	1	29	Subsea Works	
	HLV	0	0	N/A	
	Large Deck CSV	0	0	N/A	
	Light CSV	0	0	N/A	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	2891.8 Te	9167.1 Te	170.6 Te	34.7 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	14,333 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	N/A	N/A		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	5111.5	6,637	
		Remaining	0.0	0	
	Coatings	Recovered	14.8	6,637	
		Remaining	0.0	0	
	Aluminium Alloy	Recovered	18.4	N/A	
		Remaining	0.0	N/A	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so may be more challenging to have flexible contracting strategy.
	3.2 Schedule	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is major scope for overruns. Current estimate of in-field time is 124 days.
	3.3 Technical Maturity	TRL 5. No track record for lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support. Low technical maturity.

SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Full removal would leave a clear seabed and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.
	4.2 Impact on Fisheries	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.
	4.3 Impact on Communities	Medium benefit to communities as bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.

ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£17.41M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**None**	Bundle is fully removed.

APPENDIX G GROUP 2 – SALTIRE A TO SALTIRE WID BUNDLE – OPTION DATASHEETS

Appendix G.1 Option 1b - Minor Intervention - Remediate Ends and Spans Only

Area	**Saltire**
Decision / Group	**Group 2: Saltire A to Saltire WID Bundle**
Option	**Option 1b: Leave in Situ – Remediate Ends and Spans Only**
Sequence of Works	Perform as-found survey Rockdump cut ends and spans to remove snagging hazard Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	116	Man Hours	10,608	
Diver Requirement	Number	0	Man Hours	0	
Onshore Personnel	Number	10	Man Hours	1,808	
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	19	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report		
	2.2 Processing of Returned Materials	Refer to ENVID Report		
	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	0	0	N/A
	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	5	Rock Placement
	Survey Vessel	1	9	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	0	0	N/A
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**
	176.3 Te	559 Te	10.4 Te	2.1 Te
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**		
	1,828 Te	Not Evaluated		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Rockdumping	150	300Te of rockdump	
	MFE	N/A	N/A	
	Trenching	N/A	N/A	
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	0.0	0
		Remaining	662.5	2,106
	Coatings	Recovered	0.0	0
		Remaining	3.1	2,106
	Aluminium Alloy	Recovered	0.0	N/A
		Remaining	4.8	N/A
Residuals	**Type**	**Left In-Situ**	**Returned**	
	LSA Scale	N/A	N/A	
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	
	Control Fluids	N/A	N/A	

3. TECHNICAL			
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.	
	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 19 days.	
	3.3 Technical Maturity	TRL 7. Established methods and technology. Fully mature.	

4. SOCIETAL			
Societal CA Sub-Criteria	**4.1 Political**	Seabed would be left with rock dump of spans, exposures and ends.	
	4.2 Impact on Fisheries	Minimal area of natural seabed lost.	
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.	

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£1.76M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**High**	Bundle is left in situ and exposed.

Appendix G.2 Option 2a - Major Intervention - Trench and Bury Exposures

Area	**Saltire**
Decision / Group	**Group 2: Saltire A to Saltire WID Bundle**
Option	**Option 2a: Leave in Situ Major Intervention – Trench and Bury Exposures**
Sequence of Works	Perform as-found survey Prepare for trenching (remove vent valves and ballast chains) Trench and backfill pipeline Rockdump end transitions Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	212	Man Hours	30,096	
Diver Requirement	Number	6	Man Hours	2,736	
Onshore Personnel	Number	10	Man Hours	7,608	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	47	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report		
	2.2 Processing of Returned Materials	Refer to ENVID Report		
	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	1	19	Subsea Works
	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	5	Rock Placement
	Survey Vessel	1	9	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	1	9	Trench / Backfill
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**
	854.8 Te	2709.8 Te	50.4 Te	10.3 Te
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**		
	3,978 Te	Not Evaluated		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Rockdumping	2840	4500Te of rockdump	
	MFE	N/A	N/A	
	Trenching	1806	Trenching Spread	
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	0.0	0
		Remaining	662.5	2,106
	Coatings	Recovered	0.0	0
		Remaining	3.1	2,106
	Aluminium Alloy	Recovered	0.0	N/A
		Remaining	4.8	N/A
Residuals	**Type**	**Left In-Situ**	**Returned**	
	LSA Scale	N/A	N/A	
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	
	Control Fluids	N/A	N/A	

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Suitable trenching/backfill equipment available. Bundle outside diameter is within but approaching the limits of current technology therefore flexibility may be somewhat limited in terms of contracting strategy.
	3.2 Schedule	High chance of multi-pass trenching being required to achieve sufficient trench depth. Moderate risk of failure to achieve trench depth resulting in additional time for alternative method, e.g. rock dump. In field time of 47 days.
	3.3 Technical Maturity	TRL 6. This is a routine subsea operation but has no track record of trenching large diameter bundles. However, bundle is within the limit of current track record in terms of product outside diameter. Achieving a depth of cover of 0.6 metres along the entire bundle length has been assessed to be challenging with a high risk of failure, which would require local rock dump in the area of failure.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	If successful, would leave a clear seabed. Moderate risk of not achieving required depth of cover requiring additional material (e.g. rock dump)
	4.2 Impact on Fisheries	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time. Permanent loss of seabed areas if remedial rock dump is required.
	4.3 Impact on Communities	Minimal impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£8.86M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Bundle is left in situ buried below seabed and not exposed.

Appendix G.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	**Saltire**
Decision / Group	**Group 2 Saltire A to Saltire WID Bundle**
Option	**Option 2c: Leave in Situ Major Intervention – Rock Cover Exposures**
Sequence of Works	Perform as-found survey Blanket rockdump bundle Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	116	Man Hours	10,848	
Diver Requirement	Number	0	Man Hours	0	
Onshore Personnel	Number	10	Man Hours	2,536	
Impact to Other Users of the Sea	Number of Vessels Used	3	Duration of Operations	20	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	0	0	N/A	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	6	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	193.6 Te	613.6 Te	11.4 Te	2.3 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	1,882 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	19610	31000Te of rockdump		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	0.0	0	
		Remaining	662.5	2,106	
	Coatings	Recovered	0.0	0	
		Remaining	3.1	2,106	
	Aluminium Alloy	Recovered	0.0	N/A	
		Remaining	4.8	N/A	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established methods and technology. No special requirements that would limit number of available decommissioning contractors. Good flexibility in terms of contracting strategy.
	3.2 Schedule	No particular technological factors or major risk factors that could extend schedule. In field time of 20 days.
	3.3 Technical Maturity	TRL 7. Established methods and technology. Fully mature.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Seabed would be left with rock dump over entire bundle length.
	4.2 Impact on Fisheries	Significant area of natural seabed permanently lost.
	4.3 Impact on Communities	Minimal impact on communities and amenities as no material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£2.82M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Bundle is left in situ covered by rock and not exposed.

Appendix G.4 Option 3 - Full Removal - Cut and Lift

Area	**Saltire**
Decision / Group	**Group 2: Saltire A to Saltire WID Bundle**
Option	**Option 3a: Full Removal – Cut and Lift**
Sequence of Works	Perform as-found survey Cut pipe in to 24m lengths using hydraulic shears Recover pipeline sections to pipehaul barge Rockdump cut ends at crossing location Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL897-PL899	Surface Laid Bundle	Steel	26.5	2,106	670	Surface Laid & Exposed

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	288	Man Hours	43,824	
Diver Requirement	Number	6	Man Hours	1,872	
Onshore Personnel	Number	16	Man Hours	8,584	
Impact to Other Users of the Sea	Number of Vessels Used	6	Duration of Operations	65	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	1	13	Material Transport	
	CSV	1	20	Subsea Works	
	DSV	1	13	Subsea Works	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	5	Rock Placement	
	Survey Vessel	1	9	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	1218.1 Te	3861.3 Te	71.9 Te	14.6 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	4,548 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	150	300Te of rockdump		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	646.8	2,056	
		Remaining	15.7	50	
	Coatings	Recovered	3.0	2,056	
		Remaining	0.1	50	
	Aluminium Alloy	Recovered	4.7	N/A	
		Remaining	0.1	N/A	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	The vessels required are readily available but there is no established methodology for lifting and removing bundles of this size, so it is likely that, if such a technology is developed, it will be single source.
	3.2 Schedule	Major technological risk factors to the schedule in that an established lifting technology is not in place and there is major scope for overruns. Current estimate of in-field time is 65 days.
	3.3 Technical Maturity	TRL 5. No track record for lift and removal of large diameter bundles. Extensive subsea works required, likely complete with diver support. Low technical maturity.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Full removal would leave a clear seabed (only short section, 50m, left rock covered at crossings) and BEIS encourages all decommissioning programmes to review existing and emerging technology for bundle removal.
	4.2 Impact on Fisheries	Medium impact on commerical fisheries due to a significant area of the natural seabed being temporarily disturbed. However, the area would recover to its natural condition over time.
	4.3 Impact on Communities	Medium benefit to communities as majority of bundle would be returned to shore for dismantling/recycling. Local infrastructure upgrades may be required.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£7.47M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Very Low**	Bundle is fully removed with the exception of the short section (approx. 50m) which is covered by rock at the MacCulloch pipeline crossings.

APPENDIX H GROUP 3 – CHANTER OIL / CONDENSATE FLEXIBLE FLOWLINE – OPTION DATASHEETS

Appendix H.1 Option 2a - Major Intervention - Trench and Bury Exposures

Area	**Chanter**
Decision / Group	**Group 3: Chanter Oil/Condensate Flexible Flowline**
Option	**Option 2a: Leave in Situ Minor Intervention – Trench and Bury Exposures**
Sequence of Works	Perform as-found survey Cut & recover pipeline ends Trench and backfill pipeline exposures and cut ends Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	17,952	
Diver Requirement	Number	6	Man Hours	864	
Onshore Personnel	Number	16	Man Hours	4,256	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	30	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report		
	2.2 Processing of Returned Materials	Refer to ENVID Report		
	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	1	6	Subsea Works
	Reel Vessel	0	0	N/A
	Rockdump Vessel	0	0	N/A
	Survey Vessel	1	10	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	1	9	Trench / Backfill
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**
	357.6 Te	1133.5 Te	21.1 Te	4.3 Te
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**		
	2,671 Te	Not Evaluated		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Rockdumping	N/A	N/A	
	MFE	N/A	N/A	
	Trenching	98	Trenching Spread	
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	2.6	40
		Remaining	688.1	10,635
	Stainless Steel	Recovered	0.5	40
		Remaining	124.0	10,635
	Plastics	Recovered	0.6	40
		Remaining	172.5	10,635
Residuals	**Type**	**Left In-Situ**	**Returned**	
	LSA Scale	N/A	N/A	
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned	
	Control Fluids	N/A	N/A	

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.
	3.2 Schedule	In field time of 30 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Risk of failure of achieving 0.6 m depth of cover, which would require additional rockdump in that area.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2b and 2c but slightly more impact than 3a as pipeline will be left in-situ.
	4.2 Impact on Fisheries	Modest area of natural seabed temporarily disturbed, area would recover to natural condition. Low impact.
	4.3 Impact on Communities	Low impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£4.78M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Moderate**	Flowline is left in situ buried below the seabed with no exposures.

Appendix H.2 Option 2b - Major Intervention - Cut and Remove Exposures

Area	**Chanter**
Decision / Group	**Group 3: Chanter Oil/Condensate Flexible Flowline**
Option	**Option 2b: Leave in Situ Minor Intervention – Cut and Remove Exposures**
Sequence of Works	Perform as-found survey Cut & recover pipeline ends and exposures Rockdump cut ends Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	19,968	
Diver Requirement	Number	6	Man Hours	1,296	
Onshore Personnel	Number	16	Man Hours	3,824	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	30	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	9	Subsea Works	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	6	Rock Placement	
	Survey Vessel	1	10	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	364.3 Te	1154.9 Te	21.5 Te	4.4 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	2,689 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	950	1900Te of rockdump		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	6.3	98	
		Remaining	684.4	10,577	
	Stainless Steel	Recovered	1.1	98	
		Remaining	123.4	10,577	
	Plastics	Recovered	1.6	98	
		Remaining	171.5	10,577	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.
	3.2 Schedule	In field time of 30 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2a and 2c but slightly more impact than 3a as pipeline will be left in-situ.
	4.2 Impact on Fisheries	Limited area of natural seabed disturbed.
	4.3 Impact on Communities	Low impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£4.11M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Moderate**	Flowline is left in situ buried below the seabed with no exposures.

Appendix H.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	**Chanter**
Decision / Group	**Group 3: Chanter Oil/Condensate Flexible Flowline**
Option	**Option 2c: Leave in Situ Minor Intervention – Rock Cover Exposures**
Sequence of Works	Perform as-found survey Cut & Recover Pipeline Ends Rockdump cut ends and exposures to remove snagging hazard Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	17,232	
Diver Requirement	Number	6	Man Hours	864	
Onshore Personnel	Number	16	Man Hours	3,240	
Legacy Risk	Number	0	Man Hours	0	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	27	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	6	Subsea Works	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	1	6	Rock Placement	
	Survey Vessel	1	10	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	305.8 Te	969.5 Te	18 Te	3.7 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	2,507 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	950	1900Te of rockdump		
	MFE	N/A	N/A		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	2.6	40	
		Remaining	688.1	10,635	
	Stainless Steel	Recovered	0.5	40	
		Remaining	124.0	10,635	
	Plastics	Recovered	0.6	40	
		Remaining	172.5	10,635	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.
	3.2 Schedule	In field time of 27 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2a and 2b but slightly more impact than 3a as pipeline will be left in-situ.
	4.2 Impact on Fisheries	Limited area of natural seabed disturbed.
	4.3 Impact on Communities	Low impact on communities and amenities as minimal material returned to shore.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£3.38M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Moderate**	Flowline is left in situ buried below the seabed with exposures covered by rock.

Appendix H.4 Option 3 - Full Removal - Reverse Reeling

Area	**Chanter**
Decision / Group	**Group 3: Chanter Oil/Condensate Flexible Flowline**
Option	**Option 3: Full Removal – Reverse Reeling**
Sequence of Works	Perform as-found survey Debury flowline Disconnect and rig pipeline ends Reverse reel pipeline Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL847	6" Oil.Condensate Flexible Flowline	Steel / Plastics	6	10,675	988	Partially Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	324	Man Hours	33,120	
Diver Requirement	Number	6	Man Hours	1,008	
Onshore Personnel	Number	16	Man Hours	9,368	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	40	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	1	10	Subsea Works	
	DSV	1	7	Subsea Works	
	Reel Vessel	1	8	Reverse Reeling	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	10	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	733.8 Te	2326.2 Te	43.3 Te	8.8 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	3,157 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	N/A	N/A		
	MFE	21350	MFE Spread		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	689.4	10,655	
		Remaining	1.3	20	
	Stainless Steel	Recovered	124.3	10,655	
		Remaining	0.2	20	
	Plastics	Recovered	172.8	10655	
		Remaining	0.3	20	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	Flushed & Cleaned	Flushed & Cleaned		
	Control Fluids	N/A	N/A		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Reel vessel of suitable capacity required. Vessels are generally available from a number of vendors. Reasonably flexible contracting strategy.
	3.2 Schedule	In field time of 40 days. Potential for extension to schedule due to possible failure of pipeline during reverse reeling.
	3.3 Technical Maturity	TRL 7. Reel installation of pipelines is a standard subsea operation but, while reverse reeling has been carried out elsewhere, there is a relatively limited track record of reverse reeling for removal of pipeline in the UKCS.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Advantage over other options in that pipeline is permanently removed, leaving a clear seabed, with the exception of the bundle crossing where a short (20m) section of pipe will be left buried.
	4.2 Impact on Fisheries	Significant area of seabed temporarily disturbed but this will revert to natural condition over time and there would be no impact on fisheries after this time.
	4.3 Impact on Communities	Medium impact on communities and amenities as majority of pipeline would be returned to shore for dismantling/recycling.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£9.65M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Very Low**	Flowline is fully removed with the exception of short section (approx. 20m) where line is crossed by Saltire A to Saltire WID bundle.

APPENDIX I GROUP 4 – TRENCHED & BURIED UMBILICALS / POWER CABLES – OPTION DATASHEETS

Appendix I.1 Option 2a - Major Intervention - Trench and Bury Exposures

Area	**Saltire & Chanter**
Decision / Group	**Group 4: Trenched & Buried Umbilicals / Power Cables**
Option	**Option 2a: Leave in Situ Minor Intervention – Trench and Bury Exposures**
Sequence of Works	Perform as-found survey Cut & recover umbilical/cable ends Trench and backfill exposures and cut ends Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	25,440	
Diver Requirement	Number	6	Man Hours	2,016	
Onshore Personnel	Number	16	Man Hours	5,568	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	36	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	0	0	N/A	
	DSV	1	14	Subsea Works	
	Reel Vessel	0	0	N/A	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	11	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	1	6	Trench / Backfill	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	494.1 Te	1566.2 Te	29.2 Te	5.9 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	2,990 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	N/A	N/A		
	MFE	N/A	N/A		
	Trenching	80	Trenching Spread		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	19.0	1440	
		Remaining	296.9	23,854	
	Plastics	Recovered	21.9	1,440	
		Remaining	416.6	23,854	
	Copper	Recovered	10.3	1,440	
		Remaining	116.9	23,854	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	N/A	N/A		
	Control Fluids	Flushed	Flushed		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.
	3.2 Schedule	In field time of 36 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2b and 2c but more political impact than option 3a as items would be left in-situ.
	4.2 Impact on Fisheries	Low impact on commerical fisheries as items are already trenched and buried and small number of exposures would also be buried.
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£6.26M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Umbilical/cables are left in situ buried below the seabed with no exposures.

Appendix I.2 Option 2b - Major Intervention - Cut and Remove Exposures

Area	**Saltire & Chanter**
Decision / Group	**Group 4: Trenched & Buried Umbilicals / Power Cables**
Option	**Option 2b: Leave in Situ Minor Intervention – Cut and Remove Exposures**
Sequence of Works	Perform as-found survey Cut & Recover Ends and Exposures Rockdump cut ends to remove snagging hazard Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY		
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report
	1.2 Personnel Onshore	Refer to HAZID Report
	1.3 Other Users	Refer to HAZID Report
	1.4 Residual Risk	Refer to HAZID Report

Additional Safety Data for Information:				
Offshore Personnel	Number	192	Man Hours	25,200
Diver Requirement	Number	6	Man Hours	2,016
Onshore Personnel	Number	16	Man Hours	5,080
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	35
Potential for High Consequence Events	Refer to HAZID Report			

2. ENVIRONMENTAL		
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report
	2.2 Processing of Returned Materials	Refer to ENVID Report
	2.3 Resource Consumption	Refer to ENVID Report
	2.4 Disturbance	Refer to ENVID Report
	2.5 Loss of Habitat	Refer to ENVID Report

Additional Environmental Data for Information:

Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	1	14	Subsea Works
	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	5	Rock Placement
	Survey Vessel	1	11	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	0	0	N/A

Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**
	476.8 Te	1511.5 Te	28.1 Te	5.7 Te

Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**
	2,935 Te	Not Evaluated

Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**
	Rockdumping	400	800Te of rockdump
	MFE	N/A	N/A
	Trenching	N/A	N/A

Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	19.3	1,466
		Remaining	296.6	23,828
	Plastics	Recovered	22.5	1,466
		Remaining	416.0	23,828
	Copper	Recovered	10.3	1,466
		Remaining	116.9	23,828

Residuals	**Type**	**Left In-Situ**	**Returned**
	LSA Scale	N/A	N/A
	Hydrocarbon	N/A	N/A
	Control Fluids	Flushed	Flushed

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.
	3.2 Schedule	In field time of 35 days. No particular technology or major operation risk factors.
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2a and 2c but more political impact than option 3a as items would be left in-situ.
	4.2 Impact on Fisheries	Low impact on commerical fisheries as items are already trenched and buried and small number of exposures would also be buried.
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£5.55M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Umbilical/cables are left in situ buried below the seabed with no exposures.

Appendix I.3 Option 2c - Major Intervention - Rock Cover Exposures

Area	**Saltire & Chanter**
Decision / Group	**Group 4: Trenched & Buried Umbilicals / Power Cables**
Option	**Option 2c: Leave in Situ Minor Intervention – Rock Cover Exposures**
Sequence of Works	Perform as-found survey Cut & Recover Umbilical / Cable Ends Rockdump cut ends and exposures to remove snagging hazard Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	192	Man Hours	25,200	
Diver Requirement	Number	6	Man Hours	2,016	
Onshore Personnel	Number	16	Man Hours	5,008	
Legacy Risk	Number	0	Man Hours	0	
Impact to Other Users of the Sea	Number of Vessels Used	4	Duration of Operations	35	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL				
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report		
	2.2 Processing of Returned Materials	Refer to ENVID Report		
	2.3 Resource Consumption	Refer to ENVID Report		
	2.4 Disturbance	Refer to ENVID Report		
	2.5 Loss of Habitat	Refer to ENVID Report		
Additional Environmental Data for Information:				
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**
	Barge / Pipehaul	0	0	N/A
	CSV	0	0	N/A
	DSV	1	14	Subsea Works
	Reel Vessel	0	0	N/A
	Rockdump Vessel	1	5	Rock Placement
	Survey Vessel	1	11	Survey Works
	Trawler	1	5	Trawl Sweep
	Trenching Vessel	0	0	N/A
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**
	476.8 Te	1511.5 Te	28.1 Te	5.7 Te
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**		
	2,935 Te	Not Evaluated		
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**	
	Rockdumping	400	800Te of rockdump	
	MFE	N/A	N/A	
	Trenching	N/A	N/A	
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**
	Carbon Steel	Recovered	19.0	1440
		Remaining	296.9	23,854
	Plastics	Recovered	21.9	1,440
		Remaining	416.6	23,854
	Copper	Recovered	10.3	1,440
		Remaining	116.9	23,854
Residuals	**Type**	**Left In-Situ**	**Returned**	
	LSA Scale	N/A	N/A	
	Hydrocarbon	N/A	N/A	
	Control Fluids	Flushed	Flushed	

3. TECHNICAL			
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Established technology with a wide range of vendors. Flexible contracting strategy.	
	3.2 Schedule	In field time of 35 days. No particular technology or major operation risk factors.	
	3.3 Technical Maturity	TRL 7. Technically mature. Standard subsea operations.	

4. SOCIETAL			
Societal CA Sub-Criteria	**4.1 Political**	Similar to options 2a and 2b but more political impact than option 3a as items would be left in-situ.	
	4.2 Impact on Fisheries	Minimal area of seabed impacted by introduced rock however insufficient to have impact on commercial fishing operations.	
	4.3 Impact on Communities	Low as minimal material returned to shore for dismantling/recycling.	

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£5.45M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Low**	Umbilical/cables are left in situ buried below the seabed with exposures covered by rock.

Appendix I.4 Option 3 - Full Removal - Reverse Reeling

Area	**Saltire & Chanter**
Decision / Group	**Group 4: Trenched & Buried Umbilicals / Power Cables**
Option	**Option 3: Full Removal – Reverse Reeling**
Sequence of Works	Perform as-found survey Debury umbilical and cables Disconnect and rig umbilical/cable ends Reverse reel umbilical and cables Perform as-left survey Perform trawl sweep of site

ID No.	Type	Material	Diameter (inches)	Total Length (m)	Total Weight (Te)	Burial Status
PL849	Umbilical	Various	5.4	10,790	361	Trenched and Buried
PL4531	Power Cable	Various	4.8	7,241	260	Trenched and Buried
PL4532	Power Cable	Various	4.8	7,263	261	Trenched and Buried

1. SAFETY					
Safety CA Sub-Criteria	**1.1 Personnel Offshore**	Refer to HAZID Report			
	1.2 Personnel Onshore	Refer to HAZID Report			
	1.3 Other Users	Refer to HAZID Report			
	1.4 Residual Risk	Refer to HAZID Report			
Additional Safety Data for Information:					
Offshore Personnel	Number	324	Man Hours	44,976	
Diver Requirement	Number	6	Man Hours	1,296	
Onshore Personnel	Number	16	Man Hours	8,720	
Impact to Other Users of the Sea	Number of Vessels Used	5	Duration of Operations	53	
Potential for High Consequence Events	Refer to HAZID Report				

2. ENVIRONMENTAL					
Environmental CA Sub-Criteria	**2.1 Impact of Decommissioning Operations Offshore**	Refer to ENVID Report			
	2.2 Processing of Returned Materials	Refer to ENVID Report			
	2.3 Resource Consumption	Refer to ENVID Report			
	2.4 Disturbance	Refer to ENVID Report			
	2.5 Loss of Habitat	Refer to ENVID Report			
Additional Environmental Data for Information:					
Marine Impact (Vessels)	**Vessel Type**	**Number off**	**Duration**	**Activity**	
	Barge / Pipehaul	0	0	N/A	
	CSV	1	16	Subsea Works	
	DSV	1	9	Subsea Works	
	Reel Vessel	1	12	Reverse Reeling	
	Rockdump Vessel	0	0	N/A	
	Survey Vessel	1	11	Survey Works	
	Trawler	1	5	Trawl Sweep	
	Trenching Vessel	0	0	N/A	
Energy Use	**Fuel**	**CO_2**	**Nox**	**SO_2**	
	1134.1 Te	3595 Te	66.9 Te	13.6 Te	
Life Cycle Emissions	**CO_2**	**CO_2 (Credit)**			
	3,979 Te	Not Evaluated			
Marine Impact (Seabed)	**Activity**	**Area (m^2)**	**Resources**		
	Rockdumping	N/A	N/A		
	MFE	50588	MFE Spread		
	Trenching	N/A	N/A		
Materials	**Component / Material**	**Parameter**	**Weight (Te)**	**Length (m)**	
	Carbon Steel	Recovered	315.7	25,274	
		Remaining	0.2	20	
	Plastics	Recovered	438.1	25,274	
		Remaining	0.4	20	
	Copper	Recovered	127.2	25,274	
		Remaining	0.02	20	
Residuals	**Type**	**Left In-Situ**	**Returned**		
	LSA Scale	N/A	N/A		
	Hydrocarbon	N/A	N/A		
	Control Fluids	Flushed	Flushed		

3. TECHNICAL		
Technical CA Sub-Criteria	**3.1 Contracting Strategy**	Reel vessel of suitable capacity required. Vessels are generally available from a number of vendors. Reasonably flexible contracting strategy.
	3.2 Schedule	In field time of 53 days. Potential for extension to schedule due to possible failure of cables/umbilicals during reverse reeling.
	3.3 Technical Maturity	TRL 7. Reel installation of cables/umbilicals is a standard subsea operation and has been completed succesfully but there is a limited track record of reverse reeling for removal of cables/umbilicals in the UKCS.

4. SOCIETAL		
Societal CA Sub-Criteria	**4.1 Political**	Advantage over other options in that cables/umbilical is permanently removed, leaving a clear seabed.
	4.2 Impact on Fisheries	Area of seabed temporarily disturbed but this will revert to natural condition over time and there would be no impact on fisheries after this time.
	4.3 Impact on Communities	Medium impact on communities and amenities as full items would be returned to shore for dismantling/recycling.

5. ECONOMIC			
Economic CA Sub-Criteria	**5.1 Total Abandonment Expenditure**	£7.84M	
	5.2 Net Present Cost	N/A	
	5.3 Cashflow	N/A	
Potential for Future Remediation		**Very Low**	Umbilical/cables are fully removed with the exception of short section (approx. 20m) of umbilical where it is crossed by Saltire A to Saltire WID bundle.

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