



ENI UK

ENI UK Liverpool Bay Partial Decommissioning Comparative Assessment

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Version 06 Report for Consultation



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EXECUTIVE SUMMARY

ERM supported ENI UK in performing a comparative assessment of options for the partial decommissioning of its Liverpool Bay Asset (LBA) to facilitate ENI UK's proposed carbon capture and storage (CCS) project.

The purpose of the comparative assessment was to:

- determine the optimal decommissioning options for subsea pipelines and associated infrastructure considering environmental, safety, economic, technical and societal matters, and
- demonstrate to the Offshore Petroleum Regulator for Environment and Decommissioning that the Phase 1 Partial Decommissioning (Phase 1) to allow the conversion of LBA into CCS, will not prejudice any Final Decommissioning options for subsea pipelines and associated infrastructure.

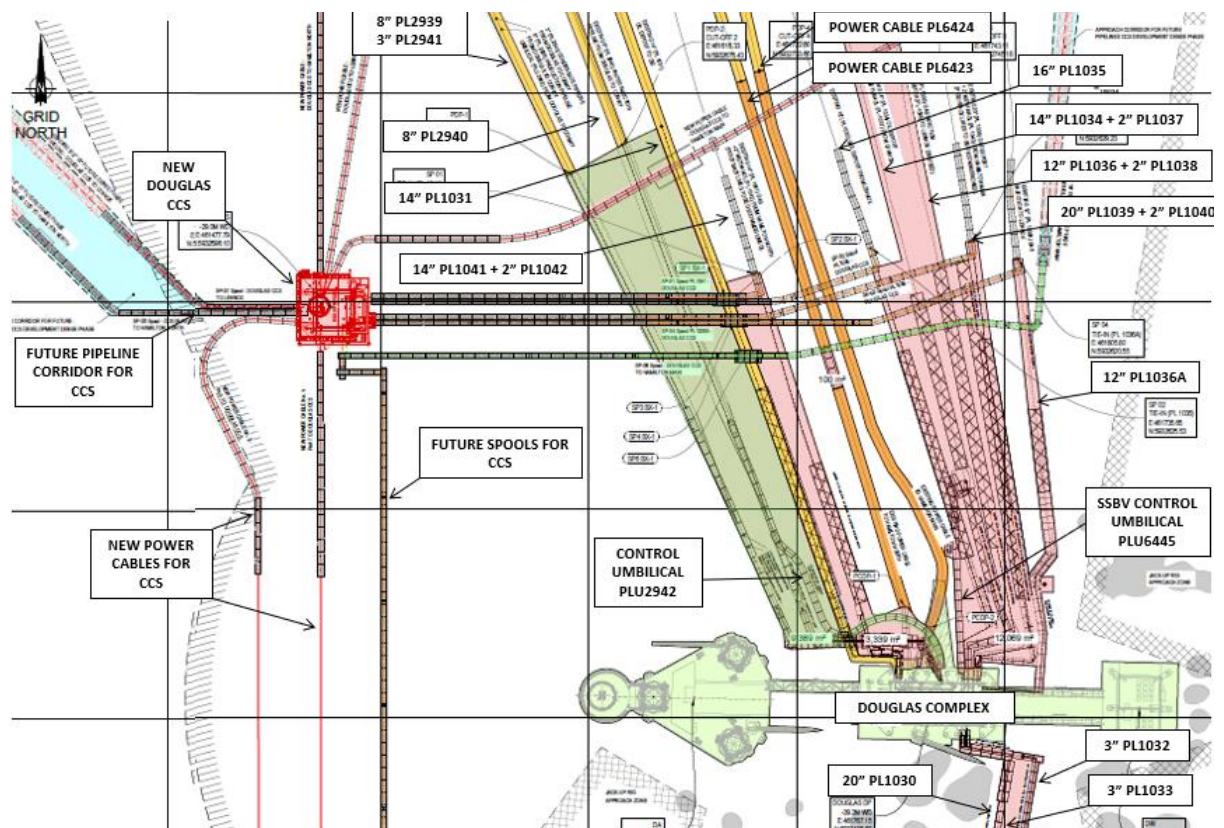
The Final Decommissioning is envisaged as a subsequent phase to Phase 1, to be performed once the conversion of LBA into CCS is completed.

The comparative assessment was conducted using applicable UK Government and industry guidance and informed by a previous comparative assessment conducted elsewhere by ENI UK.

Key outcomes of the assessment were as follows:

The removal during Phase 1 of the subsea items in proximity to platforms (such as those within the 27,714 m² of pink areas shown in *Source: Eni*

- Figure 1 below for the Douglas Complex), eliminates any constraints or prejudice of any future removal option of either those subsea items or other equipment outside of the pink area temporarily left in situ until Final Decommissioning.



Source: Eni

Figure 1 Phase 1 Partial Decommissioning near Douglas Complex (showing equipment in pink areas to be fully removed).

- The most favourable option for buried rigid pipelines (concrete coated or not) outside of the pink area (shown in Figure 1 for Douglas Complex and equivalent areas at other platforms, see Appendix B), is to decommission in-situ, with a minimum burial depth of 0.6m. This excludes any spools and lengths of pipeline with less than 0.6m of cover, which would be removed. The material currently present on the spools will be re-distributed via jetting and rock re-distribution to fill the excavated trenches, and so cover the cut ends.
- Decommissioning options of i) removal by reeling and ii) partial removal / in situ decommissioning of flexible pipelines, umbilicals and power cables (outside of the pink areas for each platform) scored equally favourably, given that some of the adverse environmental, safety and economic impact of full removal by reeling (which would potentially have greater impact than leaving situ) was countered by the potential ability to re-use the equipment once removed.
- Several large diameter pipelines have smaller diameter pipelines piggybacked to them. The large diameter pipes are either to be partially re-used for CCS or decommissioned. It is not considered feasible to separate and remove the piggybacked pipelines for reasons of technical, field time, cost and safety considerations. Therefore, any pipelines piggybacked to pipes not required for CCS would be subject to the same decommissioning method as the large diameter pipe, the favourable option for which is burial to a minimum of 0.6m.
- In cases where pipe is to be re-used for CCS, any piggybacked pipelines would be subject to inspection, maintenance and repair procedures associated with the CCS project. Thus, their condition would be maintained sufficiently to enable a full range of decommissioning options to be considered at a later date.
- Due to natural patterns of water and sediment movement in the Liverpool Bay area, it was identified that the opening of trenches for the removal of pipelines would need to be done in sections to avoid natural backfilling of trenches. While this staged approach prevents backfilling, it would potentially result in more seabed disturbance and time in the field.

An Excel workbook (please refer to Appendix A) was prepared during the comparative assessment (which included a workshop to review and refine the workbook) which provides further detail on the content and outcomes of the assessment.

INTRODUCTION

ERM was commissioned by ENI UK to complete a comparative assessment of options for the partial decommissioning of its Liverpool Bay Asset. The purpose of the comparative assessment was to evaluate and subsequently enable demonstration to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) of the optimal decommissioning options for subsea pipelines and associated infrastructure.

Guidance¹ published by the Department for Business, Energy and Industrial Strategy (BEIS Guidance 2018), Oil and Gas UK², and communication with OPRED informed the approach to the comparative assessment. As the proposed decommissioning programme is partial, OPRED have highlighted to ENI UK the importance of ensuring any decommissioning action now does not prejudice options for future decommissioning. Identifying any such potential consequences was therefore included as a key consideration in the comparative assessment process.

The partial decommissioning programme is being undertaken to enable ENI UK to implement its carbon capture and storage (CCS) project in Liverpool Bay, which includes re-use, partial removal and full removal of different items associated with the asset's use for oil and gas production.

METHOD

An overview of the comparative assessment process undertaken is provided in Figure 1 below.

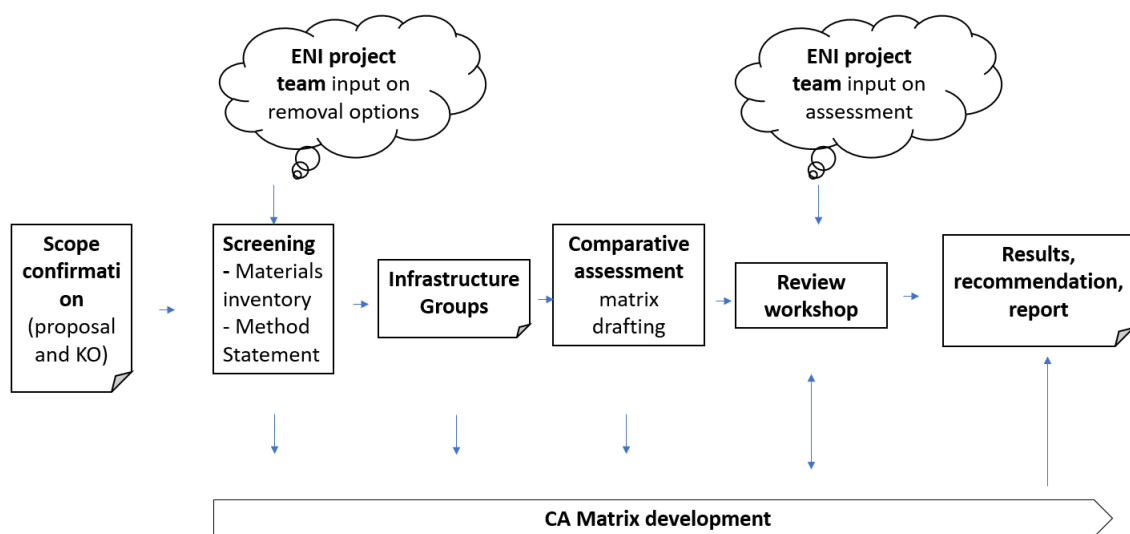


Figure 2 Overview of Comparative Assessment Process

Following a kick off meeting and confirmation of scope of equipment included in the comparative assessment, a structured process of screening infrastructure items was undertaken. This screening enabled infrastructure items to be grouped according to key common characteristics, for example, 'concrete coated rigid pipelines', to enable a subsequent process of comparative assessment to be undertaken more efficiently (by group rather than each individual item).

¹ *Guidance Notes, Decommissioning of Offshore Oil and Gas Installations and Pipelines*, Department for Business, Energy and Industrial Strategy, 2018.

² *Guidelines for Comparative Assessment in Decommissioning Programmes*, Oil and Gas UK, 2015.

Each infrastructure group was then assessed against a number of decommissioning options ranging from full removal to being left in situ, including different means of removal and intervention. Each decommissioning option was then assessed for its impact on the environment, safety, economic, technical and societal matters. Subject matter experts were engaged in the assessment, including a workshop on 29th June 2023 involving ERM and ENI UK personnel. Using a risk assessment style scoring system, each infrastructure group emerged with a preferred decommissioning option.

A workbook was populated through the process which is provided at Appendix A.

In assessing each decommissioning option, individual impacts on the environment, safety, economic, technical and societal matters were assessed based on professional judgement of subject matter experts from ERM and ENI UK. Impacts were categorised either: Attractive, Acceptable, Unattractive, or a Showstopper (where the option was either not technically feasible or considered likely to be unacceptable to OPRED based on the BEIS Guidance 2018). The evaluation of each option against the environment, safety, economic, technical and societal matters resulted in a score for that option. Comparisons were subsequently made horizontally between sub-options which may have resulted in modification of the category awarded, thus enabling relative attractiveness of options to be determined. The highest scoring option was considered the most favourable.

Inputs, assumptions and limitations

A number of inputs and assumptions were considered prior to, or during, the comparative assessment process, as follows:

- Areas for removal of subsea equipment in Phase 1 around each platform (Douglas Complex, Hamilton, Hamilton North and Lennox) are shown in Appendix B.
- The pink areas around each platform shown in the figures in Appendix B can be considered to be the approximate area of seabed disturbance associated with pipeline removal.
- It was determined that pipelines piggybacked to other pipelines would be subject to the same approach as the host pipeline, due to significant technical and cost constraints associated with separating them.
- Various other assumptions were made around costs of different options in the absence of detailed costing for different removal methods. A qualitative comparison of relative costs based on professional judgement and experience was utilised.
- Although no third-party stakeholders were involved in the comparative assessment, it was determined that their participation was not essential given the limited scope of the partial decommissioning programme. However, it is worth noting that future comprehensive decommissioning comparative assessments will incorporate input from third-party stakeholders.

Technical scope and battery limit

Table 1 below provides a description of the typology of the items to be removed:

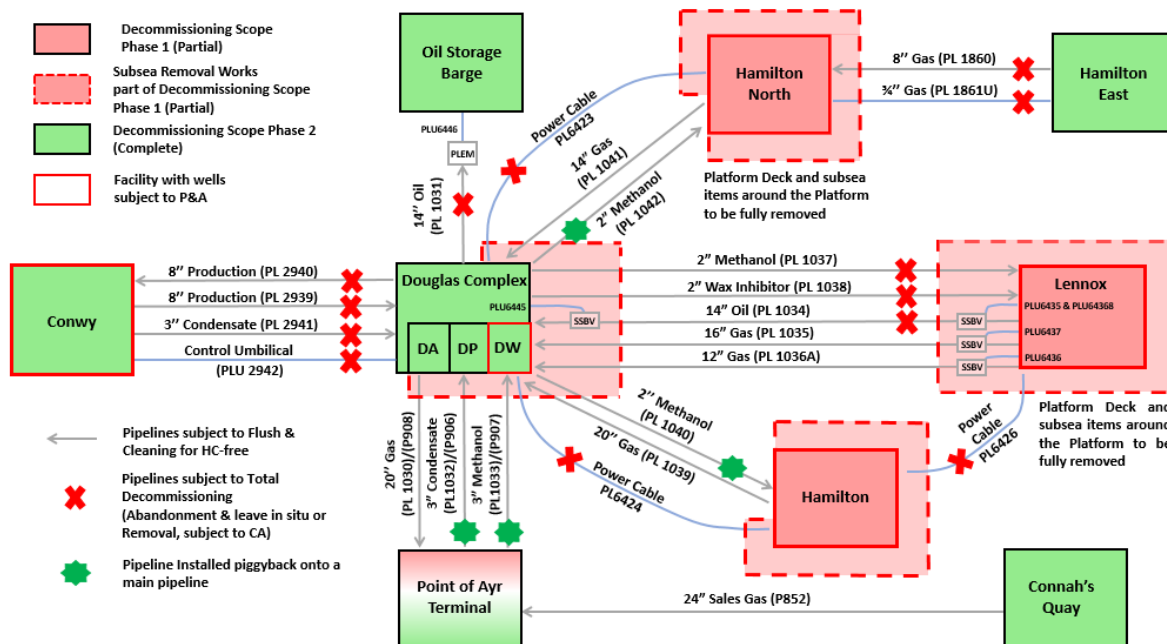
Table 1 List and typology of items to be decommissioned

POA to Douglas Pipelines
PL1032 3" Condensate Pipeline – Douglas to POA (Piggybacked on PL1030) ending pipeline section plus spools at Douglas DP
PL1033 3" Methanol Pipeline – Douglas to POA (Piggybacked on PL1030) ending pipeline section plus spools at Douglas DP
PL 1030/P908 20" Gas Pipeline – Douglas to POA ending pipeline section plus spools at Douglas DP

Lennox Pipelines
PL1035 16" Gas Export Pipeline – Lennox to Douglas – ending pipeline section plus spools at Douglas DP
PL1034 14" Oil Pipeline – Lennox to Douglas – SSBV plus spools at Lennox and ending pipeline section plus spools at Douglas DP
PL1037 2" Methanol Pipeline - Lennox to Douglas (Piggybacked on PL1034) spools at Lennox and ending pipeline section plus spools at Douglas DP
PL1036 12" Gas Injection DISUSED – Lennox to Douglas – ending pipeline section plus spools at Lennox and ending pipeline section plus spools at Douglas DP
PL1036A 12" Gas Injection – Douglas to Lennox - ending pipeline section plus spools at Douglas DP
PL1038 2" Wax Inhibitor Pipeline - Lennox to Douglas (Piggybacked on decommissioned PL1036) ending pipeline section plus spools at Lennox and ending pipeline section plus spools at Douglas DP
PLU6435 Control Umbilical for PL1034 SSBV (Lennox), from SUTU (LD area) to SSBV (PL1034)
PLU6436 Intrafield Control Umbilicals and SUTU in the Lennox area connecting the PL1034 SSBV with PL1036A SSBV and Lennox
PLU6437 Control Umbilical for PL1035 SSBV (Lennox), from SUTU (LD area) to SSBV (PL1035)
PLU6438 Control Umbilical from Lennox Platform to SUTU (LD area)
PL6426 Power Cable – Hamilton to Lennox – ending sections at Hamilton and at Lennox, as per Subsea Removal Layout around Hamilton and Lennox
PLU6445 Intrafield Control Umbilicals and SUTU in the Douglas DP area connecting the PL1034 SSBV with Douglas DP
Hamilton Pipelines
PL1040 2" Methanol Pipeline - Hamilton to Douglas (Piggybacked on PL1039) - spools at Lennox and ending pipeline section plus spools at Douglas DP
PL1039 20" Gas Export – Hamilton to Douglas – ending pipeline section plus spools at Douglas DP
PL6424 Power Cable – Douglas to Hamilton - ending sections at Douglas DP and at Hamilton, as per Subsea Removal Layout around Douglas DP and Hamilton
Hamilton North Pipelines / Power Cables
PL1041 14" Gas Pipeline – Hamilton North to Douglas – ending pipeline section plus spool at Douglas DP
PL1042 2" Methanol Pipeline - Hamilton North to Douglas (Piggybacked on PL1041) - ending pipeline section plus spool at Douglas DP
PL1860 8" Flexible Gas Pipeline - Hamilton East to Hamilton North - ending section as per Subsea Removal Layout around Hamilton North
PLU1861 Umbilical – Hamilton North to Hamilton East - ending section as per Subsea Removal Layout around Hamilton North

PL6423 Power Cable – Douglas to Hamilton North - ending sections at Douglas DP and at Hamilton North, as per Subsea Removal Layout around Douglas DP and Hamilton North

Figure 3 below shows the facility schematic illustrating the split between Phase 1 and Final Decommissioning.



Source: Eni

Figure 3 Schematic of proposed phasing of decommissioning.

Base case removal option methodology for Phase 1 is the so called 'cut & lift' method. This can be used for any diameter or length of pipeline. For the cut & lift recovery technique, the pipeline is cut and recovered to a suitable vessel (CSV or DSV) which utilises subsea cutting equipment operated by either drivers or ROV. The pipeline is cut subsea along the pipeline route into manageable lengths depending on the vessel deck space available typically ranging from 12m to 24m. Upon completion of cutting, the pipeline is recovered by the vessel crane to either the vessel deck or a suitable barge for transportation to port for onshore disposal.

Two options are available for pipeline cutting, the first being that all cuts can be completed along the route before conducting pipe section recovery, or the 2nd option of cutting and recovering each pipe section in turn as the vessel proceeds along the route.

All recovery operations are conducted in a horizontal orientation.

This option has been widely used in industry for removing shorter sections of pipe, either for the removal of a short pipeline in its entirety, or when discrete sections are being removed under a decommissioning plan. It is usually the preferred removal option for short sections of pipe, when it is impractical or prohibitively expensive to mobilise major removal equipment.³

³ LBA Decommissioning Project. Offshore Pipelines Decommissioning Method Statement.

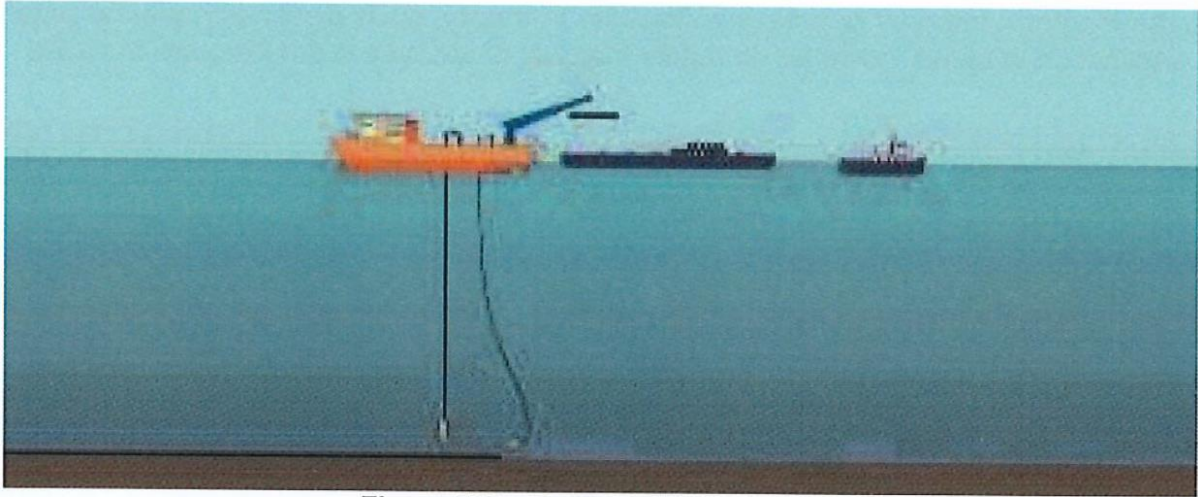






Figure 4 Cut and Lift Technique



Figure 5 Recovering Cut Pipe section with Hydraulic Grapple


Some of the tools intended to use for cut & lift are:

Table 2 Tools to be used for cut & lift⁴

Tool	Description
<p>DWS SubSea Cutter</p> 	<p>Deck Crew to rig up the cutting tool and deploy it to cut location (typically from 6 to 18m length – based on Flexible product behaviour observed after first cut and recovery on deck).</p>
<p>10 TONNE SUBSEA SHEARS - 42" Jaw Opening</p> 	<p>Alternatively, if shear cutter is not able to cut the unknown Flexible product section a 6" ROV rotary disk cutter from ROV might be used.</p>
<p>20 Tonne Grab</p> 	<p>Deck Crew with Crane Operator assistance deploy Grabbing Tool pre-rigged with associate rigging in order to grab the demolished Flexible product as per identified location by ROV.</p> <p>Alternatively, bridle lifting rigging will be used for recovery with diver assistance.</p>
<p>10Te Clamshell Grab</p> 	<p>Once the grabbing tool is locked on the demolished section, crane to start lifting the Flexible product section under ROV monitoring for recovery on DSV/ROV vessel deck.</p>


The items would be removed and transported to the shore for disposal and/or recycling in a safe transportation, and for these activities is it projected to use following vessels:

Table 3 Transportation to be used for cut & lift⁵

Vessel	Services	Picture
<p>DSV Challenger</p>	<p>Subsea construction and installation work.</p> <p>Diving support operations, saturation and air diving.</p> <p>Subsea inspection, repair and maintenance works.</p> <p>Light trenching support.</p>	

⁴ LBA Decommissioning Project. Pipeline, Umbilical and Flexible Flowlines Marine Outline Removal Procedure.

⁵ LBA Decommissioning Project. Pipeline, Umbilical and Flexible Flowlines Marine Outline Removal Procedure.

Vessel	Services	Picture
	Survey and ROV operations	
Pat Taylor	Platform Supply Vessel	

The Marine Outline Procedure for Removal includes also the following important aspects to support Phase 1:

- Vessel positioning / Mooring.
- Comparison Option 1,2 for ROV ops and Diver ops.
- Weather Criteria to be taken into account by Contractor for performing the Phase 1 removals.
- Areas of concern also already identified in an early stage of the design in preparation to the one for the execution.
- Typologies of vessels already identified for performing the works.
- Sequence / study drawings prepared to understand the sequence for removals by means of cut & lift (base case for removal).

The cut & lift method could be also considered as base case for further removals on Final Decommissioning, as determined by the outcomes of the Full Comparative Assessment.

RESULTS AND CONCLUSIONS

Results of the comparative assessment are detailed in the workbook included at Appendix A.

Equipment was screened into the following groups for subsequent assessment:

- G1 – Concrete coated rigid pipelines.
- G2 – Concrete coated rigid pipelines with piggybacked pipeline(s).
- G3 – Rigid pipelines without concrete coating⁶.
- G4 – Flexible pipelines.
- G5 – Umbilicals and power cables.

In summary, the comparative assessment identified that:

- Removal of all subsea equipment within the pink areas shown around platforms (see Appendix B) will avoid prejudicing any future decommissioning options for that equipment or other equipment left in situ.

⁶ Categories G3b and G3c (piggybacked pipelines) were initially assessed but subsequently disregarded from further consideration once it was determined that their separation was not feasible and therefore would be treated as their host pipeline (covered in either G2 or G3). Following removal of G3b and G3c, Group G3a was renamed G3 (see worksheet in Appendix A).

- The most favourable option for buried rigid pipelines (concrete coated or not) other than those being removed from the pink areas shown in Appendix B is to decommission in-situ, with a minimum burial depth of 0.6m. This excludes spools and lengths of pipeline with less than 0.6m of cover approaching in-field facilities, which would be removed. The material currently present on the spools will be re-distributed via jetting and rock re-distribution to fill the excavated trenches, and so cover the cut ends.
- Removal by reeling (where feasible) and partial removal / in situ decommissioning of flexible pipelines, umbilicals and power cables were considered equally attractive options, given that some of the adverse environmental, safety and economic impact of full removal was countered by the potential ability to re-use the equipment if removed by reeling.
- Within the scope of partial decommissioning, there are several large diameter pipelines that have one or two smaller diameter pipelines attached to them. These large diameter pipes may either be partially reused for CCS purposes or decommissioned entirely. It is not considered feasible to separate and remove the attached piggybacked pipelines. In cases where the large diameter pipe is to be re-used for CCS, the piggybacked pipelines would be subject to inspection, maintenance and repair procedures associated with the CCS project. Thus, their condition would be maintained sufficiently to enable a full range of decommissioning options to be considered at a later date. In cases where the large diameter pipe is being decommissioned, the piggybacked pipelines would be subject to the same decommissioning option and treatment as the large diameter pipe, that is burial to a minimum of 0.6m.
- Due to natural patterns of water and sediment movement in the Liverpool Bay area, it was identified that the opening of trenches for the removal of pipelines would need to be done in sections to avoid natural backfilling of trenches. While this staged approach prevents backfilling, it would potentially result in more seabed disturbance and time in the field.

APPENDIX A COMPARATIVE ASSESSMENT WORKBOOK

APPENDIX B DECOMMISSIONING PHASE 1 FIGURES

Douglas, Hamilton North, Hamilton and Lennox platforms

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