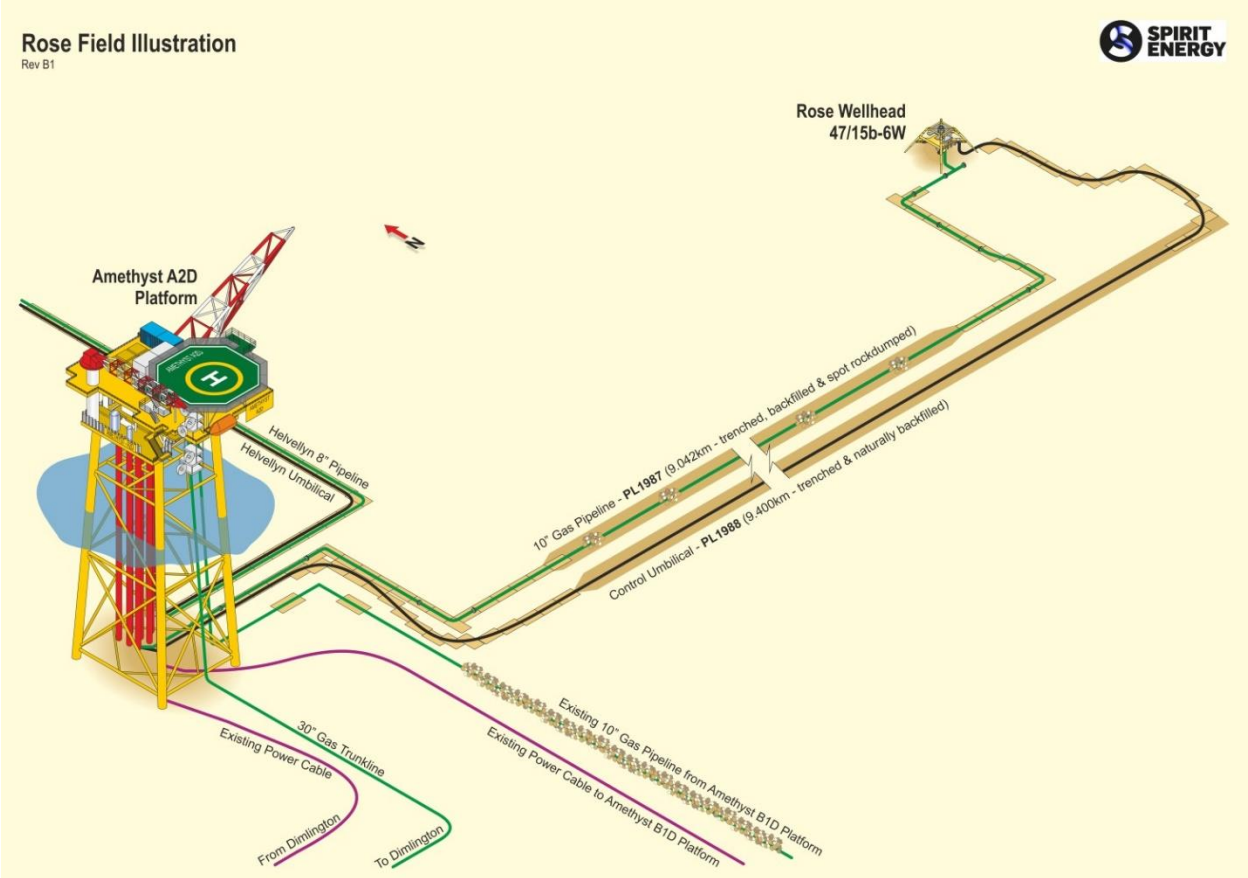
Rose Decommissioning
Close-Out Report



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Prepared by:	R. Taylor		25/7/18
Reviewed by:	S. Axon		25/7/18
Approved by:	C. Arkless		25/7/18

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EXECUTIVE SUMMARY

This document contains the close-out report for the two Rose Decommissioning Programmes (DP) approved by the Secretary of State on the 29 May 2015, one for each set of notices under section 29 of the Petroleum Act 1998:

- The Rose installation (a wellhead protection structure), and;
- The associated pipeline and umbilical.

Key elements of the approved Decommissioning Programmes are summarised below:

- The Rose well will be abandoned;
- Removal of WHPS: To remove the installation and leave a clear seabed;
- Pipeline will be flushed and most of it will be left *in situ* with the short end sections cut and removed to minimise snag hazards arising in future;
- Umbilical will be flushed and will be left buried *in situ* with the short end section being cut and removed to minimise snag hazards arising in future. The section of umbilical within the J-tube at the Amethyst A2D platform will be fully removed;
- Mattresses and grout bags will be removed as part of the partial pipeline and umbilical removal activities.

Following completion of the Rose decommissioning operations, Spirit Energy Resources Limited (SERL) has reviewed the activities to ensure that the scope has been fully executed in accordance with the approved Decommissioning Programmes, that risks to other users of the sea have been removed or reduced to as low as reasonably practical (ALARP), and regulatory requirements have been met.

As a result of monitoring and review of recorded data, SERL believes that all residual risks to other users of the sea have effectively been removed on a long-term basis and that a programme of future field infrastructure surveys would not provide any useful information in this regard. SERL believes that the stability of the seabed, pipeline and umbilical in this area is such that assuming the burial survey results from 2018 are satisfactory it will be unnecessary to conduct further inspection and verification work in future.

Analysis of environmental survey data also suggests that the local environment is returning to a state typical of the wider southern North Sea region. With no further site specific anthropogenic inputs, it is felt that that natural degradation of contaminants should help restore the area to pre-developed conditions on a relatively short timescale. Accordingly, SERL proposes that, no additional site and environmental surveys in the Rose area are necessary.

Approval for the final status of the seabed in the former development area has been acquired from National Federation of Fishermen's Organisation (NFFO), in the form of the trawl clearance certificate. SERL now seeks formal approval from Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to enable full project close-out.

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ACRONYMS AND GLOSSARY OF TERMS

ACRONYM	DESCRIPTION
A2D	Amethyst A2D Platform, a NUI owned and operated by Perenco UK Limited
AET	Apparent Effects Threshold
ALARP	As Low As Reasonably Practical
Ba	Barium
BAC	Background Acceptance Criteria
BC	Background Concentrations
BOP	Blow Out Preventer
BRC	Background Reference Criteria
bscf	billion standard cubic feet
Bullhead	The operation of placing a column of heavy fluid into a well bore in order to prevent the flow of reservoir fluids without the need for pressure control equipment at the surface
CA	Comparative Assessment
COP	Cessation of Production
DECC	Department of Energy and Climate Change
DOB	Depth of burial. The depth between the blue line (DOC) and maroon line (DOL) on the burial profiles
DOC	Depth of Cover: The blue line on the burial profiles shows the profile of cover. The area between the blue line (DOB) and maroon line (DOL) shows the backfill
DOL	Depth of Lowering: Pipeline trench profile; depth of lowering to top of pipe
DP	Decommissioning Programme(s)
DPSV	Dynamic Positioning Supply Vessel
DSV	Dive Support Vessel
EPA	Environmental Protection Agency
FEMUL	Fugro EMU Limited
FIV	Flowline Isolation Valves
GY	Great Yarmouth, UK
HSE	Health and Safety Executive
IBC	Intermediate bulk container
ICC	Isolation Confirmation Certificate(s)
kg	kilogramme
KIS	Kingfisher Information Service. KIS keeps the fishermen up to date via bulletins with the latest information on latest hazards, planned developments, new structures being installed and zones created
km	kilometre
m	Metre
NB	Nominal Bore
NFFO	National Federation of Fisherman's Organisation
NORM	Naturally Occurring Radioactive Material
NUI	Normally Unattended Installation
MAT	Master Application Template
OGA	Oil & Gas Authority
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo-Paris Convention
PAH	Polycyclic Aromatic Hydrocarbon
Perenco	Perenco UK Ltd, owner and operator of Amethyst A2D Platform
PL1987	Rose pipeline
PLU1988	Rose umbilical pipeline
PWA	Pipeline Works Authorisation
ROVSV	ROV Support Vessel
SAT	Subsidiary Application Template
SEI	Significant Environmental Impact
SERL	Spirit Energy Resources Limited (formerly Centrica Resources Limited)

ACRONYM	DESCRIPTION
SNS	Southern North Sea
Spirit Energy	In November 2017 Centrica Exploration and Production and Bayerngas formed a Joint Venture called Sprit Energy
SS7	Subsea 7
SUTU	Subsea Umbilical Termination Unit
Te	Metric Tonne (1,000kg)
TOC	Total Organic Carbon
TOP	Top of Pipe
TOM	Total Organic Matter
TUTU	Topside Umbilical Termination Unit
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKOOA	United Kingdom Offshore Operators Association
US	United States (of America)
VOWD	Value of work done
WBM	Water Based Mud
Wellhead	Component at the seabed surface that provides the structural and pressure containing interface for the drilling and production equipment. A wellhead must be present in order to use a Xmas tree
WHPS	Wellhead Protection Structure
Xmas Tree	Christmas Tree. An assembly of valves, spools, and fittings used for different types of well and used to control the flow of fluids into or out of the well

1 INTRODUCTION

1.1 Purpose

This document contains the close-out report for the two Rose Decommissioning Programmes approved by the Secretary of State on the 29 May 2015, one for each set of notices under section 29 of the Petroleum Act 1998:

- The Rose installation (a wellhead protection structure), and;
- The associated pipeline and umbilical.

The Decommissioning Programmes explain what was to have been achieved after completion of the removal activities. The Decommissioning Programmes were supported by a Comparative Assessment [2] and an Environmental Impact Assessment [1].

This decommissioning report provides the outcome of the Rose Decommissioning activities and marks the formal close out submission to the Offshore Petroleum Regulator for Environment and Decommissioning as described within their Guidance Notes.

1.2 Field Overview

The Rose field (block 47/15), wholly owned by SERL and comprised of a single subsea well (47/15b-6W) within the Southern North Sea tied back to the Perenco UK Ltd (Perenco) operated Amethyst A2D platform via a 9.042km long 10" nominal bore pipeline. Methanol supply and control of the tree at Rose was by means of a 9.400km nominal 4" diameter umbilical from the A2D platform.

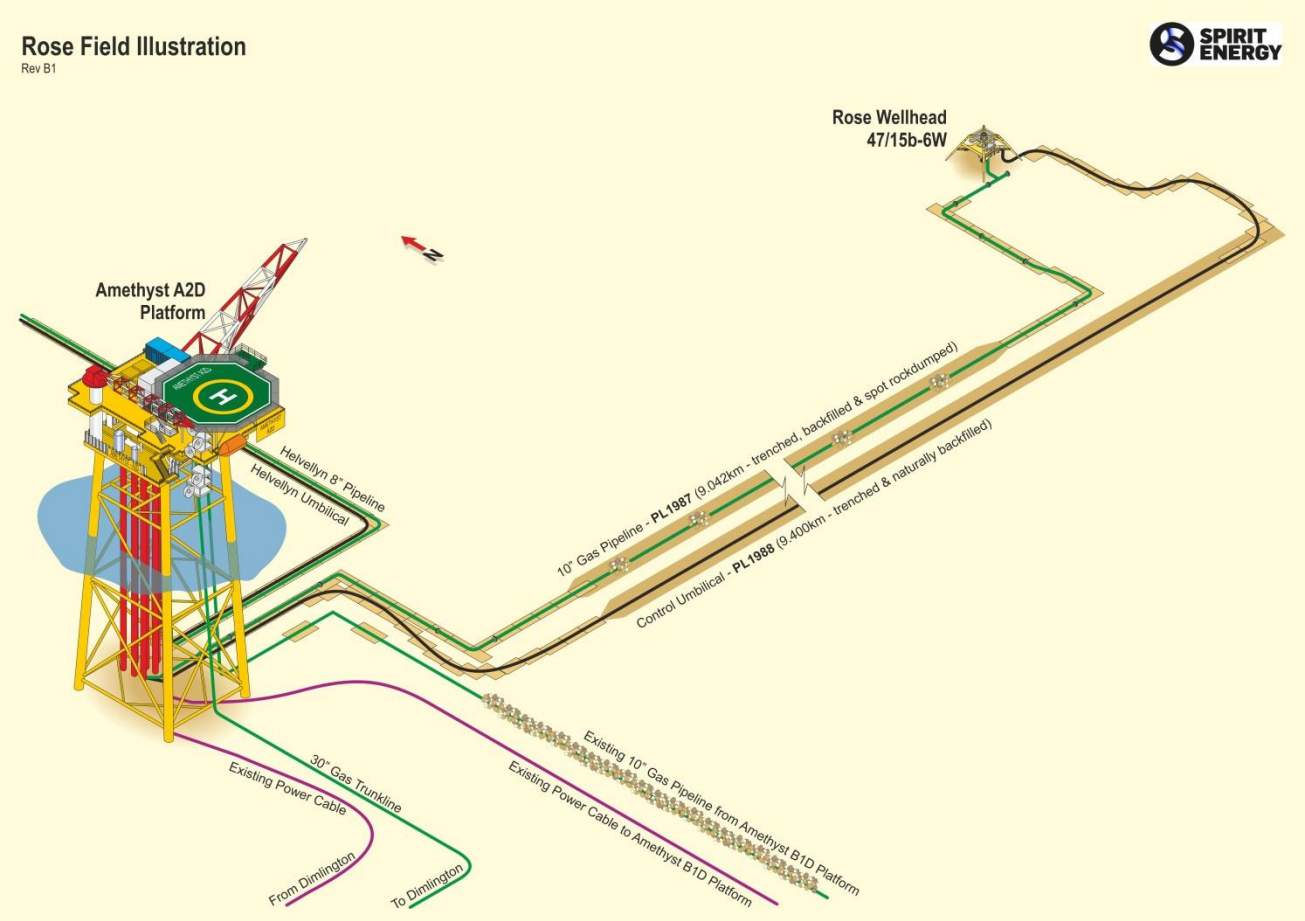


Figure 1.2.1: Rose Field layout prior to Decommissioning

The remaining subsea infrastructure included the Rose wellhead, wellhead protection structure (WHPS), Xmas tree and stabilisation features for protection which included concrete mattresses, grout bags and deposited rock.

Perenco operated the Rose well on behalf of SERL via the A2D platform with produced gas being transported to the Easington Gas Terminal for onshore processing. First gas was achieved in January 2004 with production ceasing in September 2010.

An attempt was made to restart the well in February 2011, but this was unsuccessful due to what was believed to be heavy liquid loading within the Rose well. The use of foam to aid lifting of liquids was examined but deemed uneconomic as the existing chemical injection was routed to only the wellhead and so it was not possible to inject foaming agents down the well. Remaining development opportunities were also evaluated at the time but were deemed neither technically nor economically feasible. As a result, SERL began planning for decommissioning of the Rose field and its related infrastructure.

2 DECOMMISSIONING PROGRAMMES

With the Rose well no longer producing and any extension options not being considered viable a Cessation of Production report was submitted to DECC Licensing, Exploration and Development (now part of OGA) and approved on the 22 May 2015. The Rose Decommissioning Programmes were submitted along with all required supporting data and approved on the 29 May 2015; the OPRED approval reference is 12.04.06.08/43C.

Key elements of the approved DP are summarised below and covered in more detail in this report.

- The Rose well will be abandoned;
- Removal of WHPS: To remove the installation and leave a clear seabed;
- Pipeline will be flushed and left buried *in situ*: Most of the 10” pipeline will be left *in situ* with the short end sections cut and removed to minimise snagging hazards arising in future;
- Umbilical will be flushed and left buried *in situ*: The umbilical and its associated 36mm steel ballast wire will be left *in situ* with the cut ends excavated locally at the cut location and removed to minimise snagging hazards arising in future. The section of umbilical within the J-tube at the Amethyst A2D platform will be fully removed;
- Mattresses and grout bags will be removed as part of the pipeline and umbilical partial removal activities.

3 AMENDMENTS AND REVISIONS TO THE DP

No formal amendments were made to the approved DP and no deviations to decommissioning guidance and legislation requirements were made during the project.

4 DECOMMISSIONING ACTIVITIES

The following section describes the completed decommissioning activities, how they were executed and confirms that the completed activities were carried out in accordance with the approved DPs. Decommissioning activities carried out on pipelines PL1987 & PLU1988 are provided in more detail within section 5 of this report.

The execution phase was split into three distinct phases: Phase 1 platform and subsea works, Well Abandonment and Phase 2 platform and subsea works. This was deemed to be the best execution strategy from a cost and scheduling perspective, taking advantage of efficiencies that could be gained during phase 2 of execution.

Phase 1 was executed for Rose as a standalone campaign and comprised the following:

- Preparatory works on Amethyst A2D platform;
- Preparation at Rose well location using DSV to facilitate full well abandonment by the jack up drill rig. Activities included isolations and barrier testing disconnection of pipeline PL1987 and umbilical PLU1988 from the tree and removal of WHPS.

Following completion of phase 1 the Rose well was fully abandoned, including removal of Xmas tree and wellhead. Once the well abandonment was completed, phase 2 of the work was completed as part of a wider campaign associated with Stamford. This is because there were similarities in scope and timing for the final phase of the Stamford and Rose decommissioning campaigns. The work for phase 2 comprised the following.

- Preparatory works on Amethyst A2D platform;
- DSV related works, including flush and clean PL1987 & PLU1988, cutting and recovery of end sections, removal of concrete mattresses, grout bags & remaining subsea facilities to leave clean seabed.

4.1 Preparatory Work on Amethyst A2D Platform

Prior to arrival of the DSV in the field the following activities were carried out on the A2D platform to allow diver intervention work to commence:

- Depressurised pipeline PL1987 to seabed ambient and provided the required valve isolations topsides;
- Depressurised and fully isolated hydraulic lines within the Rose umbilical;
- Depressurised and fully isolated chemical injection lines within the Rose umbilical;
- Fully isolated Rose umbilical electrical power;
- Provide Isolation Confirmation Certificates (ICC) for pipeline and umbilical.

4.2 Phase 1 DSV Activities

The offshore work was carried out by Subsea 7 using their Seven Pelican DSV. The vessel mobilised from Hull on the 11 June 2015. The offshore DSV campaign took 13 days to complete. The work scope completed is briefly described below:

- Cleaning and inspection of tree and associated infrastructure which was heavily covered in marine growth;
- Isolations, barrier testing and tree spool flushing for removal;
- Disconnection of pipeline from tree and installation of blind flange on pipeline end in preparation for the next diving campaign;
- Protection of pipeline and umbilical ends using sand bags;
- Fitting blind flange and leak testing of the tree;
- Tree tie-in spools disconnected and recovered;

- Umbilical disconnection, jumper/flushing loop reconfiguration and relocation of SUTU;
- Remove WHPS.

These activities were completed by the dive team on the Seven Pelican. The WHPS was removed using the Seven Pelican prior to arrival of the drilling rig. The pipeline and umbilical were successfully disconnected to allow the drill rig to remove the Xmas tree and wellhead.

4.2.1 Phase 1 Removal of WHPS

The Rose WHPS was of welded construction and connected to the wellhead. It was cut and removed in sections. First the top canopy (debris cover) was removed, followed by the sloping legs and the remaining structure leaving just the base. This was left in place to be recovered along with the wellhead using the drill rig.

The debris cover was secured by two locking pins in diagonally opposite corners on the WHPS. Once the locking pins were moved to the 'open position' the debris cover could then be removed and recovered to the vessel deck.

The posts were cut using a diamond wire cutter, with the cuts being made as close to the main structure as possible. The sloping legs were then recovered to deck. While the diamond wire cutter could be used to cut three out of the four posts the fourth was cut using a reciprocating saw because access was restricted. While most of the WHPS was recovered to the deck of the DSV, the base was recovered to the drill rig. Figure 4.2.1 shows the points where the posts were cut.

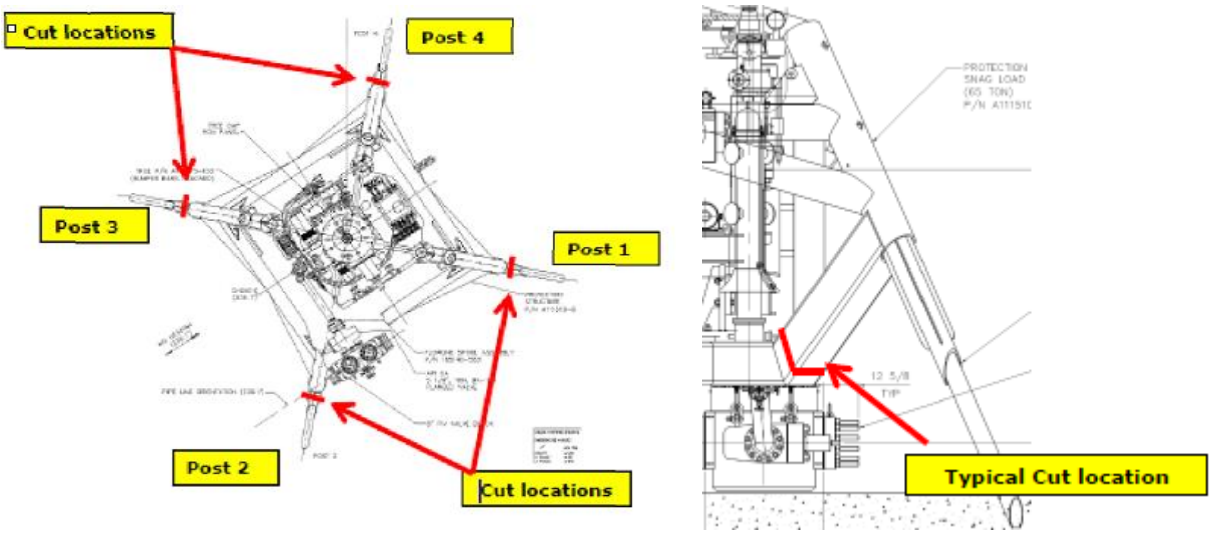


Figure 4.2.1: Rose WHPS – Cut locations for posts

4.3 Abandonment of the subsea well

The Rose subsea well 47/15b-6W was abandoned in line with Oil and Gas UK "Guidelines for the Suspension and Abandonment of Wells" [9] and adhering to SERL Standards. This involved removing the subsea Xmas tree, recovering the upper completion and setting three permanent barriers. These barriers were to isolate the hydrocarbon bearing Leman Sandstone reservoir, the over-pressured water bearing Plattendolomit formation and chalk sequence. The subsea wellhead system was also recovered to 10ft below the seabed.

The jack up rig Paragon B391 arrived on location on the 2nd July 2015 and ran a landing string to connect to the tree. The tubing contents were bullheaded with seawater and a plug set in the lower completion. After cutting the tubing above the production packer the completion brine was displaced with seawater from the annulus. The Xmas tree was then recovered before rigging up the BOP and pulling the completion.

The 9 5/8” casing was logged with an isolation scanner which identified channelled cement behind the 7” liner, requiring remediation to isolate the Plattendolomit formation. A 1,005ft cement plug was set deep in the 7” liner, which was tagged 9,037ft before displacing the well to heavy WBM. This plug served as a barrier between the over-pressurised water bearing Plattendolomit formation and the Hauptdolomit/Leman Sandstone. It is also a barrier to surface for the Leman Sandstone.

A second combination cement plug was then set by perforating 200ft of 7” liner and 9-5/8” casing and setting cement across the interval. Cement was then brought back to 800ft above the bottom perforation. This plug was tagged at 7,663ft, inflow tested with seawater and is as a barrier to isolate the over-pressured water bearing Plattendolomit formation, whilst also acting as the secondary barrier to the Leman Sandstone in wells 47/15b-6Y and 47/15b-6W. The 9 5/8” and 13-3/8” casings were cut and pulled before displacing to seawater and setting a 3rd cement plug of 518ft. This was tagged at 300ft. Wellhead and casings were then cut 10ft below seabed before performing an as left seabed survey and departing the location.

All activities were consented under the appropriate permits and monitored throughout operations by an independent well examiner. The subsea well 47/15b-6W abandonment was completed in a total of 44 days. The abandoned well schematic is included in Appendix A.1.

4.4 Phase 2 Decommissioning Activities

The final part of the campaign was concerned with removal of the remaining infrastructure thereby leaving a clear seabed. Three vessels were used to carry out the work and these were:

- The DSV **Seven Pelican** addressed all diving critical activities which included; flooding PL1987 from former Rose well location, hook up of Olympic Taurus for receipt of flushing waste, flush and clean PL1987 with the required 120% line-volume, cutting the umbilical at A2D, and disconnection of PL1987 at base of the riser and installation of a blind flange at the base of the riser;
- The DPSV **Olympic Taurus** took receipt of flushing waste via filtration equipment on-board the vessel;
- The ROVSV **Seven Pacific** completed all remaining pipeline and umbilical cuts at required burial depths, recovery of concrete mattresses, grout & sand bags and remaining infrastructure on the seabed.

4.4.1 Phase 2 Preparatory Works on Amethyst A2D Platform

Prior to and during the offshore campaign for the phase 2 scope of work, the A2D operations team and 3rd party contractors carried out the below activities on the platform to support the subsea decommissioning work. This included:

- Installation of flushing equipment skid & flushing of PLU1988 methanol cores;
- Supported flooding of PL1987 back to A2D platform from the former Rose well location, venting pipeline gas from the platform vent system;
- Installation of support on A2D for flushing hoses routed between DSV and A2D;
- Topsides barriers and isolations put in place prior to nitrogen purge of topsides pipework to allow breaking containment for hook up of pipeline flushing pipework;
- Flushing of PL1987 from A2D platform to former Rose well location. This included loading of gel pig train and transfer of flushing hose assembly from DSV to platform tie-in location;
- Cutting of PLU1988 at base of J-tube using hydraulic shears deployed from the DSV. This operation included the installation of a winch on A2D platform to support the umbilical section as it was lifted through the J-tube. This also required the safe removal of walkway grating panels on several deck levels;
- Topping up the Rose riser with treated potable water once the pipeline had been disconnected and installation of a blind flange at the base of the riser;

- Confirmation of permanent isolations being in place once pipework re-installed following flushing and leak testing of pipeline;
- ICCs signed & copies issued as required during operations.

4.4.2 Subsea Equipment and Pipeline Stabilisation Features

Prior to the removal of mattresses by the Seven Pacific, an ROV survey was carried out to confirm the condition and number of mattresses to be removed at the former Rose well site and the Amethyst A2D Platform.

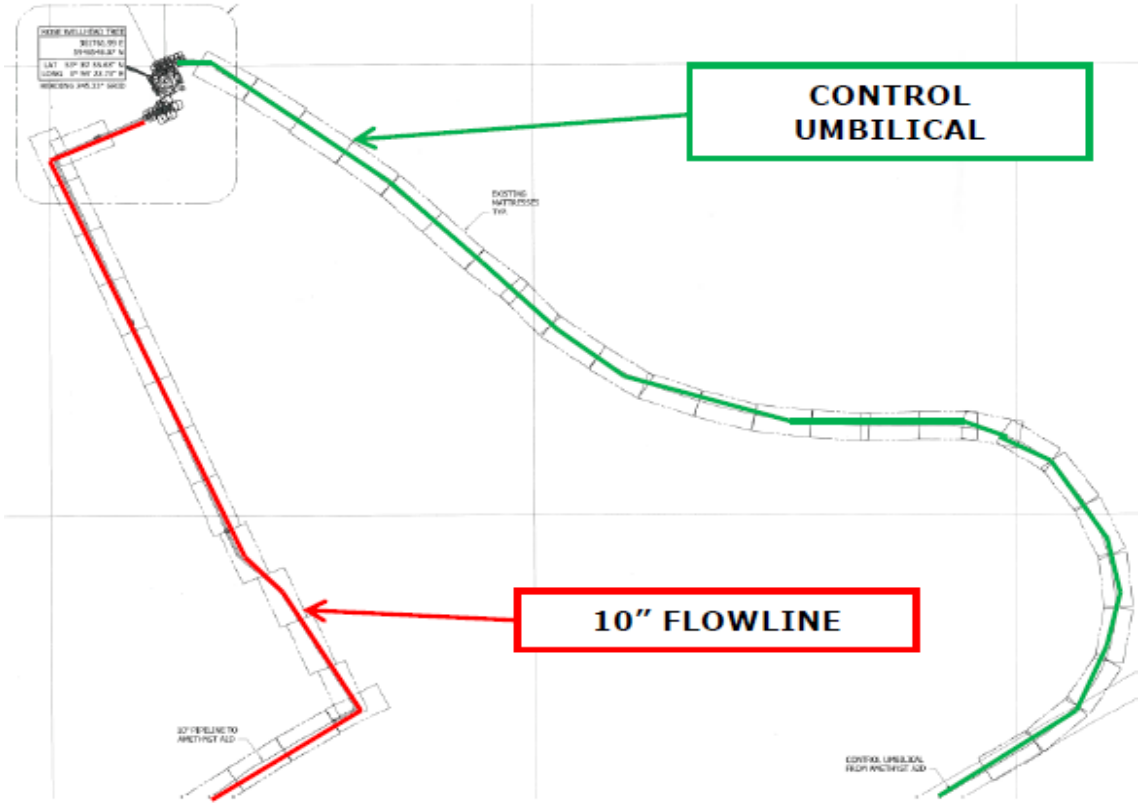


Figure 4.4.1: Mattress locations on Rose well approaches

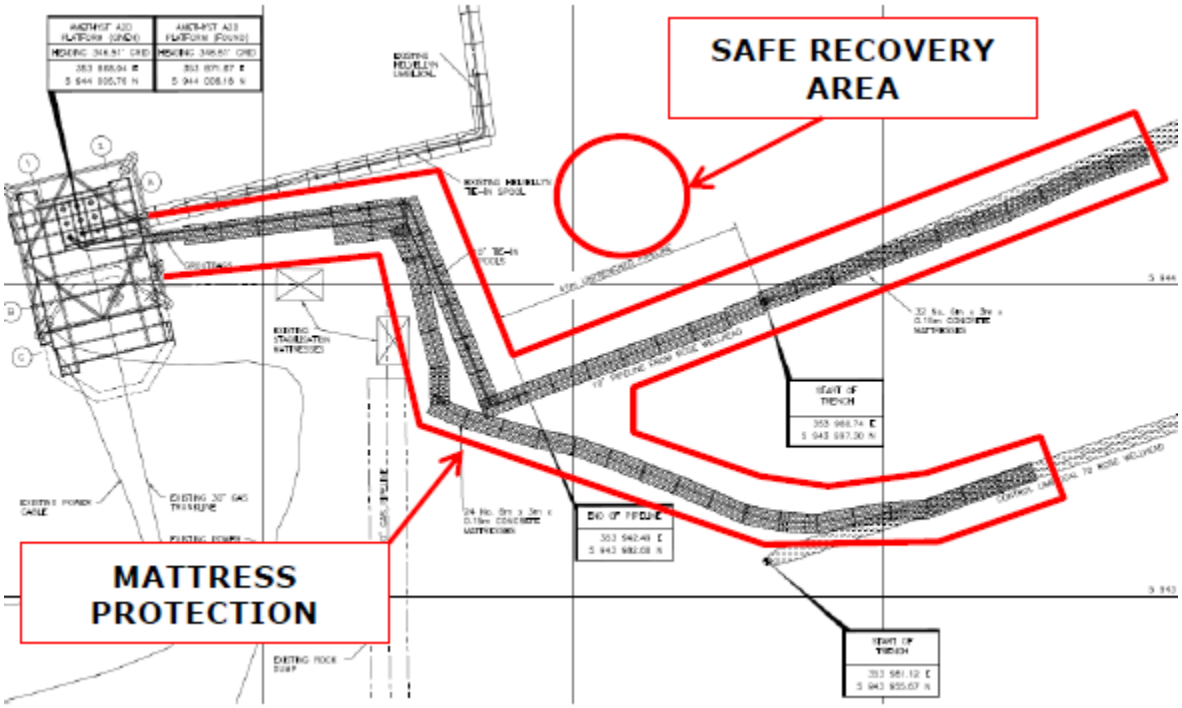


Figure 4.4.2: Mattress Removal at Amethyst A2D Platform

Lifting loops were checked for condition prior to each lift. An ROV operable mattress spreader beam was then deployed via the ROVSV crane (Figure 4.4.3). The lifting beam was positioned over the concrete mattress and snap hooks were connected by ROV along one edge. The crane hook was lifted gently all-the-while with the ROV monitoring the activity. The mattresses were brought back to deck and stored in speed loaders for ease of back load.

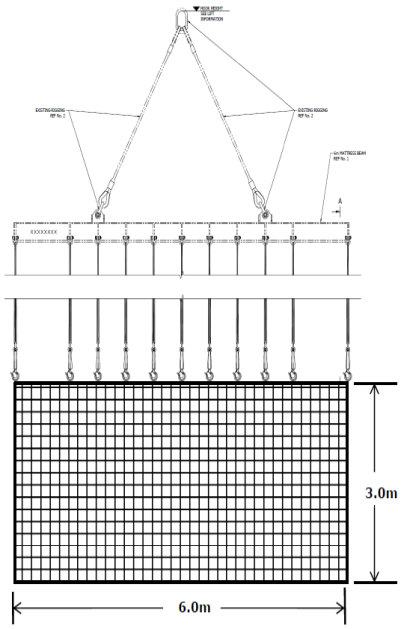


Figure 4.4.3: Mattress Rigging

All concrete mattresses at Rose and Amethyst A2D were found to be in good condition and were lifted successfully using this method. There was some minor degradation of mattresses but this did not impede the method used.

All grout and sandbags were removed from the seabed using an hydraulic grab with half shell bucket attachments, once lifted from the seabed they were decanted into a subsea basket and recovered to deck. Sand bags were recovered as they had been deposited during phase 1 to protect the FIVs and SUTU. The FIV block (Figure 4.4.4) and SUTU (Figure 4.4.5) were lifted to deck with the platform crane and localised rigging. An visual survey was carried out to ensure that no further subsea equipment or stabilisation items were present at the wellhead location.

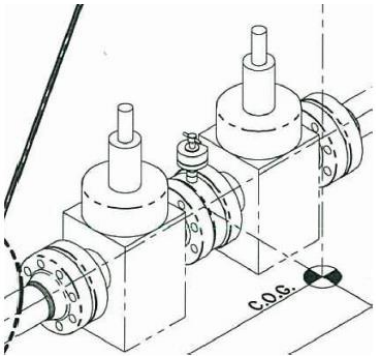


Figure 4.4.4: FIV Block Removal

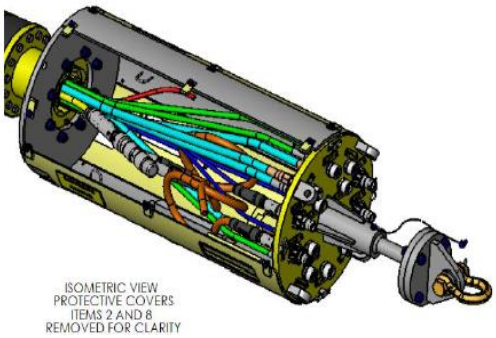


Figure 4.4.5: SUTU Removal

4.5 Rose after decommissioning complete

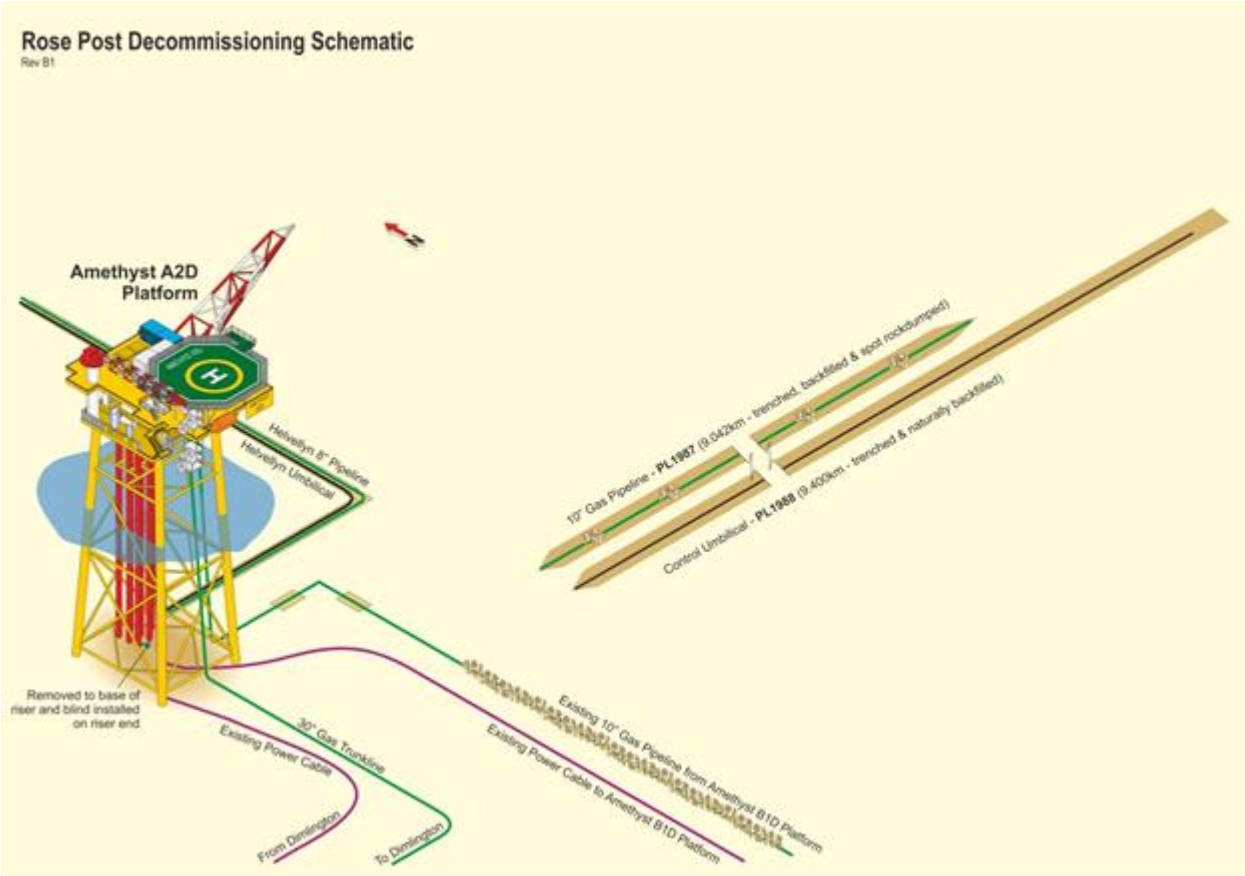


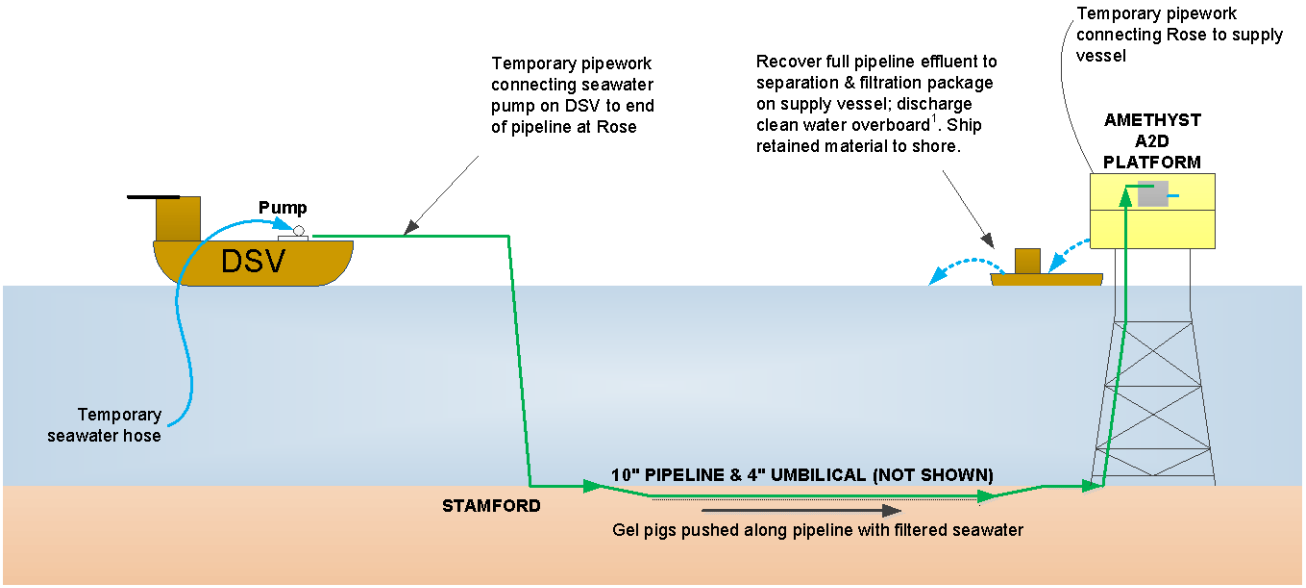
Figure 4.5.1: Rose Following Completion of Decommissioning

5 PIPELINE DECOMMISSIONING

5.1 PL1987 Decommissioning Activities

5.1.1 Flushing, Isolation & Severance

To disconnect the pipeline from the well, during the phase 1 campaign two out of three tie-in spools were removed after being locally flushed to remove hydrocarbon content. With the required barriers and isolations in place, divers disconnected the spools to be recovered to deck. Blind flanges were fitted to tree and pipeline ends and leak tests carried out. The spool pieces were found to contain low levels of NORM contamination. Once on deck, the pipespools were bagged and tagged and quarantined ready for back load and processing onshore.



NOTE
1. This was the original intention, although due to problems encountered with the flitration package, all fluids were retained and dealt with onshore.

Figure 5.1.1: Rose Pipeline Flushing Schematic

During Phase 2 pipeline flushing operations were completed between the Seven Pelican and Olympic Taurus. The Olympic Taurus was located at the former Rose well location. Divers operating at this end removed the blind flange and installed a flooding flange[1] that was to be used to allow the pipeline back to the A2D platform to fill freely with raw seawater, with any displaced gas being vented at the platform. The divers also attached a crossover flange assembly to the flushing hose routed to the Olympic Taurus. The DSV then moved to the Rose platform to connect the flushing hose between the DSV and platform. A gel pig train was loaded into the pipeline at the platform and DSV started pumping operations using filtered seawater.

The pipeline was flushed clean with using 120% line-volume with the pipeline contents being received by a filtration spread on the Olympic Taurus. Once pipeline flushing was completed the DSV disconnected and retrieved the flushing hose from the platform and sailed to the former well location to disconnect the Olympic Taurus hose subsea, thereby completing the pipeline flushing work scope.

At the Amethyst A2D platform end the pipeline was disconnected at the base of the riser and blind flange installed as an environmental barrier. The riser was then filled with potable water using the temporary pipework that had been installed for the pipeline flush. Once the diver intervention works at both locations has been completed, the DSV was demobilised.

[1] Essentially this is a specially designed pipeline flange that is perforated with several small holes in place of one hole the size of the pipeline bore. This reduces the possibility of ingress material that would otherwise clog the pipeline.

The final pipeline decommissioning activities were completed using the Seven Pacific. The remaining exposed pipeline was cut starting at the FIV location at the end of the pipeline using an hydraulic shear cutter and vessel crane. The ROV was used to guide the crane rigging to the required cut locations 10m apart, using a buoy and sonar reflectors. At the deposited rock transition point the 6" pipeline was exposed using a grapple, and the cut was made at the required 0.6m depth of burial.

The hydraulic grab was then used and pipeline sections removed from the seabed and recovered to deck.

5.1.2 PL1987 Burial Status

The pipeline burial status in 2012 [3] showed excellent depth of burial and cover along most of the length.

Following completion of decommissioning activities, the pipeline was surveyed again in 2016 (Appendix B.1). The results showed a similar trend, with a good and consistent depth of cover along the pipeline. The pipeline will be surveyed again in 2018.

5.2 PLU1988 Decommissioning Activities

5.2.1 Flushing, Isolation & Severance

During the phase 1 campaign with the umbilical fully isolated at the A2D platform the dummy stab plate was removed from the park position on the Xmas tree, the production stab plate was then disconnected and placed in a safe laydown area off the seabed. The dummy stab plate was then installed onto the production stab plate for protection in preparation for the upcoming drill rig activities. The electrical connectors were removed along with hydraulic and chemical connectors. Once all jumpers were disconnected they were removed from the Xmas tree and recovered to surface in a basket. Flushing loops were installed on the chemical injection lines at the SUTU to allow round trip flush from platform at later date. The SUTU was moved to a safe laydown area clear of the tree and protected with sand bags.

The next phase of umbilical decommissioning was flushing of the chemical injection cores from the platform, displacing the chemicals within the cores with filtered sea water with return waste being contained in Tote Tanks located on the platform. This was completed prior to the Phase 2 offshore campaign commencing.

Phase 2 activities were then carried out on the A2D platform with the umbilical disconnected from the topside umbilical termination unit (TUTU) and cut at the J-tube hang off location with access via overboard scaffold which had been installed prior to DSV arrival. The exposed cut section of umbilical at the J-tube hang off was then rigged accordingly and connected to the platform crane. The bottom seal was removed by diver and the umbilical was cut at the base of the J-tube. The severed section of umbilical within the J-tube was then recovered using the platform crane. The umbilical was then cut into sections for transfer to shore.

The umbilical was removed from the seabed at the former Rose well location using the same method as used for the pipeline. At the cut location the seabed was excavated locally within the trench to gain access for cutting. At the well end the umbilical was cut at 0.8m below seabed and at the platform end the umbilical was cut at a depth of 1.0m below the seabed. This was to ensure that the length of umbilical remaining *in situ* would remain sufficiently buried, thereby avoiding the need for potential remedial work in future. The changes are detailed in Pipeline Works Authorisations [4][5].

The hydraulic grab was then used to remove the umbilical sections from the seabed and recover them to deck.

5.2.2 PLU1988 Burial Status

In 2012 [3] the umbilical showed excellent depth of burial and cover along most of its length.

Following completion of decommissioning activities, the umbilical was surveyed again in 2016 (Appendix B.2). The results show a trend largely consistent to that determined in 2012, with a good but varying depth of cover along the umbilical, particularly along the first 3.5km, where the depth of cover is relatively shallow.

The 2016 burial profile for PLU1988 is presented in Appendix C. The events listings are summarised in Table 5.2. Events listings for 2012 are presented in Table 5.1 for comparison.

Table 5.1: PLU1988 Events Listings, 2012

KP Start	KP End	Length (m)	Comment
0.862	0.866	4.0m	1 x concrete mattress, left *in situ*
0.989	0.990	1.0	Exposure
1.782	1.782	<1.0m	Exposure
3.085	3.096	11m	Exposure
6.543	6.562	19m	3 x concrete mattresses; left *in situ*
9.229	9.377	148m	Concrete mattresses, removed

Table 5.2: PLU1988 Events Listings, 2016

KP Start	KP End	Length (m)	Comment
0.681	0.687	6m	1 x concrete mattress, not noted in 2012
2.662	2.665	3m	Exposure
4.298	4.332	34m	Exposure
6.544	6.562	18m	3 x concrete mattresses; left *in situ*

The depth of burial survey data for PLU1988 showed temporal variability. This variability is not observed in the PL1987 data indicating that the variability may be associated with the survey method, rather than a change to burial status. Interrogation of the survey data and the associated metadata show that in areas where the umbilical is at a shallower depth there is consistency between the two surveys. In areas where the umbilical is at a deeper depth there is variability. This can be attributed to the difficulty in validation due to the umbilical construction. This may be particularly pronounced because at the time of the survey the area was subject to strong currents which can have an impact on data quality. Therefore, given the above, we don't believe that the umbilical burial status has changed significantly between 2012 and 2016.

Three buried midline mattresses between KP6.544 and KP6.562 are noted in the 2012 and 2016 data. However, after more detailed analysis and examination of video data it can be concluded that the concrete mattress at KP0.681 (2012) is not the same concrete mattress as at KP0.862 (2016). There is no evidence of any movement. Therefore, we propose to survey PLU1988 again in 2018 to validate any apparent inconsistencies.

The type of fishing activity in the area is such that we would propose to leave the mattress at 0.681 *in situ* as we believe that there is a low likelihood of snagging on obstructions on the seabed. Both the 2012 and 2016 data show good level of burial and cover with no spans and two exposures, albeit in different locations to those noted in 2012. Given the temporal variability in the depth of burial along parts of the first section of the umbilical we propose to obtain one additional set of survey data in 2018 to confirm the trend of good depth of burial along most of the umbilical and to confirm that it remains stable. Given the type of fishing in the area there is a low likelihood of snagging. Therefore, assuming that the 2018 survey results are satisfactory, we would propose not to carry out any additional site and environmental surveys or inspection of remaining features in the Rose area in future.

6 ENVIRONMENTAL IMPACT AND PERFORMANCE

6.1 Permits and Licenses

The decommissioning work was undertaken under the existing OPEP for the facilities (OPEP Reference number 2053). The scope of the OPEP includes well abandonment and decommissioning.

The Environmental Impact Assessment was submitted to OPRED as a supporting document to the decommissioning programme for the Rose field. The decommissioning programmes and supporting documents were submitted to OPRED for public consultation on the 28th January 2015. Following consultation notification for approval of the decommissioning programmes was given by OPRED (formerly DECC) on 29th May 2015.

The works undertaken were aligned with the proposals submitted in the Decommissioning Programmes and the supporting documents, including the Environmental Impact Assessment.

The permits and licences obtained for the decommissioning of the Rose facilities are shown in Table 6.1 including their current status. The Rose facilities were subsea so no 'Consent to Locate' was required for the decommissioning vessels.

Table 6.1: Rose Environmental Permits and Licenses

Permit	Reference Number	Status
Marine Licence	PLA/228 ML/95/2	Return submitted
Chemical Permit	PLA/228 CP679	Return submitted
Oil Discharge Permit	PLA/228 OTP/310 and OTP/409	Returns submitted
Environmental Permit Radioactive Substances	EPR/RB3898DK	In the process of being relinquished

The Pipeline Works Authorisation for The Rose Field Development (8/W/03) was varied (227/V/16 dated 15 August 2016, [5]) to show the final decommissioned status of PL1987 and PLU1988.

6.2 Environmental Surveys

6.2.1 Background

The results of the post-decommissioning environmental sampling survey are described here. This includes any immediate consequences of the decommissioning activity that have been noticed. Two environmental surveys have been completed around the Rose area (Table 6.2).

Table 6.2: Environmental Surveys in Rose Area

Date	Title	Reference
August 2012	Rose decommissioning environmental baseline survey and habitat assessment	Fugro Report Ref: 12/J/1/03/2115/1394 [6]
October 2016	Rose post-decommissioning environmental survey	Gardline Report Ref: 10860 [7]

Where feasible the post-decommissioning survey adopted techniques and methods used in the earlier surveys to allow the results to be comparable. Similarly the sample locations were targeted to the same locations, where the presence of subsea infrastructure would allow. Sampling was targeted to the area where decommissioning activity took place.

Water depth across the survey area varied from 15.4m LAT on the top of a sand wave in the southeast to 24.5m LAT in the northwest. Seabed sediments comprised shelly gravelly sand with cobbles and boulders. Areas of mega-rippled sand and sand waves were observed in the southeast, consistent with the findings of the pre-decommissioning survey.

Of the fauna observed during seabed imagery, taxonomic richness and diversity were greatest where cobbles were most prevalent. There was a clear spatial trend of declining cobble frequency and declining faunal richness from north northwest to south southeast of the former Rose well location. A similar trend was observed along the west to east northeast transect. Overall the visible fauna assemblages were similar to the pre-decommissioning survey.

Compared with the pre-decommissioning survey the mean grain size had increased at most stations. All stations can be described as gravelly sand, sandy gravel or gravel, with generally a low proportion of fine material (≤3%) and variable gravel contents.

6.2.2 Changes in Environmental Characteristics

Total organic matter (TOM) and total organic carbon (TOC) content in the sediment showed little variation across the stations and were slightly below those of the pre-decommissioning survey.

Total hydrocarbon concentrations and n-alkane concentrations were generally below those recorded in the pre-decommissioning survey. The decline in these concentrations was most notable at stations to the south southeast, indicative of a recovery of the sediments down-current of the former Rose well location. All concentrations were below the 'significant environmental impact' (SEI) threshold, therefore were not expected to have an adverse effect upon the overall macrofaunal community.

Total polycyclic aromatic hydrocarbon (PAH) concentrations in the post-decommissioning survey were broadly similar to those recorded in the pre-decommissioning survey. All US Environmental Protection Agency 16 PAH concentrations were below their respective Apparent Effects Thresholds (AET) Effects Range Lows and Effects Range Mediums in the current and both surveys, indicating that there was no evidence of these individual concentrations having an ecotoxicological effect on the fauna. However, concentrations of US EPA 16 PAHs were not representative of a 'pristine' environment, as described by OSPAR (2005), consistent with the extent of oil and gas activities in the area. With the exception of one sample the barium concentrations were similar for both surveys.

Concentrations of arsenic (As), chromium (Cr), copper (Cu), nickel (Ni), lead (Pb), vanadium (V) and zinc (Zn), once normalised to 5% aluminium (Al), were above their respective BCs or background reference criteria (BRCs) at several or all stations, with the mean normalised As and Ni concentrations were also above their respective BAC (OSPAR, 2005) in the post-decommissioning survey. That was also the case for As, Cu, Ni, and Pb in the pre-decommissioning survey, with As, Cu and Ni mean normalised concentrations above their respective BAC (OSPAR, 2005). Except for Cu, all mean concentrations of the metals analysed were generally higher in the post-decommissioning survey than the pre-decommissioning survey, possibly indicating continued dispersion of metals contamination. It should be noted that apart from Cr and V at one station each in the post-decommissioning survey and Cr, Ni and V at one station each in the pre-decommissioning survey, concentrations of all other metals for which AETs are available, were below such thresholds, indicating that these concentrations were unlikely to have an ecotoxicological effect on fauna.

No reef-like structures or aggregations, nor any mussels beds were observed. The seabed type across the Rose survey area, at most, represented low resemblance to stony reef. Herring spawning potential was considered low. A single individual of *Ammodytes marinus* was sampled. In seabed imagery and video footage one example of *Limanda limanda* and one example of *Agonus cataphractus* were identified.

Sample faunal density and taxonomic richness were broadly similar between the pre and post-decommissioning surveys. Eight of the top ten dominant taxa in the post-decommissioning survey were also in the top ten dominant taxa in the pre-decommissioning survey and in a similar order, indicating relatively little change in the characterising species overall. No other species or habitats of conservation significance were observed across the Rose surveyed area.

In summary, the post-decommissioning survey results showed the area to be broadly similar to those identified in earlier survey; levels of contamination that are not expected to have an adverse effect upon the overall macrofaunal community.

No future environmental monitoring plan was proposed in the Decommissioning Programmes. The decision regarding the requirement for future monitoring was deferred until the results of the post-decommissioning environmental survey were known. Given the results of the post-decommissioning survey being broadly similar to the earlier surveys we cannot envisage a scenario where any remedial action to rectify the environment would be required in the future. On balance, given the relatively small extent of the development and of decommissioning activities, and the comparable results of the environmental surveys we propose not to undertake any future environmental surveys.

6.3 Waste Management Performance

6.3.1 Commitments

Waste was to be dealt with in accordance with the Waste Framework Directive. The reuse of an installation or pipelines (or parts thereof) is first in the order of preferred decommissioning options. Steel and other recyclable metal are estimated to account for the greatest proportion of the materials inventory.

The estimated mass of material to be returned to shore and our aspirations for the disposal of waste were described in the decommissioning programmes (Table 6.3 and Table 6.4) below.

Table 6.3: Inventory Disposition (Te)

Inventory (excludes rock)	Total Inventory	To shore	To be decommissioned *in situ*	Left *in-situ* for potential re-use
Installations	62	62	0	0
Pipelines	1,620	495	1,123	2

Table 6.4: Re-use, Recycle & Disposal Aspirations for Material Recovered to Shore

Inventory	Re-use	Recycle	Disposal
Installations (62 Te)	Approx. 45%	Approx. 55%	<5%
Pipelines (495 Te)	<5%	Approx. 95%	<5%

6.3.2 Performance

Table 6.3 presents the material returned to shore and the final disposal routes. The decommissioning was undertaken in alignment with the decommissioning programme. All the material listed in Table 6.4 was recycled, and no material was sent to landfill.

Table 6.5: Material returned to shore & ultimate disposal route

Item	Description	Location Landed, Date	Comment
WHPS	34.75 Te	Leith 23/06/2015 Yarmouth 13/08/2015	Recycled
Tree	20 Te	Yarmouth 17/07/2015	Reused
Wellhead	5.65 Te	Yarmouth 28/07/2015	Recycled
Spool	1.3 Te drop down spool	Leith - 23/06/2015	Recycled
Spools and pipeline sections	364m	Peterhead 12/06/2016	Recycled
Umbilical sections	377m	Peterhead 12/06/2016	Recycled
Mattresses	122 total	Great Yarmouth 19/05/16 between 02/06/2016	Recycled
Grout Bags	200 total	Great Yarmouth 18/05/16 between 02/06/2016	Recycled

Small quantities of debris were recovered and disposed of all in accordance with the waste hierarchy.

7 HEALTH, SAFETY & ENVIRONMENT

7.1 Key Performance Data

The HSE Key Performance data for the project is listed in Table 7.1. A number of Key Performance Indicators were tracked on the project.

Table 7.1: Rose HSE Performance Summary	
Metric	**Total**
HIPO Events	0
Lost Time Injuries/Restricted Work Case	0
Medical Treatment Cases	0
Health Related Treatment Case	0
First Aid Cases	0
Near Misses	0
Environmental Events	2
Material Loss	1
Observation Cards	115

Although overall the HSE performance during the project was strong, three minor incidents occurred:

- Fishing vessel carrying out a seabed clearance survey post-decommissioning activities reported that its trawl nets had become stuck on a subsea obstruction. Whilst recovering the trawl net to deck, the net became entangled in the vessels propeller, resulting in a loss of propulsion. The obstruction was found to be some man-made debris outside the Rose 500m zone. Given the size of the object and the potential hazard it presents we notified UKHO and KIS.
- Two minor environmental excursions concerning small volume loss of hydraulic fluids in the equipment used during recovery operations. These were dealt with by following due process and liaising with OPRED.

The vessel crews were fully inducted into the SERL Safety expectations during preparations for mobilising the vessel mobilisations and we believe that led to a safe project execution.

As is standard procedure when incidents occur, we have examined the root cause of the events and incorporated any lessons learned into our procedures and processes so that we can avoid the re-occurrence of similar incidents in future.

Overall we believe that the HSE performance during the Rose decommissioning project was acceptable.

7.2 Safety Case

As duty holder of Amethyst A2D platform, Perenco submitted all the appropriate Safety Case revisions under Regulation 14. At the time of the project, Amethyst A2D was still producing.

8 SCHEDULE COMMITMENTS

8.1 Original Schedule

Figure 8.1.1 shows the outline schedule commitment for Rose well abandonment and decommissioning activities as presented in the original decommissioning programmes.

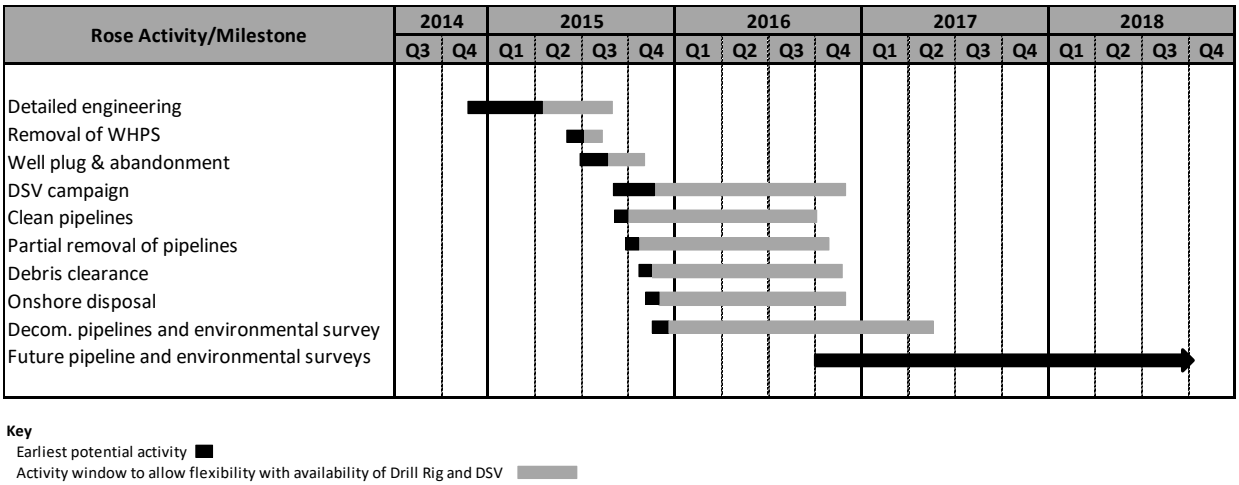


Figure 8.1.1: Original Schedule in Decommissioning Programmes

8.2 As-Built Schedule

Figure 8.2.1 presents the as-built schedule for Rose well abandonment and decommissioning activities.

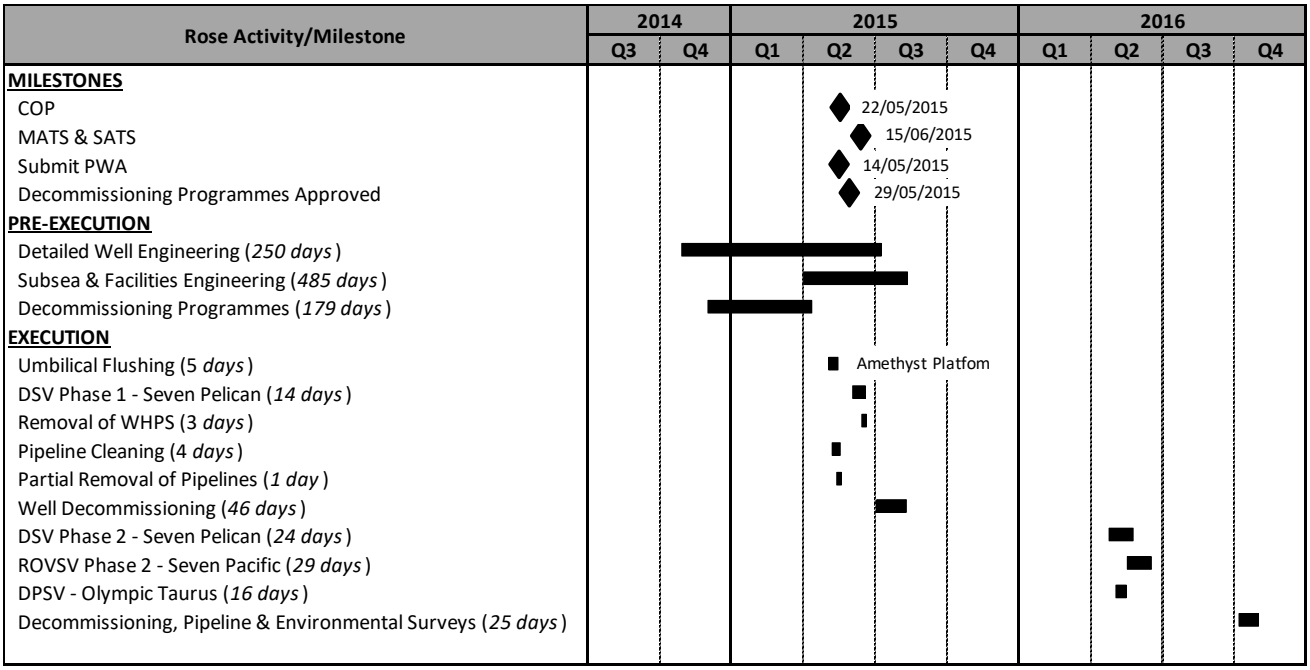


Figure 8.2.1: Rose 'As-Built' Schedule

9 COMPLETION OF ACTIVITIES

A photographic record was maintained for some of the decommission activities as included below.

9.1 Removal of WHPS & canopy

The WHPS (Figure 9.1.1) and top canopy (Figure 9.1.2) were recovered using the DSV. The following pictures show the WHPS and WHPS canopy lying on the deck of the Seven Pelican DSV.

Figure 9.1.1: Rose WHPS - recovery & on deck

Figure 9.1.2: Rose WHPS canopy on deck

9.2 Recovery of concrete mattresses

The concrete mattresses were originally constructed using polypropylene rope. They were recovered to the Seven Pacific used as ROVSV, and secured on deck (Figure 9.2.1).

Figure 9.2.1: Mattresses recovered and secured on-deck with limited degradation

9.3 Recovery of pipeline sections

The pipespools were recovered to the deck of the Seven Pacific ROVSV using the hydraulic grab and then secured Figure 9.3.1.

Figure 9.3.1: Pipeline section cut, recovered using grab, and stored on deck

9.4 Recovery of umbilical from J-tube

The umbilical was cut at the bottom of the J-tube by divers deployed by the Seven Pelican DSV before the severed section was lifted out through the top of the J-tube using the platform crane (Figure 9.4.1).

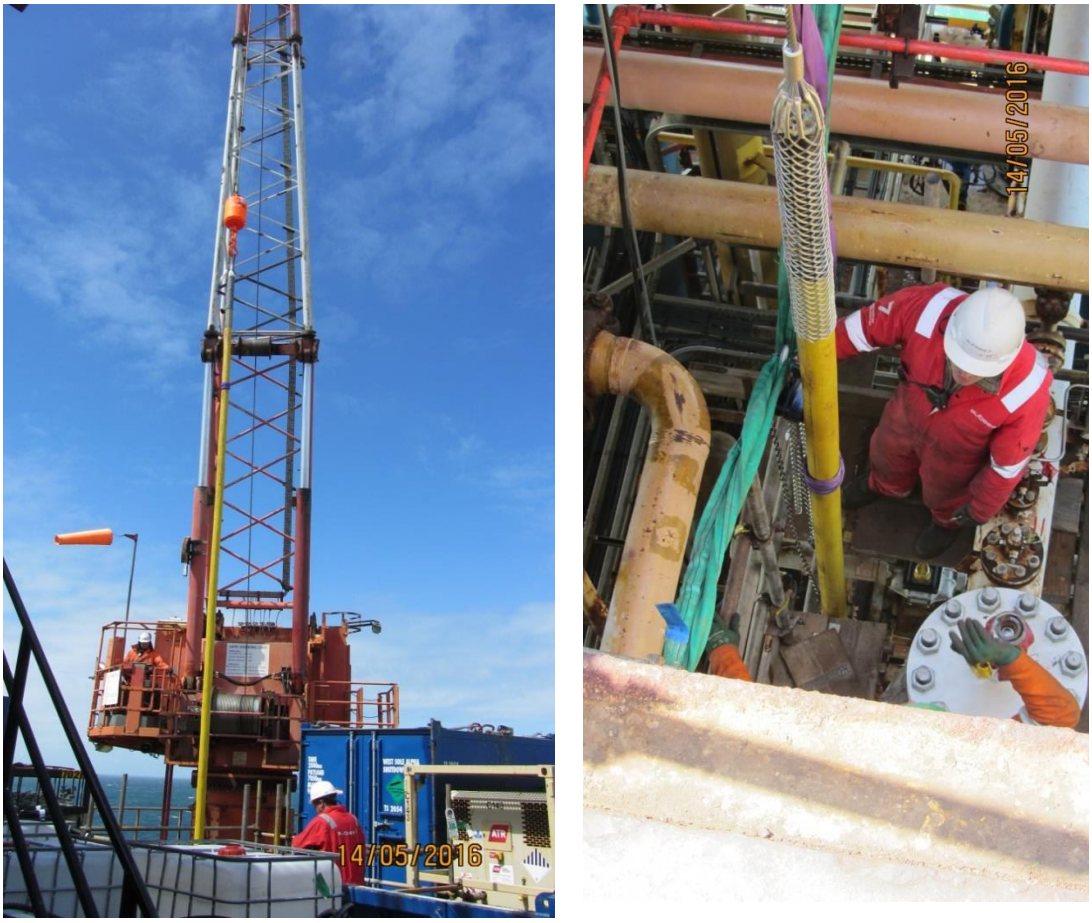


Figure 9.4.1: Umbilical lifted through J-tube using A2D platform crane

Figure 9.4.2: Shear cutter

Figure 9.4.3: Umbilical sections on A2D

9.5 Final disposal

The concrete mattresses were finally crushed and recycled (Figure 9.5.1).

Figure 9.5.1: Concrete mattresses finally crushed and recycled

10 COST SUMMARY

A comparison of gross estimated and outturn costs for the completion of the Rose decommissioning is provided in Table 10.1. We propose to carry out at least one legacy survey (in 2018) for the Rose pipelines in the UK, and we have included a nominal incremental cost for this activity.

This is based in the abandonment of one subsea well, the decommissioning of the pipeline and umbilical pipeline as per the approved Rose Field Decommissioning Programmes. The costs cover project management, execution of works, onshore treatment of materials and field surveys.

Table 10.1: Rose Cost Summary

Scope	Estimated Cost	Outturn Cost
Pipeline, umbilical decommissioning and subsea installation removal	13.0	8.0
Well Abandonment	10.0	12.3
Future pipeline and environmental survey requirements	1.0	0.1
TOTAL:	**24.0**	**20.4**

Well abandonment costs were higher than originally estimated due to contingencies identified during detailed design not being included within the original estimate.

Pipeline, umbilical and subsea installation costs were lower than estimated due to market rates for vessels at time of execution, the use of ROV supply vessel for recovery of seabed infrastructure rather than DSV as originally planned and the cost efficiencies gained by combining phase 2 execution into one campaign for both Rose & Stamford Decommissioning projects.

11 LESSONS LEARNED

In preparing for and carrying out the decommissioning activities offshore, there are a number of elements that we felt were good practice and others that with the benefit of hindsight we felt were not so good. The lessons we have learned from these aspects of the project will be carried forward to future projects:

- This work was carried out as part of a wider campaign with Stamford well abandonment and decommissioning works led to cost efficiencies and savings;
- Onshore cutting trials: We felt there were benefits in carrying out onshore trials to validate different cuttings techniques that could be used for the WHPS;
- Xmas tree cleaning: Be cognisant that the quantity and density of marine growth might not be as expected, requiring extra time for cleaning operations;
- Xmas tree valve testing: We found it useful to prepare contingency plans to allow us to deal with passing valves;
- Pipeline pressure: We have found it useful to leave the pipeline at seabed ambient pressure prior to conducting underwater operations as this made it easier to implement contingency plans in the event that pipeline valves were found to be passing;
- Concrete mattresses: We found it beneficial to carry out trial lifts of the concrete mattresses in the field to facilitate an understanding of the condition of the mattresses and to ensure that it would be possible to recover the mattresses safely;
- Pipeline and umbilical cutting: We found it effective to use hydraulic shears for cutting the pipeline, pipespools and umbilical rather than using diamond wire cutters;
- Grout bag recovery: We found it effective to use a hydraulic grab for removing grout bags.

12 SEABED CLEARANCE CERTIFICATE

On completion of the planned decommissioning activities as detailed within the approved decommissioning programme(s) the National Federation of Fisherman's Organisation (NFFO) were approached to carry out a seabed clearance over trawl survey. This was carried out by the Whitby based trawler - The Advance, an NFFO member.

The Advance completed a series of bi-directional sweeps of the Rose well 500m zone plus the associated pipeline and umbilical to the Amethyst A2D platform. During the trawl survey standard southern North Sea trawl equipment was used with chains attached to the trawl to ensure continuous contact with the seabed determine if there were any major obstructions. While no debris or obstructions were encountered within the designated areas, a man-made object was encountered just outside the Rose 500m zone, and the UKHO and KIS were notified.

Based on this survey, a 'Clean Seabed Certificate' was issued to SERL 13 December 2016.

13 CONCLUSIONS

Following completion of the Rose decommissioning operations, SERL has reviewed all activities to ensure that the scope has been fully executed in accordance with the approved DP, that risks to other users of the sea have been removed or reduced to ALARP and all regulatory requirements have been met. Where any variations to the DP have arisen, they have been documented in this report.

As a result of monitoring and review of recorded data, SERL believes that all residual risks to other users of the sea have effectively been removed on a long-term basis and that a programme of future field infrastructure surveys would not provide any useful information in this regard. SERL believes that the stability of the seabed, pipeline and umbilical in this area is such that assuming the burial survey results from 2018 are satisfactory it will be unnecessary to conduct further inspection and verification work in future.

Analysis of environmental survey data also suggests that the local environment is returning to a state typical of the wider southern North Sea region. With no further site specific anthropogenic inputs, it is felt that that natural degradation of contaminants should help restore the area to pre-developed conditions on a relatively short timescale. Accordingly, SERL proposes that, no additional site and environmental surveys in the Rose area are necessary.

Approval for the final status of the seabed in the former development area has been acquired from NFFO, in the form of the trawl clearance certificate (Appendix A). SERL now seeks formal approval from OPRED to enable full project close-out.

14 REFERENCES

[1] CEU (2015) Rose Environmental Impact Assessment, CEU-HSEQ-SNS0057-REP-0001

[2] CEU (2015) Rose Comparative Assessment, CEU-PRJ-SNS0057-REP-0009

[3] CEU (2015) Rose Decommissioning Programmes, CEU-PRJ-SNS0057-REP-0012

[4] DECC (April 2016) Pipeline Works Authorisation 81/V/16, Approved by DECC 18 April 2016

[5] DECC (Aug 2016) Pipeline Works Authorisation 227/V/16, Approved by DECC 15 Aug 2016

[6] FEMUL (2013) Rose Decommissioning Survey Environmental Baseline Study and Habitat Assessment, 12/J/1/03/2115/1394

[7] GEL, (2017) Rose Post-Decommissioning Environmental Survey Report, 10860

[8] HSE (1996) Offshore Installations and Wells (Design and Construction etc.) Regulations

[9] OGUK (2015) Guidelines for the Suspension and Abandonment of Wells, Issue 5, July 2015

[10] OSPAR (1998) OSPAR convention for the protection of the marine environment of the North-East Atlantic: Ministerial meeting of the OSPAR commission - SINTRA: 22 – 23 July 1998.

Appendix A ROSE ABANDONED WELL SCHEMATIC

Appendix A.1 Abandoned Well Schematic

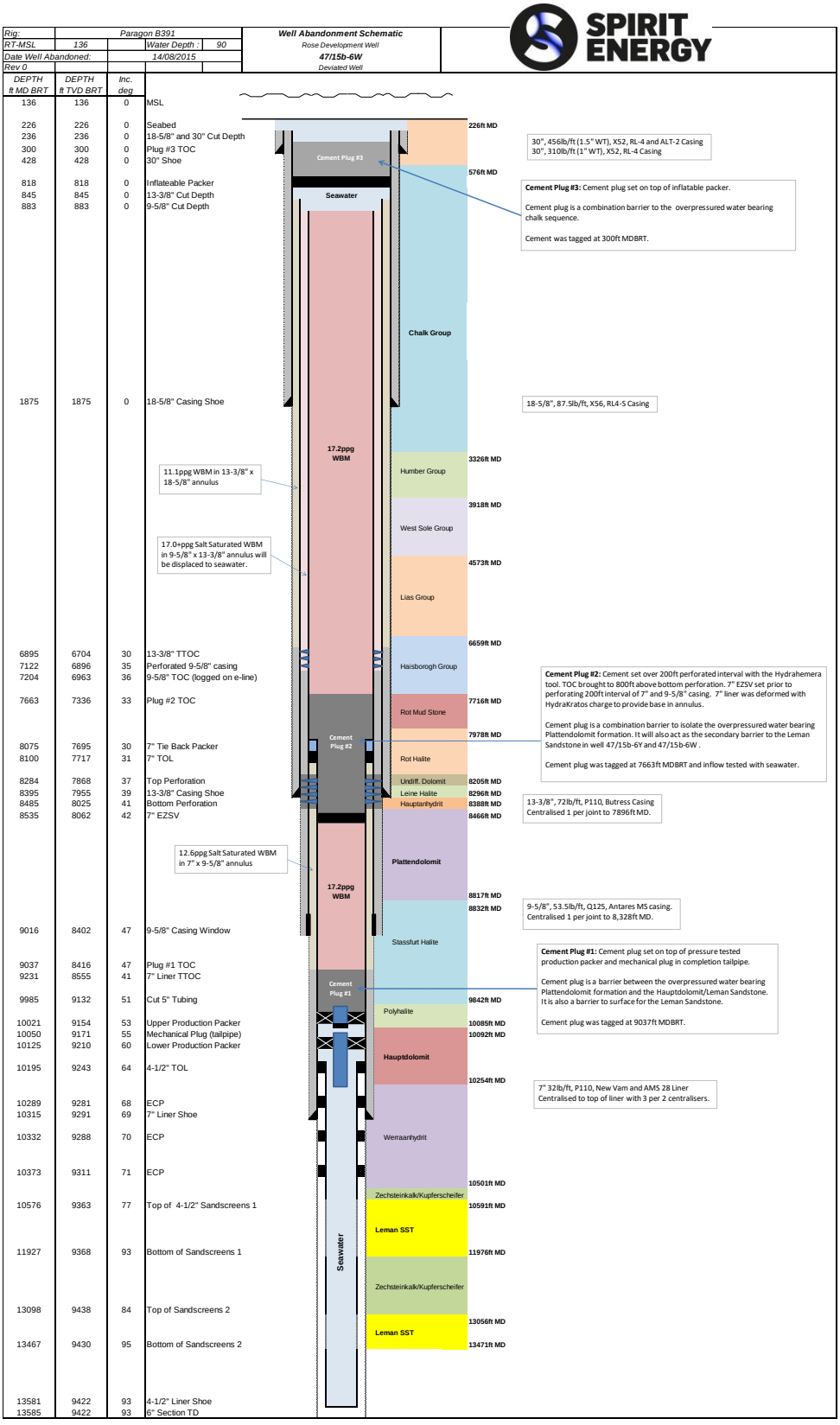


Figure A.1.1: Abandoned Well Schematic

Appendix B BURIAL STATUS (2016)

Appendix B.1 PL1987 Pipeline Burial Profile (2016)

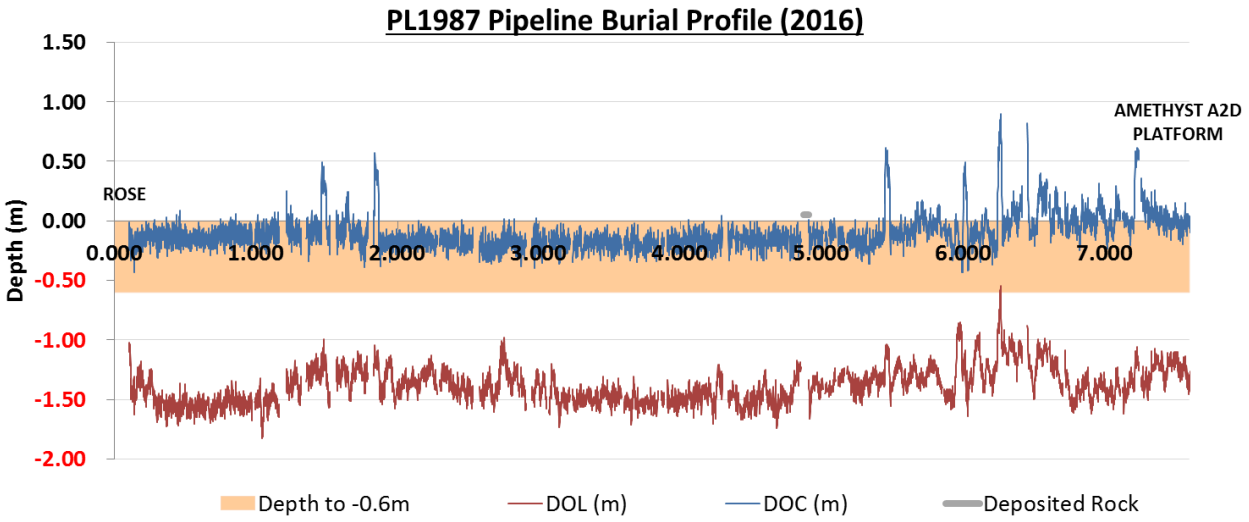


Figure B.1.1: PL1987 Burial Profile (2016)[2]

Appendix B.2 PLU1988 Umbilical Burial Profile (2016)

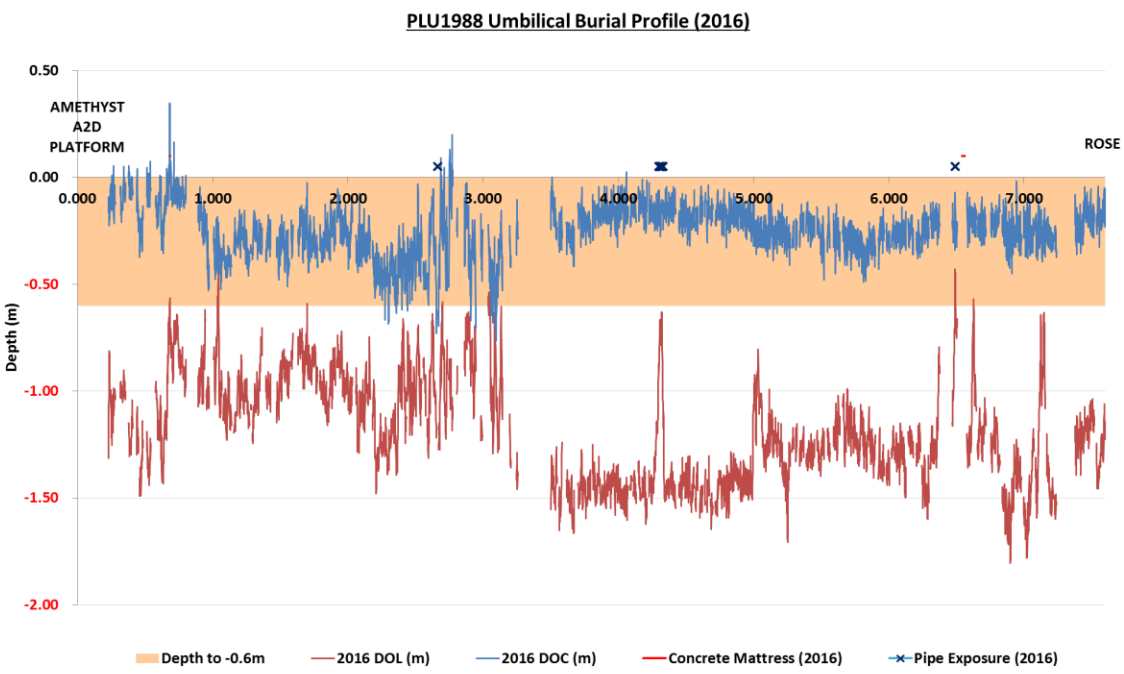


Figure B.2.1: PLU1988 Burial Profile (2016)[2]

[2] Gaps in a burial profile graph can arise in cases where the pipe-tracker is unable to track the umbilical or pipeline reliably. Typically, a pipe-tracker will move along just above the seabed, and its ability to track can be hampered usually if the pipeline or umbilical is too deep or if there's not enough material (steel) within the umbilical to allow a signal to be reflected-back to the tracker. Given the general profile of the umbilical we believe that they remain stable in those areas where no tracking data were recorded.

Appendix C BURIAL STATUS (2012)

Appendix C.1 PL1987 Pipeline Burial Profile (2012)

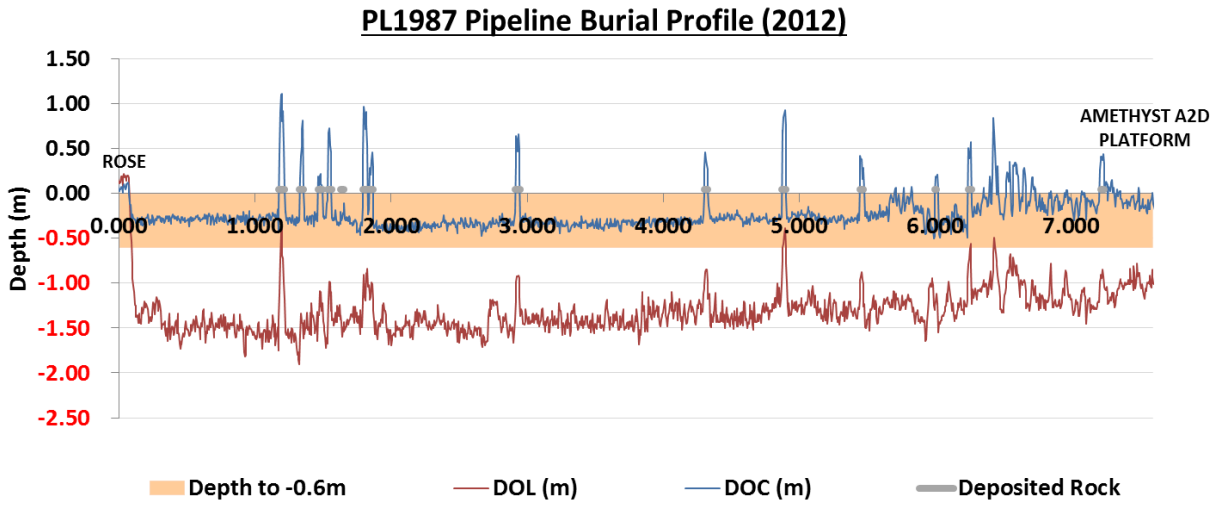


Figure C.1.1: PL1987 Burial Profile (2012)[2]

Appendix C.2 PLU1988 Umbilical Burial Profile (2012)

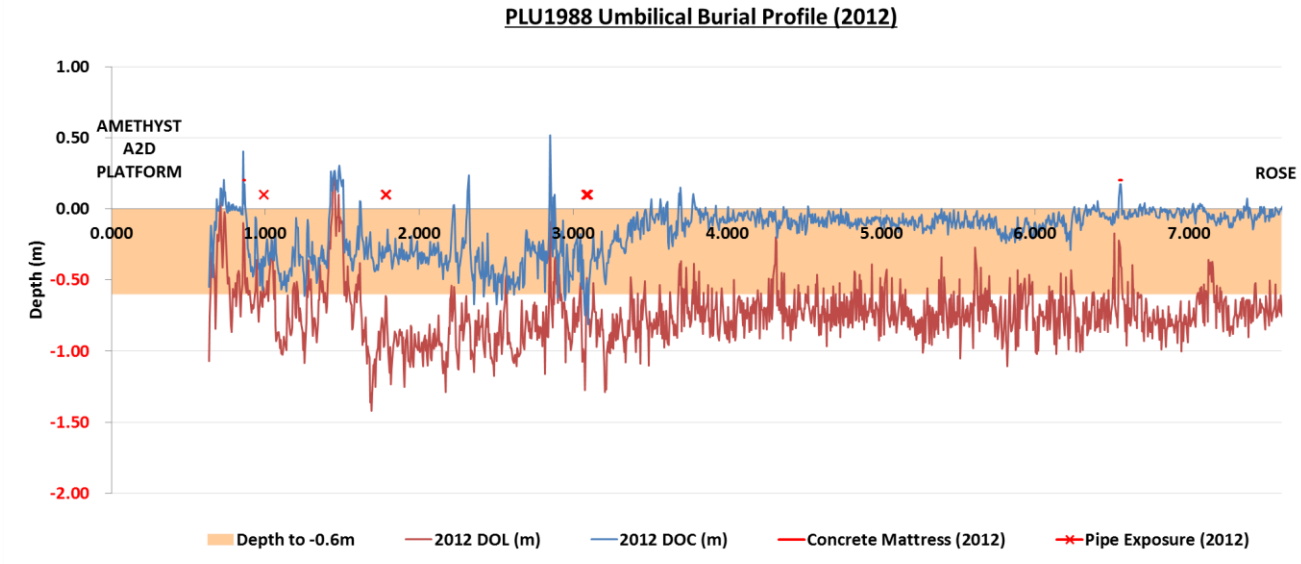


Figure C.2.1: PLU1988 Burial Profile (2012)[2]

Appendix D AS-LEFT LAYOUT DRAWINGS – AS-BUILT

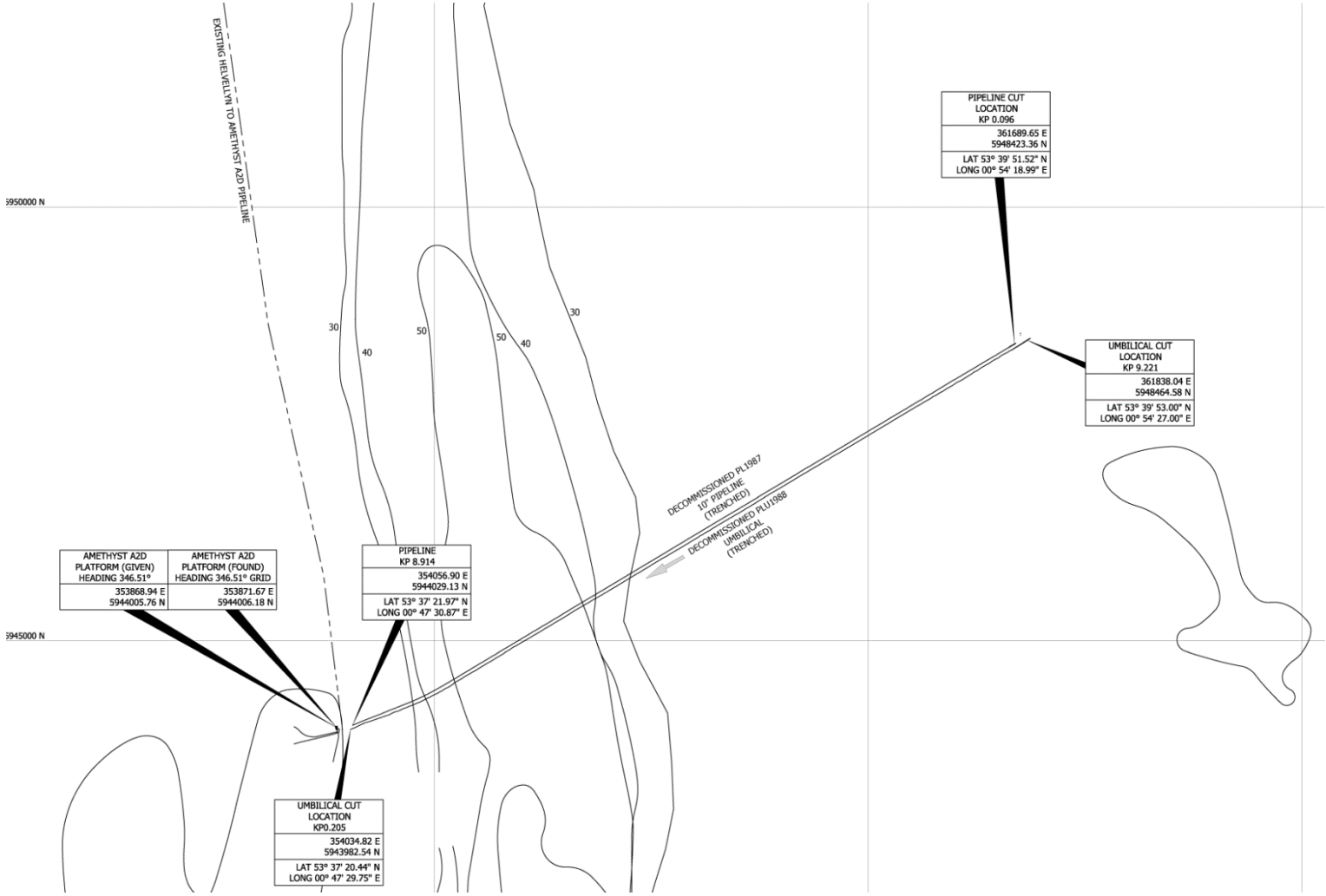


Figure C.2.1: Rose As-Left Status

Appendix E TRAWL CLEARANCE CERTIFICATE

National Federation of Fishermen's Organisations.

30 Monkgate
York
YO31 7PF

Tel: 01904 635 432
Fax: 01904 635 431
e-mail: apiggott@nffo.org.uk
Web: www.nffoservices.com

13th December 2016

To whom it may concern

Rose Field De Commissioning

CLEAN SEABED CERTIFICATE

The Whitby based Trawler **Advance** operating under NFFO membership conducted the following activities at the Decommissioned **Rose Subsea Well** 500mtr Zone and associated pipe and umbilical to Amethyst Platform.

1. A series of intense bi-directional sweeps over the known 500 metre Zones and associated Pipe Line and umbilical areas have been conducted with the objective of safe future over trawlerbility within the said zones.

A significant number of passes has been made across each area. (Individual plotter data has been supplied)
Standard Southern North Sea trawl equipment with a series of chains suspended across the mouth of the trawl was used to conduct the sweeps.
Chains were attached to the trawl to ensure continuous contact with the seabed to determine whether there were any major obstructions which might present a major snagging hazard for future fishing activities. The trawl net was also seen as a means of gathering any items of debris located in the area. **No debris or obstructions were encountered within the 500mt zone or pipeline umbilical rout.**

Following completion of the sweep programme the skipper of Advance has reported to NFFO the following:

a) No major snag was experienced during any of the sweeps.
b) On no occasion did the winch pressure showed any increase.
c) The skipper of the Advance is happy that as a result of the sweeps and the absence of any debris or snagging points on any of the above named decommissioned sites suggest that the areas will not pose any significant problem for future fishing operations.

Based upon feedback provided by the skipper, the Federation accepts that the decommissioned **(Rose Platform)** sites the abandoned wells and mattress areas along with the associated 500m safety zones associated pipeline and umbilical rout were found to be clear of debris or major obstruction and posed no significant problem for future fishing operations.

The Federation would like to thank Centrica for their efforts in ensuring that all significant items of equipment and debris have been recovered.

Signed

Alan Piggott

A Piggott
General Manager