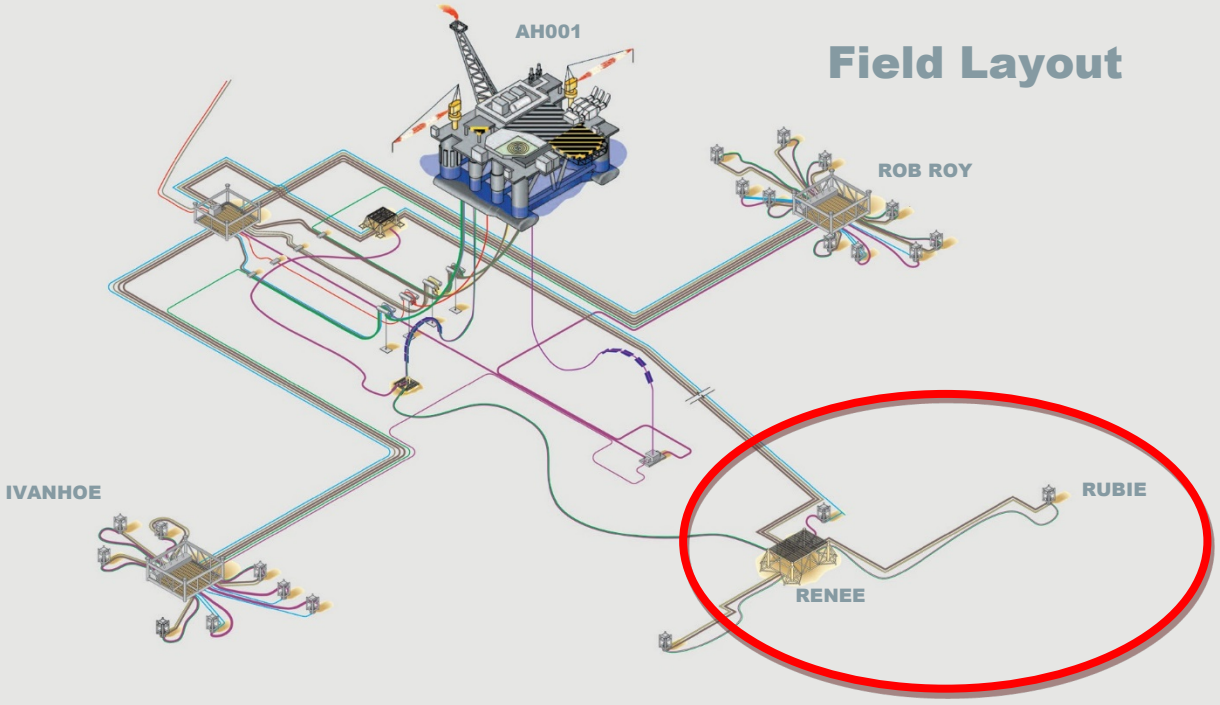
Renee & Rubie
Decommissioning Programmes
Close-Out Report



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Abbreviations

%	Per cent
BEIS	Department for Business, Energy & Industrial Strategy
BGS	British Geological Survey
BOP	Blow Out Preventer
BPEO	Best Practicable Environmental Option
CNS	Central North Sea
COS	Cross-Over Structure
CSV	Construction Support Vessel
DECC	Department of Energy and Climate Change
DP	Decommissioning Programme
DSV	Dive Support Vessel
DUBS	Dynamic Umbilical Base Structure
EBS	Environmental Baseline Survey
EEUK	Endeavour Energy UK Ltd
FPF	Floating Production Facility
HESS	HESS Services UK Limited
HM	Heavy Metals
IVRR	Ivanhoe and Rob Roy
km	Kilometre
m	Metre
MCAA	Marine and Coastal Access Act
OGUK	Oil and Gas U.K.
OSPAR	Oslo and Paris Commission
P&A	Plug and Abandon
PAH	Polycyclic Aromatic Hydrocarbons
PSA	Particle Size Analysis
RBM	Riser Base Manifold
ROV	Remotely Operated Vehicle
RPM	Renee Production Manifold (RPM)
SFF	Scottish Fishermen's Federation
SSS	Side Scan Sonar
THC	Total Hydrocarbon Content
THRT	Tubing Hanger Running Tool
TN	Total Nitrogen
TOC	Total Organic Carbon
UK	United Kingdom
UKCS	United Kingdom Continental Self

1 Introduction

HESS Services UK Limited (hereafter referred to as 'HESS') is the License operator of the newly decommissioned Rubie and Renee fields. The subsea fields are located in United Kingdom Continental Shelf (UKCS) Blocks 15/27 and 15/28, approximately 6 km apart and are located approximately 73 km west of the UK / Norway median at their closest point and 138 km east of the nearest coastline at Peterhead, Aberdeenshire (Figure 1.1).

Production from Rubie and Renee ceased in 2009, with the development suspended and the host facility AH001 Floating Production Facility (FPF) installation removed.

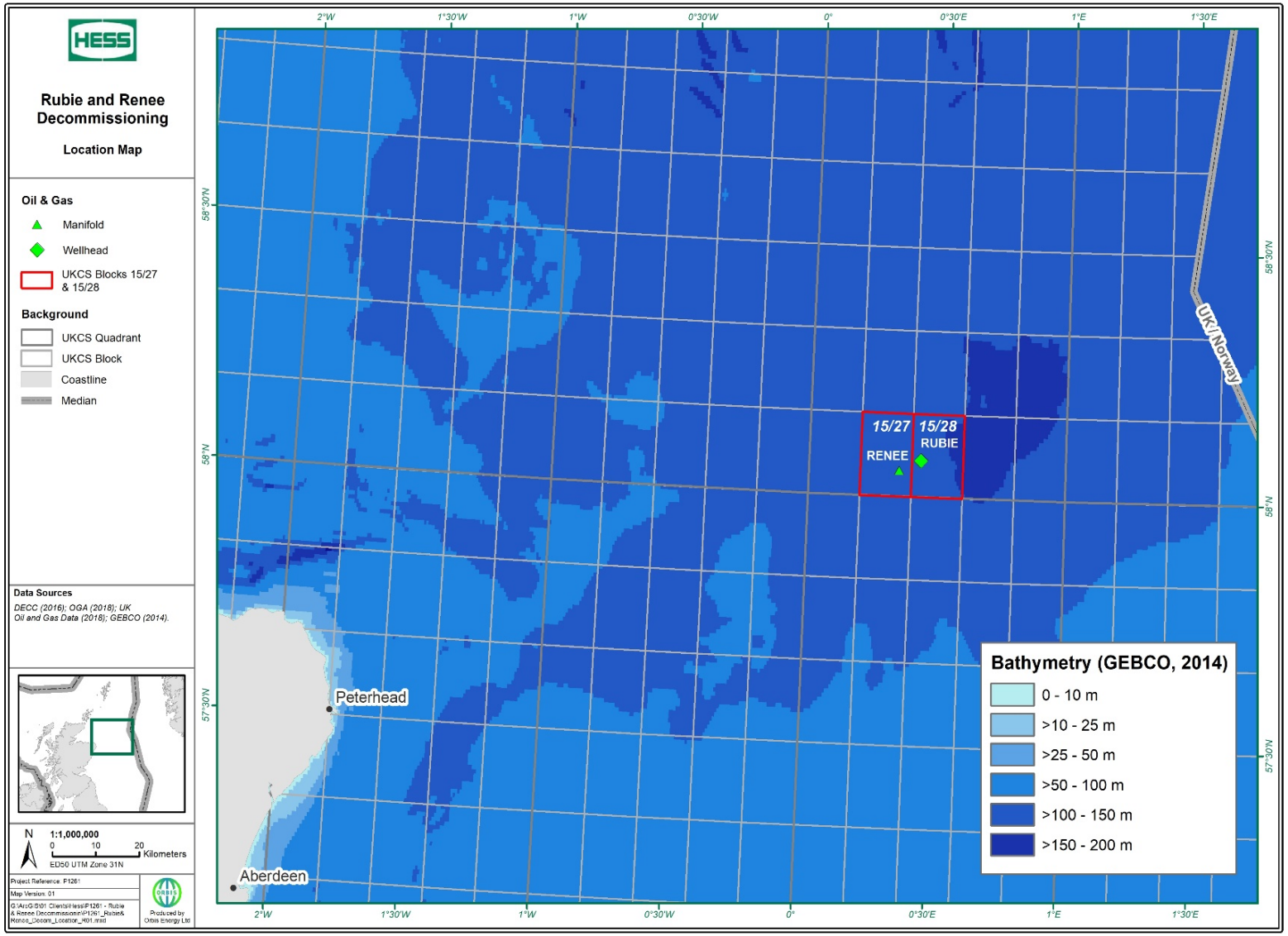
Following approval of the Rubie and Renee Decommissioning Programme (submitted by Endeavour Energy UK Ltd (EEUK) in 2014), HESS has completed the full field decommissioning activities at Rubie and Renee.

In 2018, HESS became the Operator from EEUK and in 2019, HESS appointed Petrofac Facilities Management Limited (hereafter referred to as 'Petrofac') as well operator.

1.1 Document Overview

This Decommissioning Programme Close Out Report covers the decommissioning operations that were conducted for both the Phase I and Phase II operations. The Phase I operations (conducted by EEUK in 2015) were originally covered in the Rubie / Renee Fields Decommissioning Programme Interim Report (Ref: END-RR-50-EN-REP-0001), however the results of these are also included in this close out report.

Figure 1.1: Location of the Rubie and Renee Fields



2 Background

2.1 Field History

The Rubie and Renee fields were developed in 1998 by subsea tie back to the AH001 FPF. The production facilities were installed in 1998, located in UKCS Blocks 15/21, 15/26, 15/27 and 15/28b, in the Central North Sea. Production from the fields started in 1999 and ceased in 2009. The AH001 FPF was removed later that year.

The facilities comprised two drilling centres (Rubie and Renee) connected by infield pipelines, umbilicals and subsea structures to the HESS operated FPF, AH001, located 21 km northwest of the Renee field. The Renee Field consisted of two production wells, one water injection well and the Renee Production Manifold (RPM), which was tied back to a Cross-Over Structure (COS) and on to the Riser Base Manifold (RBM) in the Ivanhoe and Rob Roy (IVRR) Development. The RPM was also tied back to the COS via a Dynamic Umbilical Base Structure (DUBS). The single Rubie production well was tied back to the RPM, via a 5.6 km, 8" pipeline (PL1624).

Oil and gas production from Rubie and Renee were comingled with IVRR fields' oil and gas production and exported via the AH001 FPF to the Claymore Alpha and Tartan Alpha platforms, respectively (Figure 2.1).

2.2 Cessation of Production

Annual oil production from the Rubie and Renee development had fallen by 2008, with cessation of production being approved on the 6th March 2009. Production from the Rubie and Renee Fields was achieved through the HESS operated FPF AH001. AH001 also processed fluids from the IVRR Development. A programme of work was completed in 2009 to flush and clean the production equipment and to release the AH001 from the Rubie, Renee and IVRR infrastructure following agreement with the Department Energy and Climate Change (DECC). All flexible risers and the FPF mooring system were disconnected from the FPF and laid on the seabed. The AH001 was then sailed away (in July 2009), leaving the IVRR and Rubie and Renee infrastructure on the seabed. At the time both HESS and EEUK has explored all options for continuing production from the fields but concluded that no option was economically viable and the Rubie and Renee installations and pipelines were to be decommissioned.

2.3 Summary of the Decommissioning Programmes

The Rubie and Renee Decommissioning Programme was approved by the regulator in April 2014.

2.3.1 Preparatory Work

Following suspension of production in 2009 HESS undertook preparatory work to enable the removal of the AH001. HESS flushed the Rubie and Renee umbilicals and pipelines, cut the spools at the trees and carried out valve status checks. The spools connecting the RBM to the COS were then disconnected and moved to wet storage along with the concrete mattresses. The wet storage areas were located within existing Rubie and Renee Safety Zones.

In 2013 HESS removed the pipeline spools between RPM to COS and sections of pipelines (PL1616, PL1617, PL1618 and PL1620) between COS and the RBM in order to avoid potential build-up of pressure.

The section of Rob-Roy umbilical, which crossed these four pipelines, was removed in 10m to 30m sections and relocated into wet storage. In addition, 50m lengths of PL1624, PL1625 and the umbilicals (PL1626.1, to PL1626.8 and PL1619.1 to PL1619.8) were also removed at trench transitions and pipeline ends. These were relocated to wet storage for subsequent recovery by EEUK. Approximately 70 tonnes of pipeline material were relocated to wet storage.

A full survey of the Rubie and Renee area was required to identify all items to be recovered by EEUK. This pre-decommissioning survey was carried out in 2014. During this survey, the subsea trees were

inspected to ensure that the workover stab plates for each tree were in place and in reasonable condition in preparation for their use during the well P&A programme.

Following the IVRR decommissioning operations and the EEUK preparatory works described above, EEUK undertook the removal and recovery of the field facilities. These included the contents of each wet storage area (Figure 2.1).

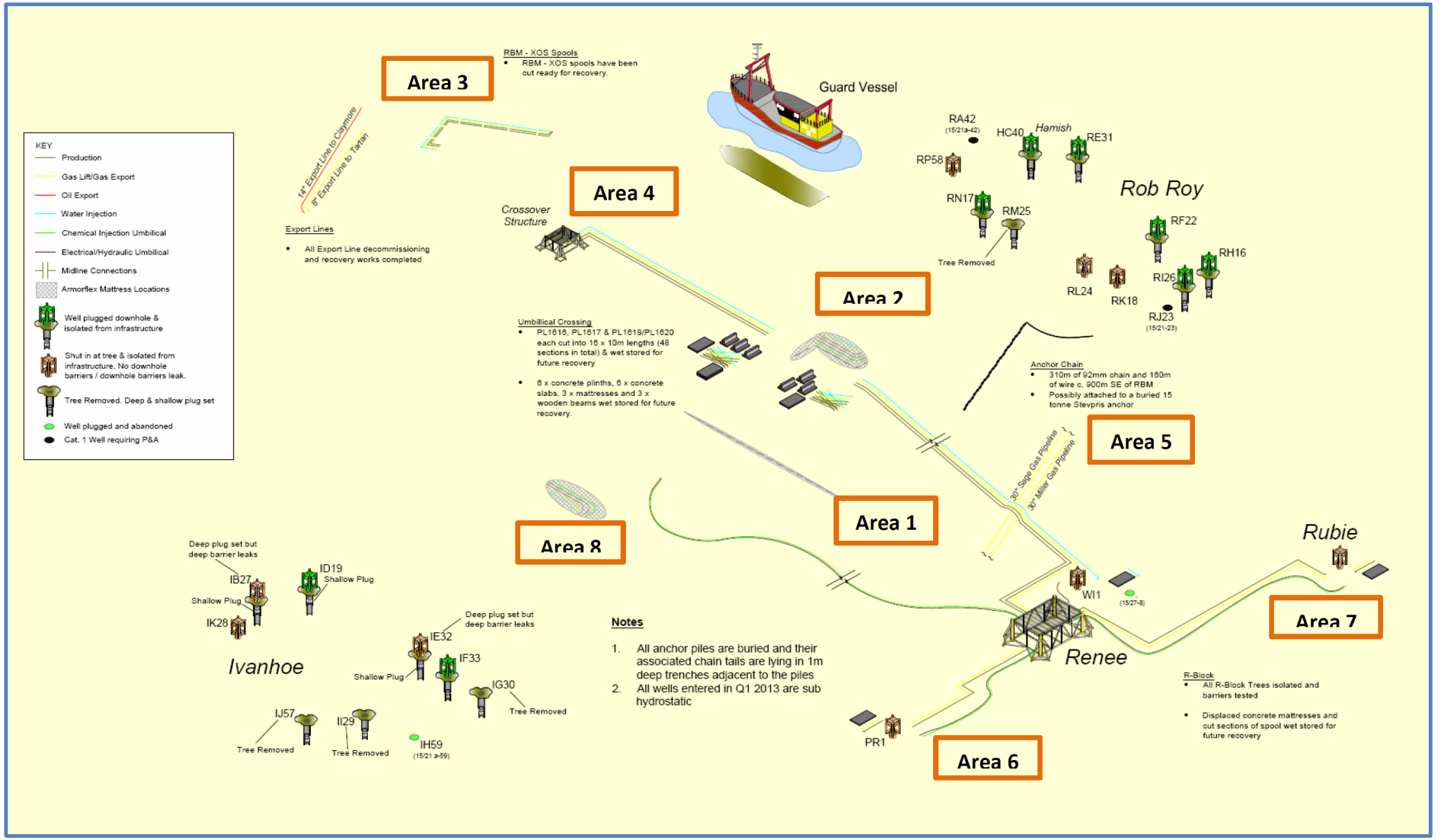
Table 2.1 summarises the facilities identified in the approved Rubie and Renee Decommissioning Programme.

Table 2.1: Summary of the Approved Decommissioning Programme (EEUK, 2015)

Subsea Installations		
All subsea installations will be removed.	To remove all seabed structures and leave a clean seabed.	COS and RPM will be removed by Construction Support Vessel (CSV) or similar vessel and returned to shore for recycling. Marine and Coastal Access Act (MCAA) application will be submitted in support of works undertaken.
Pipelines, Flowlines & Umbilicals		
Flush pipelines PL1616, PL1617, PL1618, PL1620, PL1624, PL1625 and umbilical PL1619.1 – 1619.8 and leave majority buried in situ. Leave majority of umbilical PL1626.1 – 1626.8 in situ.	Minimal seabed disturbance, lower energy usage, reduced risk to personnel.	Preparatory work has removed sections of these pipelines, the details of which are below. The cut ends will be re-buried under rock dump. Degradation will occur over a long period within seabed sediment and is not expected to represent a hazard to other users of the sea. A MCAA application will be submitted in support of works undertaken.
Remove part of pipelines PL1616, PL1617, PL1618, PL1620, PL1624, PL1625 and umbilicals PL1619.1 – 1619.8 and PL1626.1 – 1626.8.	Reduce interference with removal of associated infrastructure (see Subsea installations above).	A 200 m length of line from PL1616, PL1617, PL1618 and PL1620 (160 m at the crossing and 10 m at each of the two trench transitions) and 40 m from PL1624, PL1625 and the umbilicals PL1626.1 to PL1626.8 and PL1619.1 to PL1619.8 (20 m at each end) will be removed. Parts that have been removed will be lifted on to a CSV (or similar) and returned to shore for recycling. MCAA application will be submitted in support of works undertaken.
Remaining flowlines: PL1621, PL1622, PL1623.1 – 1623.2 will be removed completely.	Meets DECC guidelines to remove all surface laid infrastructure to leave a clean seabed.	The remaining flowlines will be removed and returned to shore for recycling via a combination of reverse reel onto a reel vessel and short section recovery. MCAA application will be submitted in support of works undertaken.

Well Abandonment Operations		
Abandoned in accordance with Oil & Gas UK Guidelines for the Suspension and Abandonment of Wells.	Meets DECC regulatory Requirements.	Chemical permit and MCAA applications will be submitted in support of works carried out.
Drill Cuttings		
Leave in place to degrade naturally.	Cuttings piles are small, thin, widely dispersed and are unlikely to exceed OSPAR 2006/5 thresholds for area and rate of hydrocarbon leaching.	Left undisturbed on seabed to degrade naturally.
Interdependencies		
No interaction expected between drill cuttings and decommissioning operations.		

Figure 2.1: Remaining Rubie and Renee Facilities Following IVRR Decommissioning Activities in 2013 (EEUK, 2015)



2.3.2 Decommissioning Work

The decommissioning work at Rubie and Renee was carried out in two phases:

2.3.2.1 Phase I

The initial phase of decommissioning was carried out in 2015, comprising the removal and recovery of the subsea installations and pipelines. A Dive Support Vessel (DSV) was used to prepare the subsea facilities for recovery and a Construction Support Vessel (CSV) was deployed to recover the items to shore. Successful clearance of the seabed was confirmed by 'as-left' surveys.

The following summarises the decommissioning and recovery works undertaken in Phase I:

- All subsea facilities were recovered in 2015 with the exception of the wellheads, well guide-bases and the over-trawlable wellhead protection structure;
- Successful seabed clearance and recovery of all items was confirmed by 'as-left' seabed surveys prior to demobilisation;
- A HESS IVRR survey (which was extended to include Rubie and Renee) in July 2015 confirmed that there were no unaccounted items at these locations (HESS, 2015);
- HESS carried out an IVRR over-trawl exercise during August 2015 to demonstrate removal of snagging hazards. This over-trawl extended into the northern area of Rubie and Renee facilities. No snagging hazards were found in this northern area (HESS, 2015).

2.3.2.2 Cement Overspill – Renee 15/27-8 Well

During the drilling of the Renee 15/27-8 well, there was an overspill of cement caused by a failed casing cement operation. Therefore, in 2016, EEUK undertook an Options Assessment (BMT, 2016) of the technically feasible decommissioning methods for the cement overspill surrounding the Renee Well 15/27-8 included in the Rubie Renee Field Decommissioning Programme.

The majority of the Rubie and Renee infrastructure and seabed facilities had already been decommissioned in 2015.

The Options Assessment methodology provided a framework for assessing the proposed decommissioning options for the cement overspill and assigning scores to five criteria (and 2 sub criteria) as follows:

1. Safety (Qualitative assessment);
2. Environment;
    a. Environmental risk;
    b. Emissions;
3. Technical Feasibility;
4. Societal;
5. Economic (cost).

The assessment scores were normalized and weighted to allow direct comparisons between the criteria for each decommissioning method. This enabled a balanced and transparent comparison in order to identify a preferred method for decommissioning of the cement overspill.

The options for well 15/27-8 were selected based on those brought forward during meetings with the Department for Business, Energy and Industrial Strategy (BEIS). Four options were selected for further assessment of the cement overspill through the options assessment process, these included:

1. Leave cement as is;
2. Rock-dump selected areas;
3. Partial removal and rock-dump;
4. Full removal to natural seabed.

Based on the findings from the options assessment, EEUK has concluded that, following removal of the wellhead and guide base, Option 1: Leave Cement 'As Is', was the preferred option for decommissioning of the cement overspill surrounding well 15/27-8.

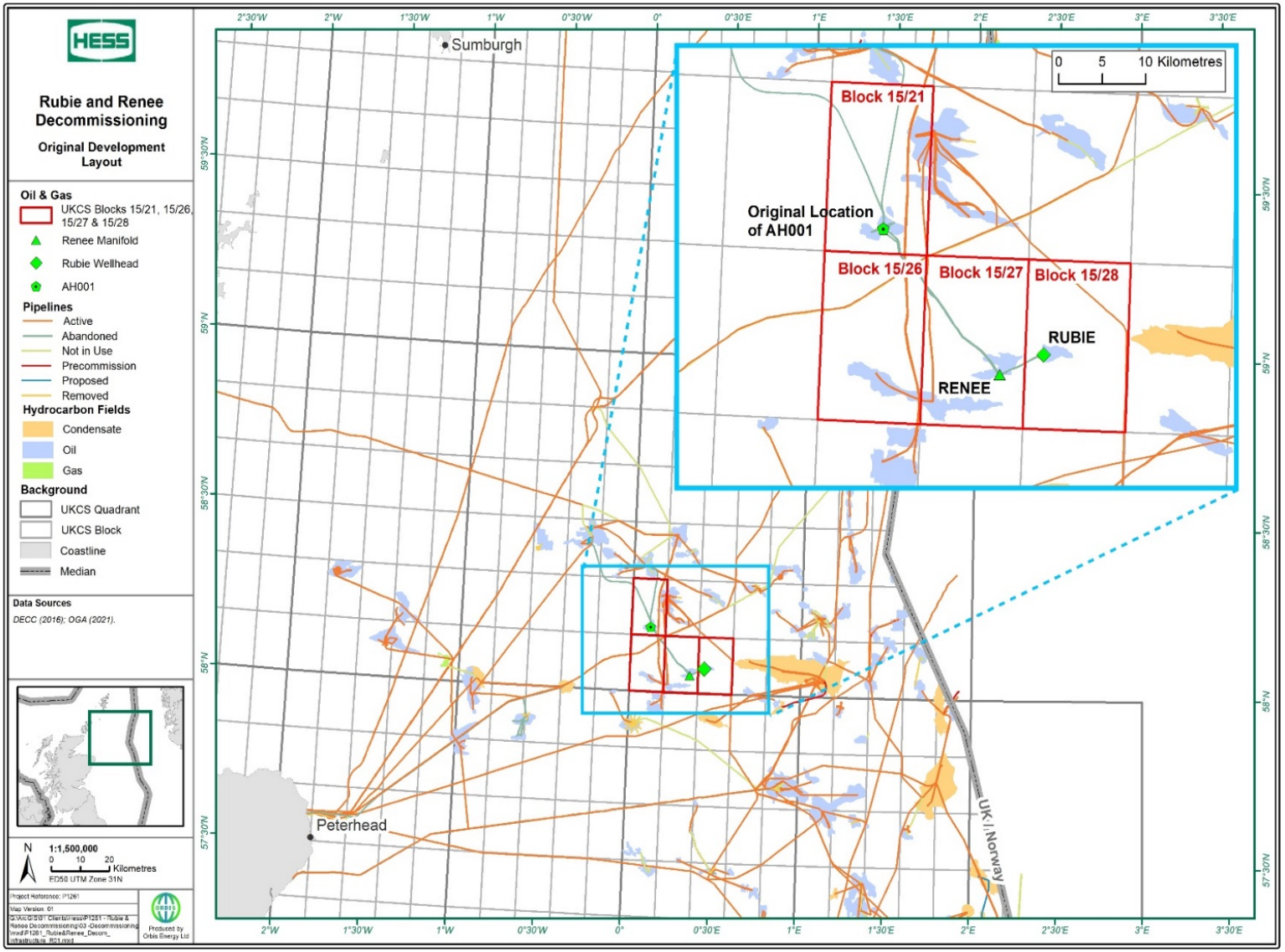
Therefore, HESS required an overtrawl survey to the Phase II scope of work (see Section 5.1.5), to ensure the cement overspill will not cause any issues to fishing activities.

2.3.2.3 Phase II

The final phase (Phase II) of the Rubie and Renee decommissioning operations was undertaken by HESS in 2020. The Phase II operations consisted of:

- A Multibeam bathymetry site survey (in 4x4 km area boxes) over the Rubie and Renee locations (undertaken by Petrofac);
- A DSV campaign to remove over-trawlable structures and prepare wellheads for Plug and Abandonment (P&A) (undertaken by Petrofac);
- P&A Campaign with Awilco WilPhoenix drilling rig to P&A the four remaining wells (undertaken by Petrofac as Well Operator):
    - Rubie 15/28-7 Producer
    - Renee 15/27-7 Water Injector
    - Renee 15/27-8 Wellhead Removal
    - Renee 15/27-6y Producer
- Post-Decommissioning multi-beam, side scan sonar and Environmental Site Survey, undertaken by Fugro;
- Scottish Fisheries Federation (SFF) Over-trawl Survey at the Renee 15/27-8 Well (cement overspill).

Figure 2.2: The Original Development of the Rubie and Renee Fields



3 Decommissioning of subsea infrastructure

3.1 Operations Undertaken – Phase I

3.1.1 Removal and Recovery Operations

The 2015 decommissioning work scope was divided into discrete campaigns of DSV removal and CSV recovery operations.

Checks conducted on both the DSV and CSV confirmed that no Naturally Occurring Radioactive Material (NORM) above background levels was present in any of the materials recovered to the vessels.

The areas mentioned below are shown in Figure 2.2.

3.1.1.1 Bibby Sapphire – April 2015 – May 2015

The Bibby Sapphire was mobilised to inspect the trees, fit dummy stab plates and conduct trials of the tool deployment unit (TDU) in order to reduce future rig time and hazard exposure. The vessel was then deployed to the Rubie and Renee manifold where the lifting frame was over-boarded and wet stored along with work baskets for subsequent recovery operations by the CSV.

The vessel then moved to Area 6 to load mattresses onto the mattress speed-loaders. Baskets of pipe offcuts and four full speed-loaders containing mattresses were lifted onto the deck and shipped onshore for disposal.

Operations resumed 18th April in Area 3 where redundant pipework associated with the crossover manifold was cut into manageable lengths (approximately 10 m) and bundled for subsequent recovery. The pipework close to the valve skid was cut and the COS and its protection structure was removed to wet storage. The mattress speed loaders were placed on the seabed within Area 3 and dimensions surveyed to enable subsequent recovery by the CSV.

The vessel then moved to Area 2 to recover to deck the previously bundled sections, one concrete slab and one concrete plinth. Two concrete slabs and two concrete plinths were left on the seabed within Area 2 for recovery during a later trip to the Area 2. The vessel relocated to Area 1 and carried out similar preparatory operations.

The vessel then moved on to Area 5 to locate and cut the pipelines PL513 14" Export AH001 RBM to Claymore and PL514 8" Export AH001 RBM to Tartan over a distance of approximately 500 metres. Debris baskets were also recovered from Area 5.

The vessel was then deployed to Area 6 to disconnect and remove all pipe spool sections and to disconnect, cut and remove the umbilicals connected to the manifold. Divers loaded the mattresses onto recovery frames. The manifold skid protection frame was removed to wet storage.

The pile pins for the protection frame were removed and the soil plugs within the piles dredged. The pile cutting tool was then deployed on all four manifold piles. However, none of the four cuts were successful and attempts to shear the piles using a clump weight from the main crane also proved unsuccessful. Subsequent inspection revealed a running bar on the outside of the piles which was believed to be the cause of the cutting failures. Further work on the piles was suspended and the vessel continued with mattress loading onto recovery frames in Area 6.

3.1.1.2 CSV Olympic Ares – May 2015

The vessel was initially deployed to Area 4 where it picked up the mattresses on speed-loaders. This operation was repeated within Areas 1, 2 and 3 until all mattresses were recovered to deck. Pipe bundles were then recovered to deck where specialist personnel checked for NORM. No readings above background radiation levels were measured. An 'as-left' survey was undertaken in Areas 1, 2, 3, 4 and 5 to ensure that all items had been recovered.

The vessel then transited to Areas 6 and 7 where it recovered mattresses and undertook 'as-left' surveys of these areas.

The two manifold roof panels were successfully recovered. The manifold protection structure was then lifted onto the deck. However, the vessel mooring winch was damaged during this operation due to vessel movement prevented the deck crew from being able to safely position this large structure on deck. The vessel then recovered the Crossover Manifold Protection Structure.

3.1.1.3 DSV Bibby Sapphire (Re-mobilisation) – June 2015

The DSV re-mobilised on 22nd June and transited to Areas 1, 2, 3, 4, 5 and 8 where concrete plinths, slabs, and pipe sections were loaded into debris baskets in preparation for recovery. ROV 'as-left' surveys confirmed that all items had either been recovered or placed in debris baskets.

At Area 8 the umbilical PL1619 was cut at its burial point and fitted with a 'Chinese Finger' in preparation for spooling onto the CSV. In Area 5 the vessel recovered a pipe-spool that had been missed from the previous campaign before transiting to Area 6 where it successfully dredged and cut the manifold piles at a depth of 0.6 metres below mean seabed level using a Diamond Wire Cutting (DWC) tool.

The DSV resumed removal of mattresses from Umbilical PL1619 and lifted them onto speed-loaders. Umbilicals PL1619 and PL1626 were then cut and prepared for recovery by the CSV. Pipeline sections PL1616, PL1617, PL1618, PL1620, PL1624 and PL1625 were then bundled and rigged up in preparation for recovery.

Since the pipeline ends were buried, the burial depths were checked using marked probes to ensure a minimum depth of cover of 0.6 metres. The burial depths of pipelines PL1618 and PL1620 were confirmed by stringing a datum line above the visible cut end of the pipelines at seabed level. The depths of the pipeline cut ends below seabed level were recorded at between 900mm to 670mm meeting the requirements of the project.

An 'as-left survey was completed at Area 6 and the vessel relocated over to Area 7. The mattresses covering the PL1626 umbilical were relocated onto speed-loaders exposing the umbilical which was then cut, bundled and rigged with a Chinese Finger ready for recovery by the CSV. Pipelines PL1624 and PL1625, previously cut into manageable lengths, were bundled and rigged ready for recovery by the CSV and the seabed was cleared of all debris. As the vessel had some spare deck capacity, two loaded mattress recovery frames were recovered to deck.

During the 'as-left' survey at Area 7, two sand bag gabions and three small fishing floats were observed. The floats were left for the CSV as it was unsafe for the divers to recover them due to the risk of trapped pressure. Once the bundles and offcuts had been secured on deck, specialist personnel undertook a check on each pipe section for NORM. No readings above background were found. The vessel then arrived at Area 8 to inspect the "Uraduct" wrap on umbilical PL1619 to assist in the recovery of this section of umbilical.

3.1.1.4 CSV Olympic Ares (Remobilisation) – July 2015

The CSV remobilised from Peterhead on 12th July 2015 to complete the 2015 recovery programme.

An "as found" survey was conducted at Area 4 and a pipe bundle was recovered. An 'as-left' survey confirmed that all debris had been removed.

The vessel then conducted "as found" surveys at Areas 1, 2 and 8. Large debris baskets containing concrete plinths were recovered and a 500m length of umbilical (from Area 8) was spooled on to the ACE spooler on board the vessel. An unrecorded 6m wooden beam was also recovered to deck. An 'as-left' survey confirmed that all debris had been removed from these areas. The vessel re-located to Area 6 and recovered a 270 m section and the 240 m end-length of umbilical which were both spooled onto the ACE spooler. The vessel then recovered the last of the debris baskets, speed-loaders, and pipe spool bundles as well as the four manifold piles.

An 'as-left' survey of Area 6 confirmed that all debris had been removed. The final decommissioning activity was at Area 7 where bundles were recovered and an 'as-left' survey was conducted. During the survey the three fishing floats were recovered to the deck where they were quarantined in a safe location due to the risk of contained pressure.

The final disposal of recovered metallic items was managed by Williamson ('Scrap Dealers' subcontracted by NorSea).

3.1.2 Summary of Decommissioning Work Scope

The following summarises the status of the decommissioning and recovery works undertaken in 2015:

- All subsea facilities were recovered in 2015 with the exception of the wellheads, well guide-bases and the over-trawl protection frames;
- The recovered pipeline items and their respective status are listed in Appendix B and the updated pipelines status has been reported to FishSafe (Appendix C);
- The 'fates' of the recovered items are recorded in Section 6;
- Successful seabed clearance and recovery of all items was confirmed by 'as-left' seabed surveys prior to demobilisation;
- A HESS IVRR survey in July extended over Areas 1, 2, 3, 4 & 8 which included the original location of the crossover manifold and the area where HESS had previously 'wet stored' sections of pipe, slabs and plinths, prior to EEUK undertaking its own decommissioning operations. This survey confirmed that there were no unaccounted items at these locations;
- HESS carried out an IVRR over-trawl exercise during August 2015 to demonstrate removal of snagging hazards. This over-trawl extended into the northern area of Rubie and Renee facilities. No snagging hazards were found in this northern area.

3.2 Operations Undertaken – Phase II

3.2.1 Multibeam Bathymetry Site Survey

HESS commissioned Petrofac to undertake a geophysical debris survey at the Rubie and Renee location (using the DSV Rever Topaz). The survey covered a 4 km x 4 km area centred at the proposed Rubie and Renee rig centre. The geophysical survey equipment consisted of single and multibeam echosounders, dual frequency side scan sonar and magnetometer (please refer to Section 5.1 for further details).

3.2.2 DSV Campaign to Remove Over-Trawlable Structure

HESS also commissioned Petrofac to undertake a DSV campaign for maintenance operations (cleaning and valve checking) on subsea wells Rubie and Renee, prior to well abandonment operations commencing (using the DSV Rever Topaz). The DSV operations were completed between March and April 2020. In addition to the maintenance operations, Petrofac also removed the drop down over-trawlable legs and the overtrawlable structure at each of the four wells.

Due to the fine work and dexterity needed for these operation, the DSV campaign was completed using divers.

Marine growth was cleaned from the trees and the remotely operated vehicle (ROV) intervention panels, plus the divers removed the tree caps and cleaned the sealing faces ready for the rig's Blow Out Preventer (BOP). None of the DSV campaign involved entering the wells.

At each of the four well locations a diamond wire cutter was used to cut and recover the 28 drop down over-trawlable legs that were attached to the Permanent Guide Bases (PGB) of the wells and the over-trawlable protection structure. A total of 112 legs and three over-trawlable protection structures were recovered to the DSV. The wellhead severance at the 15/27-8 well could not be completed during the DSV work, however the legs were cut and recovered, and then the wellhead was recovered during the P&A operations. The xmas trees also remained in place at this stage and were later recovered by the drilling rig during P&A (see Section 4).

3.2.3 Variations Against the Decommissioning Programme

For the Rubie and Renee subsea infrastructure, there has been no variation from the original Decommissioning Programme (as per Table 1.6 in the Rubie and Renee Decommissioning Programme – See Appendix B), with all of the subsea infrastructure being removed and a clean seabed left (see Section 5).

4 Well abandonment operations

4.1 Pre-decommissioning status of wells

The Renee Field consisted of two production wells (15/27-6 and sidetrack) and one water injection well (15/27-7). The Renee appraisal well (15/27-8) was previously permanently plugged in 1999, but the wellhead was left in-place.

The Rubie Field consisted of a single Rubie (15/28b-7) production well that was originally tied back to the RPM, via a 5.6 km, 8" pipeline (PL1624).

4.2 Operations undertaken

Petrofac, as well operator, undertook P&A operations for the Rubie and Renee wells, using the Awilco WilPhoenix semi-submersible drilling rig.

The P&A operations involved flushing and cleaning the wells before placing permanent cement barriers at the appropriate depths according to the specific features of each well. After the wells were abandoned downhole, the conductors and shallow casing strings were cut and pulled from below the seabed (Table 4.1).

The Rubie and Renee wells and their status is shown in Table 4.1.

Table 4.1: The Rubie and Renee Wells

Asset	Well Number	Well Type	Well Co-ordinates (ED50)	Date Drilled	Date of P&A
Renee	15/27-6, 6Z,6Y	Producer	58° 02' 59.9"N; 00° 20' 58.2"E	13th October 1998	31st August 2020
	15/27-7	Water Injector	58° 03' 2.78"N; 00° 21' 5.72"E	6th March 1998	18th August 2020
	15/27-8	Appraisal	58° 03' 1.63"N; 00° 21' 4.73"E	7th August 1999	Originally in 1999 Revisited in 2020
Rubie	15/28b-7,7Z	Producer	58° 04' 24"N; 00° 26' 10"E	27th January 1999	30th June 2020

4.2.1 Renee Producer (15/27-6y)

The 15/27-6y abandonment operation was carried out in just under 49 days and concluded on the 31st August 2020. The well was abandoned in accordance with Oil and Gas U.K. (OGUK) guidelines, although the operations did not follow the original programme due to issues with down hole conditions, equipment lost in hole, failure of rig and vendor equipment. However, all of the elements of the abandonment were achieved, as shown below:

- The original planned permanent abandonment programme was to set a deep combination abandonment cement plug in the Cretaceous, to isolate the Jurassic oil reservoir from the shallower water-bearing Palaeocene sands and the surface. As a result of operational reasons, the reservoir was permanently abandoned with a verified, single combination barrier in the Palaeocene Sands, as defined in issue 6 of the Oil and Gas U.K. Well Decommissioning Guidelines (Figure 4.1 shows a final Well Schematic (As Abandoned));

- Set a single verified barrier within 13⅜" casing near to 13⅜" casing shoe as a shallow barrier;
- Abandon the wellsite permanently by recovering the wellhead and associated equipment from a depth of 10 ft below the seabed.

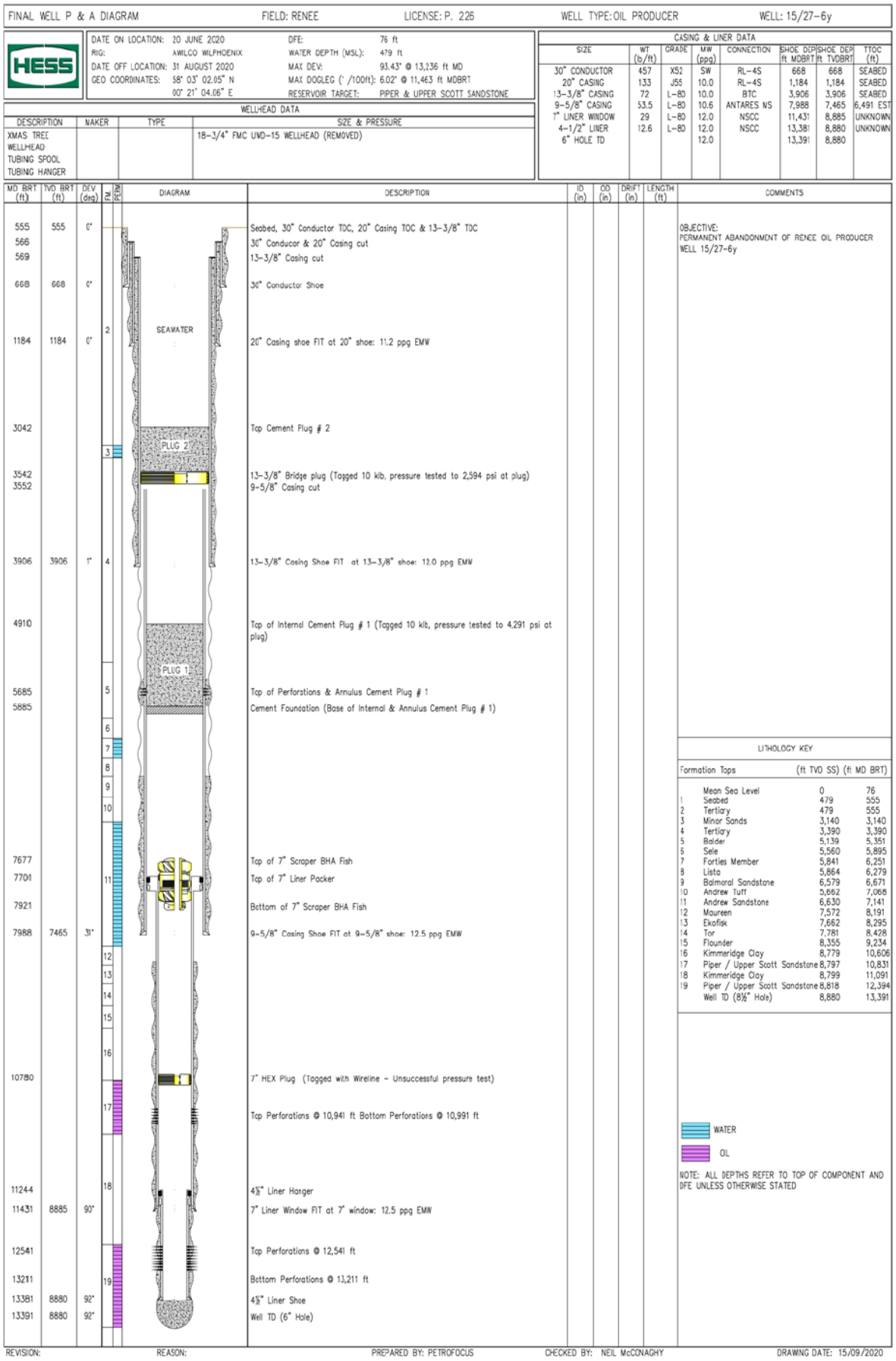
All the well abandonment objectives were met for the 15/27-6y well and the abandonment was executed in full compliance with the guidance in place at the time. The 30" and 20" casings were recovered to 10 ft below the seabed. Seabed clearance survey performed and no well-related debris was observed.

A summary of the operations are shown below:

- The debris cap was removed from the subsea tree and the BOP was run and landed out on the tree;
- The ITC was recovered. The 7-⅝" landing string was run but the Tubing Hanger Running Tool (THRT) would not latch onto the tubing hanger. The landing string was recovered and the THRT inspected (damaged seals). Multiple dummy runs were made with the THRT on 5" heavy weight drill pipe until confidence was gained that the THRT would engage without issue. The THRT was re- run on 7⅝" landing string and latched on to the tubing hanger;
- Unsuccessful attempts were made to recover the lower crown plug with a GR retrieval tool. The GR retrieval tool was changed out for a GS retrieval tool. Pressure above the lower crown plug was reduced, allowing the plug to release and be recovered to surface;
- The well was killed with inhibited seawater. The initial loss rate was 4 bbl/min;
- A drift run was completed to the 5½" x 4½" crossover in the completion. Data showed losses had stabilised and the well had become static, with the top of the fluid column at 572 ft;
- The tubing was punched at 7,571 ft. Inhibited seawater and LCM pills were pumped and losses reduced to 2.6 bbl/min, which was deemed unacceptable for recovery of the completion;
- An Interwell HEX plug was run on a WellTec E-line downhole tractor and set in the 7" liner at 10,780 ft. Pressure testing of the plug was unsuccessful, however the observed loss rate had reduced to 0.4 bbl/min;
- The tubing hanger was unlatched and the 5½" tubing was recovered to surface; Four crosscoupling control line clamps were found to be missing from the recovered upper completion (compared to the original-in hole tally);
- Multiple fishing runs were performed in an attempt to retrieve the tubing clamps, however no junk was recovered to surface;
- Following the completion of the repair work a further six fishing runs were performed, recovering, in parts, approximately 44% of the lost-in-hole clamps;
- Given the remaining junk in the hole, it was decided to recover the production packer, prior to performing the planned remediation of the 9⅝" casing annulus, thereby omitting the tractorconveyed Iso scanner (annulus) cement integrity log, due to the risk of getting the (high cost) logging tools stuck downhole due to the remaining junk. Omission of the cement integrity log necessitated a commitment to carry out annulus remediation. This programme change was covered by the material change/MOC process;
- Hence the PBR was speared and recovered, inside which two near-complete clamps were found;
- The 9⅝" production packer was milled and recovered to below the wellhead, where it became stuck. The decision was taken to washover the outside of the packer to free it from the interference in the wellhead. During these operations, the wash-over shoe and extension sub from the packer milling assembly twisted off from the BHA, requiring three fishing runs to recover. Further fishing runs were made in an attempt to recover the packer, but on the third fishing run the spear was unable to enter the production packer bore and when recovered to surface the spear grapple was missing;

- Access into the 9⅝" packer bore was (re)confirmed with a 4½" taper mill passing freely through the fish. The spear was re-run and the 9⅝" packer was successfully recovered to surface;
- A 7" casing scraper run was carried out, however the string became stuck inside the 7" liner lap at 7,922 ft and the string was unable to be worked free;
- The decision was made to sever the drill string above the BHA at the 3½" drill pipe above the top of the 7" liner, using E-line severance charges. The pipe was successfully severed at 7,653 ft. A round trip was made to dress off the stump to allow an overshot BHA to be run. The overshot successfully engaged the fish, but it was not possible to free the stuck fish despite repeated working of the string and repeated jarring to the maximum limits. The fish was left in hole between 7,921 ft and 7,677 ft;
- The decision was made to suspend operations and skid to the Renee 15/27-7 well, in order to allow for planning time and to gain approval for an alternative abandonment philosophy;
- Two RTTS packers were set and pressure tested in the 9⅝" casing. The BOPs were recovered to surface, during which a leak of control fluid was observed from the yellow pod;
- The tree was recovered to surface;
- The rig was skidded to Renee 15/27-7 well. A programme material change amendment was approved while conducting operations on the 15/27-7 well and the rig was skidded back to 15/27-6y;
- The two previously set 9⅝" RTTS packers were recovered to surface;
- The 9⅝" casing was perforated from 5,685 ft to 5,885 ft using a HydraWell perforate and wash HydraHemera tool. The interval was washed and cement set within the 12¼" x 9⅝" annulus and internally in the 9⅝" casing, with top of cement tagged and pressure tested at 4,910 ft;
- The 9⅝" casing was cut and recovered from 3,552 ft. Multiple cut and spear runs were required to retrieve the casing;
- A cleanout run was made and a 13⅜" bridge plug was set at 3,542 ft;
- The BOPs were recovered and a 13⅜" casing cut was made at 559 ft. The 13⅜" casing was section milled from 559 ft to 569 ft to avoid cement, expected behind the casing, which could potentially hinder the retrieval of the casing hanger and stump. Cement was not present and the 13⅜" casing section and casing hanger were recovered to surface on the section mill BHA;
- The PGB was recovered to surface;
- The Weatherford MOST tool was run and the 20" and 30" casings were cut at 566 ft (10.25 ft below seabed). The 20", 30" casings and wellheads were recovered to surface;
- The ROV conducted an 'as-left' survey.

Figure 4.1: 15/27-6y Final Well Status



4.2.2 Renee Water Injector (15/27-7)

The 15/27-7 abandonment operation was carried out in just over 23 days and concluded on the 18th August 2020.

The rig was skidded from the 15/27-6y well the 27th July 2020 with the riser and BOP suspended. On the 18th August 2020, P&A operations for 15/27-7 were completed, except for the wellhead removal. The rig was skidded back to 15/27-6y to complete P&A operation on that well. On the 29th August 2020, the rig was skidded back to 15/27-7 for the wellhead removal, which was completed on 30th August 2020, completing operations on the 15/27-7 well.

All planned operations were completed in line with the technical requirements of the Basis of Design and the Abandonment Programme. The Renee Water Injection well (15/27-7) was permanently abandoned in line with the requirement of the OGUK Guidelines, Issue 6. The 30" and 20" casings were recovered to 10 ft below the seabed. Seabed clearance survey performed and no well-related debris was observed.

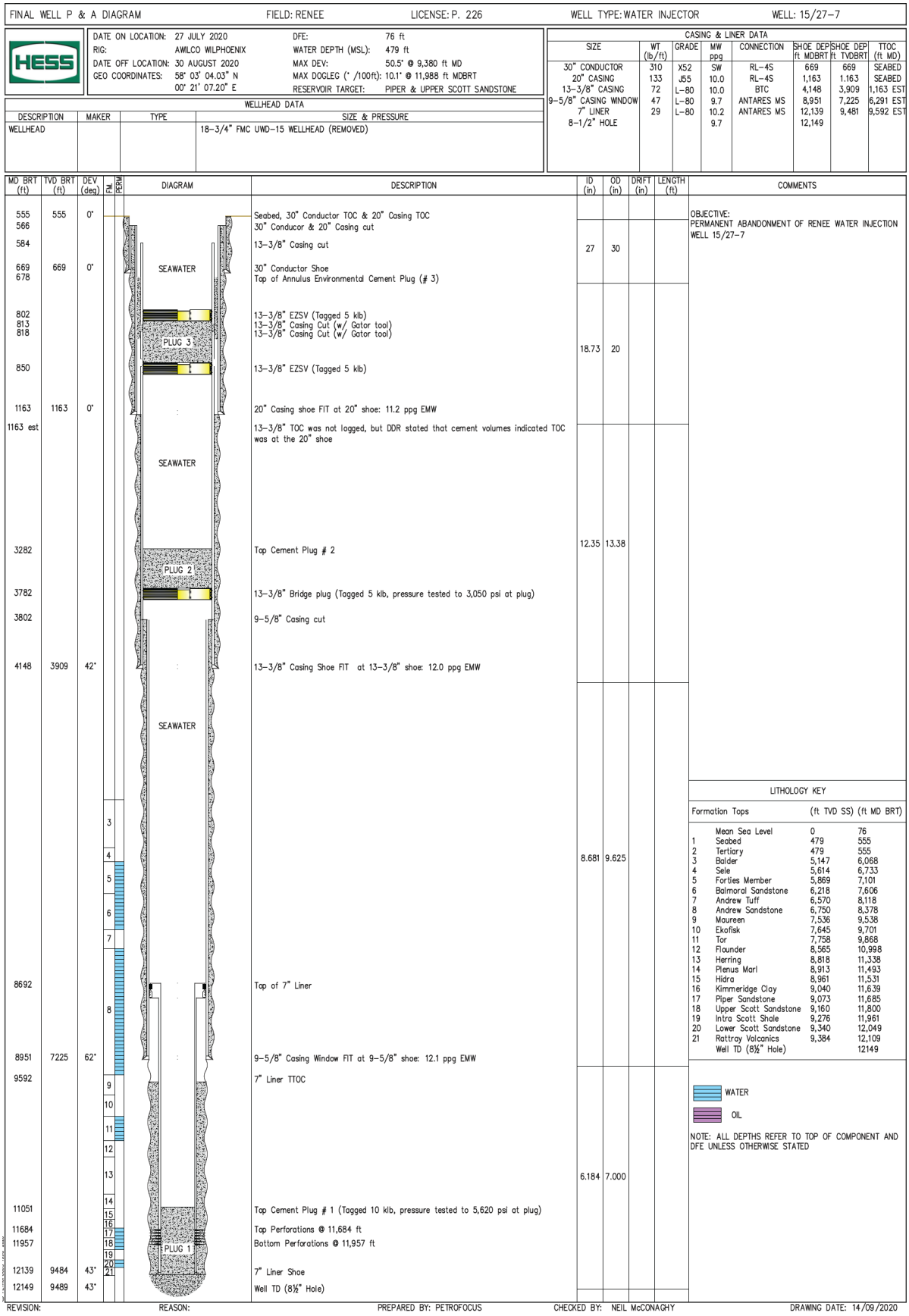
A summary of the operations are shown below:

After skidding the WilPhoenix rig over the 15/27-7 well from 15/27-6y with the riser and BOP suspended below the rig, the BOP was landed and pressure tested to 2,200 psi on the horizontal Xmas tree;

- The Internal Tree Cap was recovered, the Tubing Hanger Running Tool was run on a landing string, latched onto the Tubing hanger and then the Lower Crown Plug was recovered;
- The well was killed by bullheading seawater;
- The completion tubing was drifted to 8,800 MDBRT, before the tubing was punched at 8,670 ft MDBRT (mid-shot) in order to bullhead the annulus to seawater. However, communication between tubing and annulus was not achieved;
- The 7" water injection completion tubing was recovered down to the liner hanger at 8,692 ft MDBRT;
- A clean-out BHA was run to the TD of the well at 12,048 ft MDBRT (7 ft higher than tally), before a 997 ft combination reservoir cement barrier was set from 12,048 ft MDBRT, across the perforations and up to 11,051 ft MDBRT, 633 ft MD above the top perforations. The cement plug was tagged with 10 klb and pressure tested to 5,620 psi at the top of the plug;
- A 9⅝" RTTS was set as a suspension barrier and the BOP and the horizontal Xmas tree were recovered to surface;
- The BOP was run back onto the wellhead and the 9⅝" casing cut and recovered down to 3,802 ft MDBRT, just above the 13⅜" shoe at 4,148 ft MDBRT;
- A second 500 ft abandonment cement plug was set in the 13⅜" casing on an EZSV bridge plug. The EZSV was tagged at 3,782 ft MDBRT with 5 klb and pressure tested to 3,050 psi. Setting the cement plug went smoothly and the top of cement was not tagged, given the plug was set inside casing on a verified base and hence the tag was not required;
- An (annular) environmental plug was set in the 13⅜" casing between two EZSVs set at 850 ft and 802 ft MDBRT (mid-element). The 13⅜" casing was perforated with a GATOR tool at 818 & 813 ft MDBRT, and 60 bbl wash pill followed by 30 bbl cement was pumped between the two EZSVs and up the 13⅜" x 20" casing annulus, to seal any possible OBM in the annulus from the environment;
- The 13⅜" casing hanger and casing stump were recovered from566 ft MDBRT, 11 ft below the seabed;
- The WilPhoenix rig was then skidded over to 15/27-6y to complete abandonment operations on that well, and wellhead recovery operations on the 15/27-8 well, before being skidded back to 15/27-7 to recover the PGB to surface. The 20" & 30" casing and wellhead were cut at 566 ft MDBRT, 11 ft below seabed, completing well abandonment operations on 15/27-7.

Figure 4.2 shows a final Well Schematic (As Abandoned) of the 15/27-7 well.

Figure 4.2: 15/27-7 Final Well Status



4.2.3 Renee Appraisal (15/27-8)

The Renee appraisal well (15/27-8) was previously P&A in 1999, but the wellhead was left in-place; however, during a site inspection, small amounts of gas were noted bubbling under the trash cap. Samples of the gas were analysed and confirmed to be naturally occurring biogenic gas most likely caused by the anaerobic decay of non-fossil organic matter. The result is supported by the lack of any hydrocarbon producing intervals encountered when drilling the well. Therefore, as part of the P&A operations, the existence of the environmental plug set in the 20-inch casing during the original plugging operations was investigated and deemed to be satisfactory.

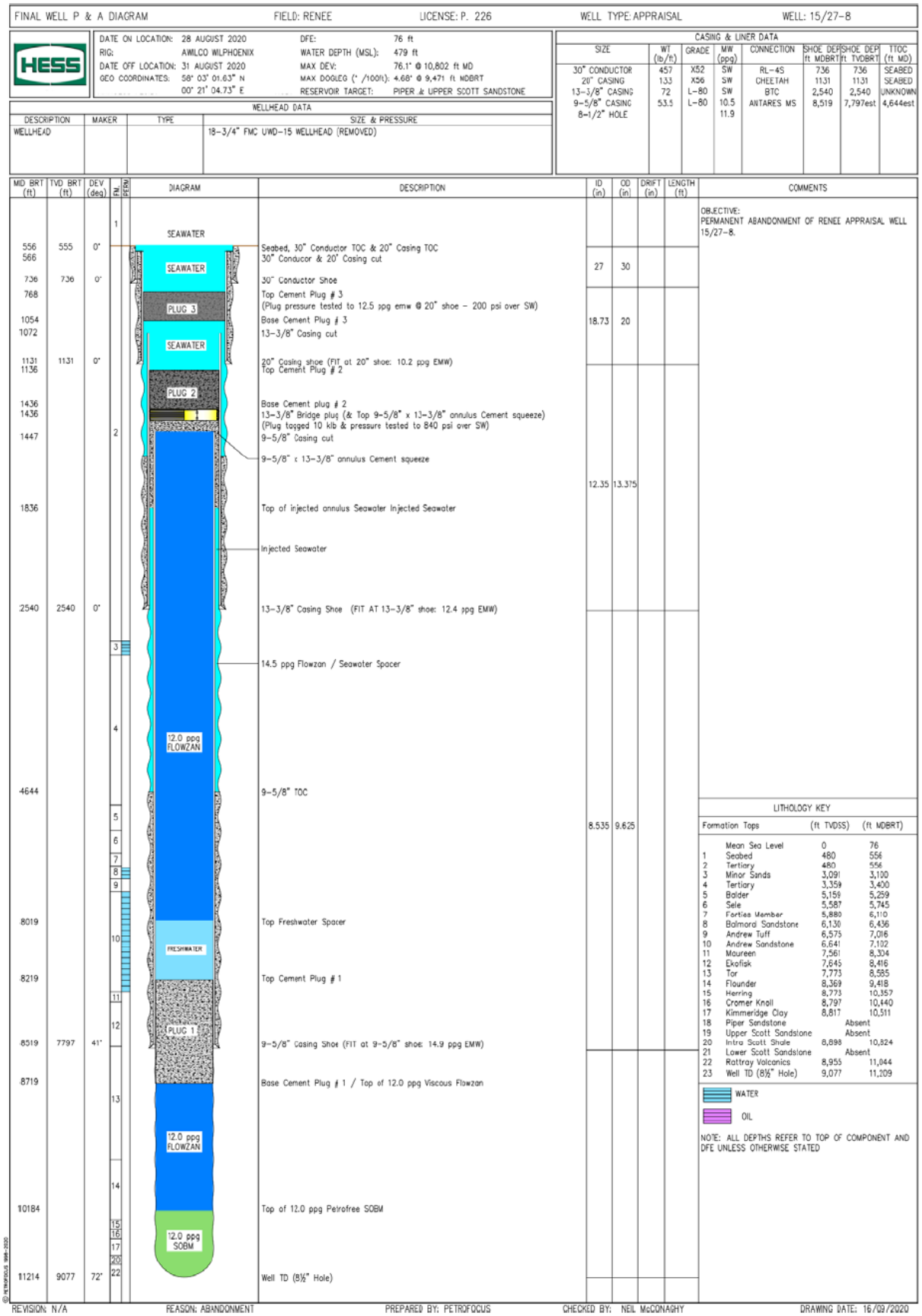
The primary objective for the Renee 15/27-8 well was to assure the presence of the existing environmental plug and then permanently abandon the well, in compliance with the UK requirements in force at the time. All elements of the abandonment were achieved. The 15/27-8 abandonment operation was carried out in just over 1 day and concluded on the 31st August 2020. The 30" and 20" casings were recovered to 10 ft below the seabed. Seabed clearance survey performed and no well-related debris was observed.

An operational summary is shown below:

- The rig was skidded approximately 25 m to well centre from the 15/27-6y well;
- A 3½" cement stinger was run into the well on 5" drill pipe to a solid, hard tag of the existing environmental plug at 768 ft, 14 ft deeper than expected;
- The permanent guide base recovery tool was run, and the guide base was recovered from the wellhead;
- The rig was skidded to the safe handling area, where the guide base was then recovered to the splash zone. At his point, the shear pins on the running tool sheared, releasing the tool from the guide base which fell back to the seabed. The guide base was observed to be undamaged and sitting level.
- The rig was skidded approximately 10 m to where the guide base was lying, and the guide base was recovered;
- The 20" and 30" casings were cut, and the wellhead was recovered;
- After carrying out a debris scan, the rig was skidded back to complete abandonment operations on the 15/27-6y well.

Figure 4.3 shows a final Well Schematic (As Abandoned) of the 15/27-8 well.

Figure 4.3: 15/27-8 Final Well Status



4.2.4 Rubie Producer (15/28b-7z)

The 15/28b-7z abandonment operation was carried out in just over 23 days (excluding mobilisation from Invergordon to the 500 m zone) and concluded on the 30th June 2020.

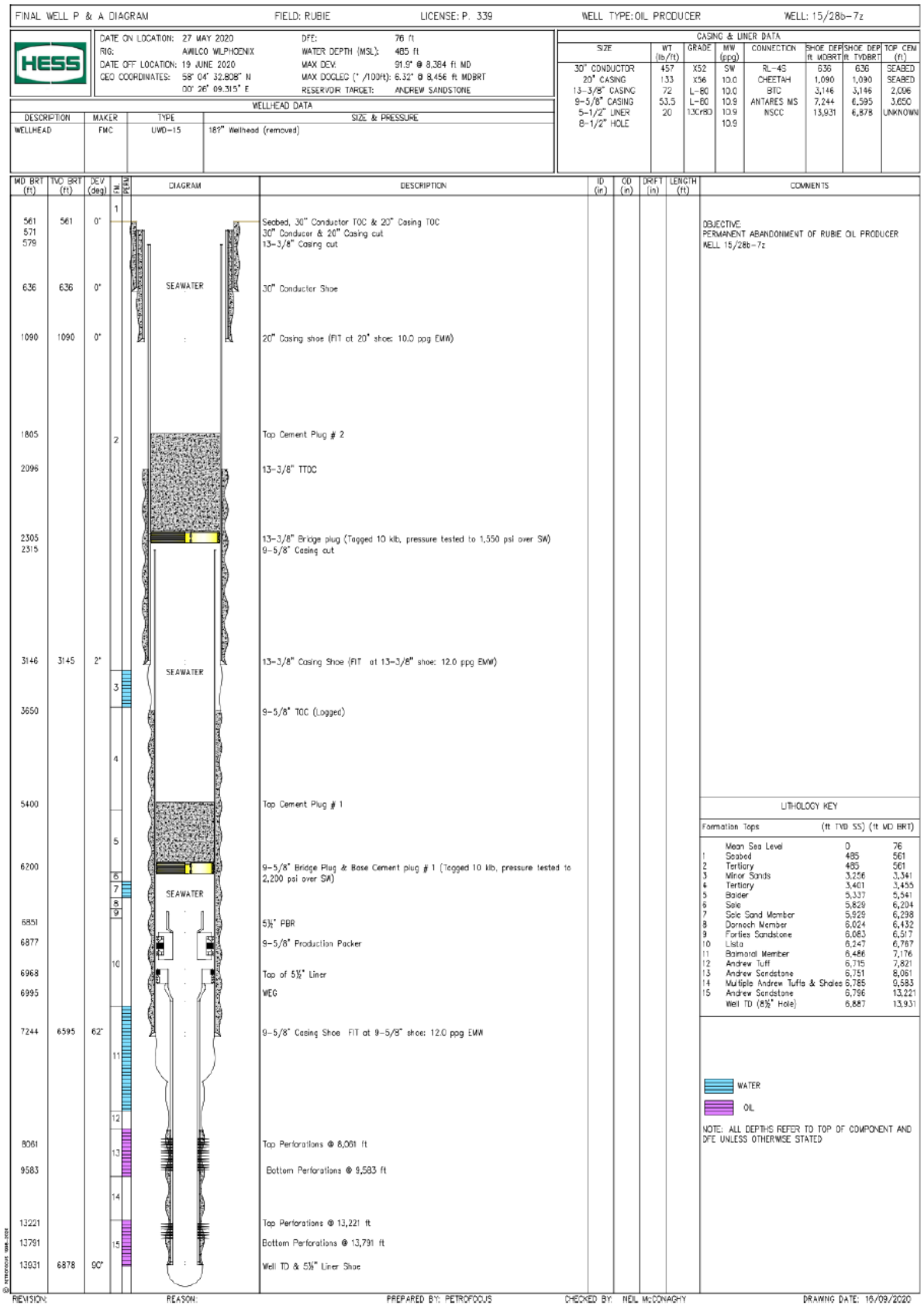
All planned operations were completed in line with the technical requirements of the Basis of Design and the Abandonment Programme. The Rubie Producer (15/28b-7z) was permanently abandoned in line with the requirement of the OGUK Guidelines, Issue 6. The 30" and 20" casings were recovered to 10 ft below the seabed. Seabed clearance survey performed and no well-related debris was observed.

A summary of the operations are shown below:

- The debris cap was removed from the subsea tree and the BOP was run on HP marine riser;
- A 7⅝" landing string was run and engaged onto the tree and tested;
- After recovering the tree cap and lower crown plug the well was killed with a 9.4 lb/gal brine, however, the brine was chased with seawater due to uncontrollable losses. Having been unable to cure the losses and establish a fluid level at surface, a bridge plug was run and set above the production packer in the completion tubing, at 6,720 ft;
- The completion tubing was cut at 6,600 ft and was recovered after displacing the annulus to seawater;
- The 9⅝" casing was scraped, cleaned-up and then logged with Schlumberger's IsoScanner logging string to assess the status of the cement behind the 9⅝" casing. The log results confirmed that no annulus remediation was required, as the annular cement bond-quality was adequate;
- 9⅝" bridge plug was run and set at 6,200 ft, tagged and then tested to 2,200 psi;
- An 800 ft permanent combination barrier cement plug was set directly on the bridge plug;
- The well was suspended while the BOP was removed, and the subsea Xmas tree was recovered prior to re-running the BOP;
- The 9⅝" seal assembly was recovered, and the casing was cut at 3,095 ft but could not initially be recovered. An intermediate cut was made at 2,315 ft and the casing down to this point was recovered. A 13 ⅜" scraper was run to clean up down to the stump at 2,315 ft, prior to making a dedicated fishing run to successfully recover the remaining section of 9⅝" casing from 2,315 ft to the initial cut at 3,095 ft;
- A 13⅜" scraper was run to clean-up the 13⅜" casing prior to setting, tagging and testing a 13⅜" bridge plug to 1,550 psi at 2,305 ft;
- A 500 ft single permanent barrier was placed directly on top of the bridge plug from 2,305 ft to 1,805 ft;
- The 13⅜" seal assembly was recovered, and the 13⅜" casing was cut below the wellhead;
- The hanger and stump were recovered;
- The BOP was recovered to surface;
- The permanent guide base was recovered prior to severing the 30" and 20" casings mechanically 10 ft below the seabed, using a Weatherford MOST tool;
- After carrying out a seabed survey and debris scan, the rig was demobilised to the 500 m mark on its way to abandon the 15/27-6y well, located in the neighbouring Renee field.

Figure 4.4 shows a final Well Schematic (As Abandoned) of the 15/28b-7z well.

Figure 4.4: 15/28b-7z Final Well Status



4.2.5 Items Recovered

For all 4 wells a number of casings and wellheads were recovered. Table 4.2 shows the items recovered from the wells.

Table 4.2: The Rubie and Renee Items Recovered During P&A Operations

Asset	Well Number	Items Recovered
Renee	15/27-6, 6Z,6Y	9⅝, 13⅜ and 20 inch Casings 30 inch Conductor and Wellhead
	15/27-7	9⅝, 13⅜ and 20 inch Casings 30 inch Conductor and Wellhead
	15/27-8	30 inch Conductor and Wellhead
Rubie	15/28b-7,7Z	9⅝, 13⅜ and 20 inch Casings 30 inch Conductor and Wellhead

5 Verification of Completion

Over the course of the Rubie and Renee decommissioning operations, various seabed and environmental surveys have been undertaken to support and confirm the decommissioning activities as they were carried out and to also provide information on baseline seabed conditions, status of remaining infrastructure, the location of any debris, and potential environmental impacts.

5.1 Surveys

There has been a number of different surveys undertaken at both the Rubie and Renee locations since the cessation of production.

Site-specific data gathered by HESS for Rubie and Renee include:

- The pre-decommissioning Environmental Baseline Survey (EBS) conducted in 2010;
- ROV Inspection Surveys in 2014 & 2017;
- Multibeam Bathymetry Site Survey completed in April 2020;
- ROV 'as-left' Surveys once P&A Operations were finalised, completed in 2020;
- Post Decommissioning Multibeam and Side-Scan Sonar Survey completed in 2020;
- Post Decommissioning Environmental Survey, which was a repeat of 2010 EBS, completed in 2020;
- SFF Over-Trawl Survey completed in 2020.

5.1.1 Environmental Baseline Survey (2010)

An EBS was conducted at the Rubie and Renee locations by HESS in 2010, soon after production was ceased. The aim of the survey was to form a baseline of seabed and benthic conditions prior to the decommissioning operations starting. Fifteen sampling stations were taken at both Rubie and Renee locations (Figure 5.1).

Figure 5.1: The Rubie and Renee Sampling Stations from the 2010 EBS (HESS, 2010)

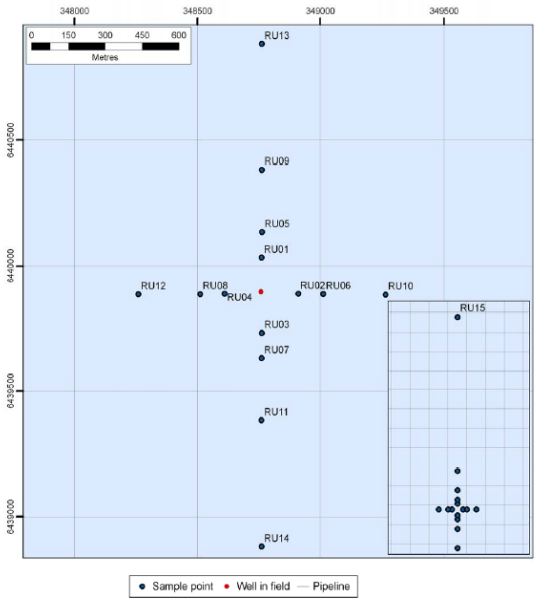


Figure 2.2: Sample Locations, Rubie Environmental Seabed Survey, August/October 2010

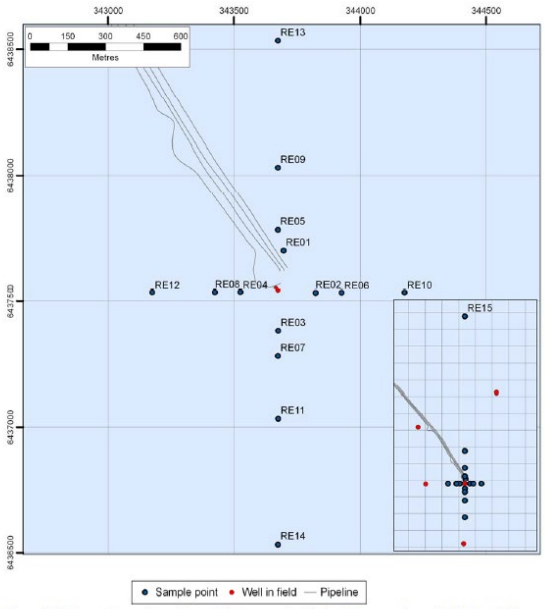


Figure 2.1: Sample Locations, Renee Environmental Seabed Survey, August/October 2010

- The survey showed that that macrofaunal communities at the Rubie and Renee fields were found to be low in the number of taxa (Renee: 33-60 taxa; Rubie: 26-62 taxa) and low to high in the number of individuals (Renee: 150-562 individuals; Rubie: 69-440 individuals). Multivariate analysis showed that there was a moderate to high degree of similarity across both survey areas (HESS, 2010). Similar benthic species were found across both sites. The most abundant species were the polychaetes *Paramphinome jeffreysii* and *Heteromastus filiformis* and the molluscs *Adontorhina similis* and *Parvicardium minimum*. Other common taxa included the polychaetes *Levinsenia gracilis*, *Spiophanes kroyeri*, *Abyssoninoe Hibernica* and the molluscs *Timoclea ovata*, *Cylichnina umbilicata* and *Thyasira flexuosa* (HESS, 2010). All of these species are typical of this area of the central North Sea.
- The 2010 EBS found very little variation between the sediments at the well sites. Sediments were classified as moderate to poorly sorted medium silts (HESS, 2010). Total carbonate (as calcium carbonate) amounts ranged from 19.4% to 30.4% (mean 22.8%) at Renee and 17.7% to 26.4% (mean 21.4%) at Rubie. Total organic matter (TOM) amounts were varied more at Renee (2.5% to 7.6% (mean 5.9%)) than at Rubie (4.3% to 10.1% (mean 7.4%)) (HESS, 2010). At Renee, total organic carbon (TOC) levels ranged from <0.10% to 1.10% (mean 0.85%) and total nitrogen levels, 1200 µgg-1 to 1620 µgg-1 (mean 1437 µgg-1). At Rubie, TOC and total nitrogen levels were 0.69% to 1.40% (mean 1.06%) and 1220 µgg-1 to 2460 µgg-1 (mean 1598 µgg-1) respectively (HESS, 2010). The total hydrocarbon concentrations (THC) measured in the surface sediments ranged from 5.3 µgg-1 to 56.8 µgg-1 (mean 24.4 µgg-1) for Renee and 5.9 µgg-1 to 34.7 µgg-1 (mean 17.7 µgg-1) for Rubie. The overall mean aromatic levels at both sites were only slightly higher than the cited background data, once outliers were removed (HESS, 2010).

Overall the levels of all heavy metals measured during the 2010 EBS were of no environmental concern and were largely typical of natural background concentrations (HESS, 2010).

5.1.2 Multibeam Bathymetry Site Survey

The survey covered a 4 km x 4 km area centred at the proposed Rubie and Renee rig centre (Figure 5.2 and Figure 5.3). The survey was conducted using the MV Fugro Venturer during the survey period 24th March to the 2nd April 2020.

During the survey, numerous pockmarks were found in the vicinity of the Rubie well and the proposed anchor locations, ranging in size between 14 m and 86 m in diameter and 0.5 and 4.0 m depth, and varying in shape from sub-circular to elliptical (Fugro, 2020). Numerous pockmarks were also found in the vicinity of the Renee wells, ranging in size between 19 m and 96 m in diameter and 0.4 and 4.0 m depth. Therefore, there was potential that the Annex I habitat 'submarine structure made by leaking gases' may be present in the surrounding area. However, no evidence of fluid escape was observed in the immediate vicinity of the pockmarks during the 2020 debris survey and there were no habitats of conservation importance considered to be present at the nearby Renee wells during the 2008 rig survey (Fugro, 2020).

During the survey, twenty-six boulders were located at the Rubie location and twenty-four boulders were identified at the Renee location (Fugro, 2020). In addition, four items of debris were also located at Rubie (Fugro, 2020), however the debris was too small to be removed and will not pose a risk to fishing. Several anchor scars were identified during the survey, radiating out from the 15/28-7z Rubie well and the nearby abandoned 15/28b-4 well, located approximately 1 km south east, as well as numerous trawl scars, however none of these would cause a snagging hazard (Fugro, 2020).

Figure 5.2: The Location of the Renee Multibeam Bathymetry Site Survey

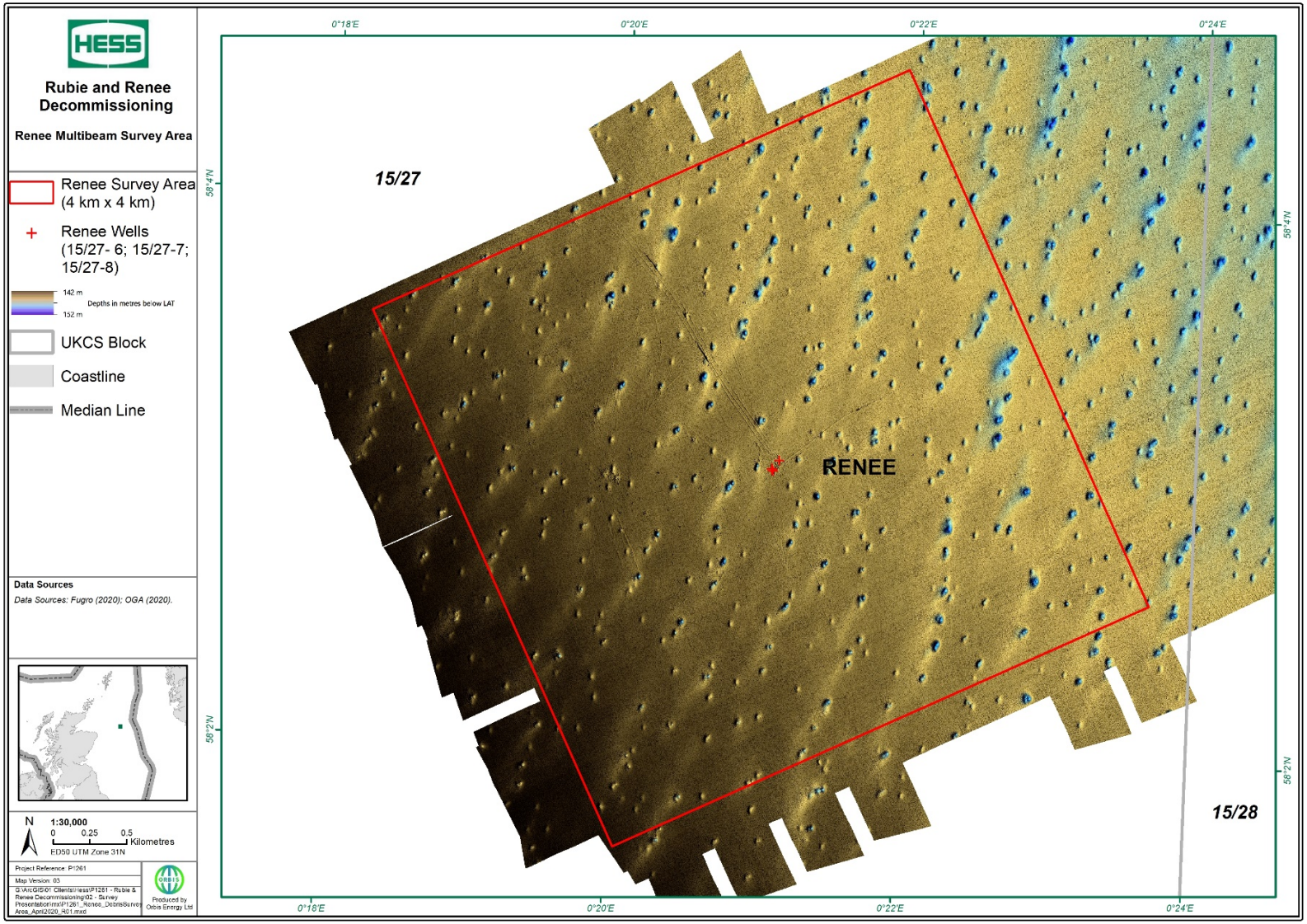
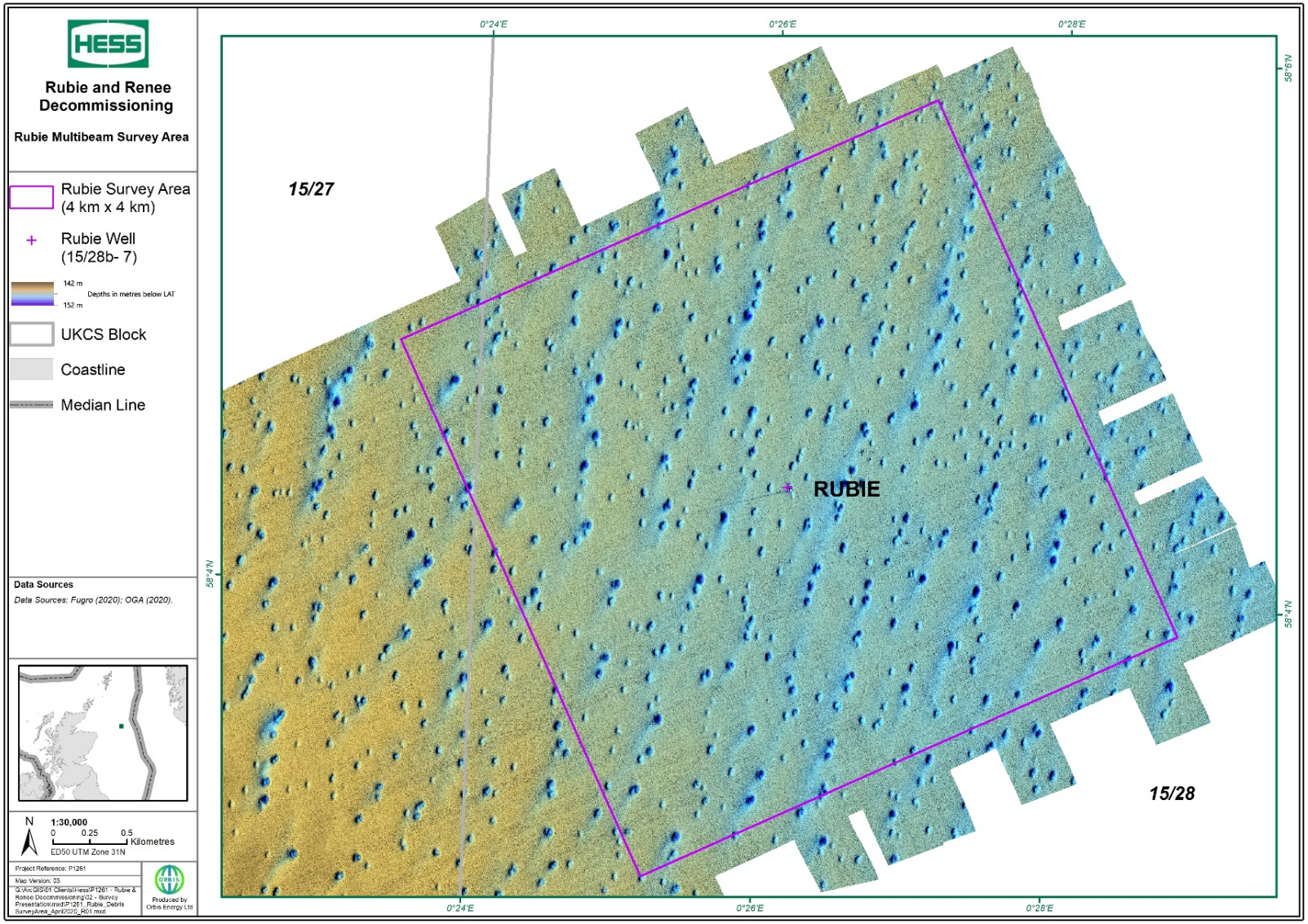


Figure 5.3: The Location of the Rubie Multibeam Bathymetry Site Survey



5.1.3 ROV 'as-left' Surveys

Once the P&A operations were finalised, Petrofac completed a ROV Visual 'as-left' Survey on each of the four wells at Rubie and Renee. The ROV Surveys confirmed that there was no debris from the P&A operations left behind.

5.1.4 Post Decommissioning Multibeam and Side-Scan Sonar Survey

On the instruction of HESS, Fugro performed a geophysical and environmental survey for the decommissioning of the Rubie and Renee fields. The survey was conducted using the MV Fugro Venturer during the survey period 1st to 10th October 2020.

The seabed features interpretation (from sidescan sonar and multibeam) are presented in Figures 5.4 – 5.7.

5.1.4.1 Renee

The side scan sonar data exhibited uniform, moderate reflectivity across the majority of the survey area and the seabed sediments are interpreted to comprise very soft slightly sandy clay. The seabed sediment interpretation was based on side scan sonar reflectivity characteristics, British Geological Survey (BGS) regional information and previous reports. Areas of gravel were interpreted to occur around the plugged and abandoned wells, indicated by higher reflectivity on the side scan sonar data.

Four depressions are observed in the north-east of the survey area with diameters ranging from 3 m to 5 m with depths of up to 1 m compared with the surrounding seabed.

A total of two objects were observed within the survey area, of which one was interpreted as a concrete slab (please see Section 2.3.2.2) and the other as a boulder. The concrete slab was left in place as this was the Best Practicable Environmental Option (BPEO), with the overtrawl survey proving there is no hazard to fishing.

A total of four magnetic anomalies were recorded during the survey. Three magnetic anomalies were identified in the survey area, which were interpreted to be associated with existing plugged and abandoned 15/27-6y and 15/27-8 wells. A fourth magnetic anomaly was identified beyond the northern boundary of the survey area and was interpreted to be associated with the 15/27-7 Well.

5.1.4.2 Rubie

The side scan sonar data exhibited uniform, moderate reflectivity across the majority of the survey area and the seabed sediments were interpreted to comprise very soft slightly sandy clay. The seabed sediment interpretation was based on side scan sonar reflectivity characteristics, BGS regional information and previous reports.

Areas of gravel were interpreted to occur around the plugged and abandoned wells, indicated by higher reflectivity on the side scan sonar data. Three depressions were observed in the survey area with diameters ranging from 4 m to 5 m with depths up to 0.5 m compared with the surrounding seabed.

No objects were interpreted within the Rubie survey area in the side scan sonar or bathymetry data.

Three magnetic anomalies were identified in the survey area, all of which were interpreted to be associated with existing plugged and abandoned 15/28b-7z well.

Three anchor scars were identified within the survey area radiating out from the plugged and abandoned 15/28-7z Well however none would pose a snagging risk (Fugro, 2020).

Figure 5.4: The Multibeam Bathymetry Site Survey at Renee (Fugro, 2020)

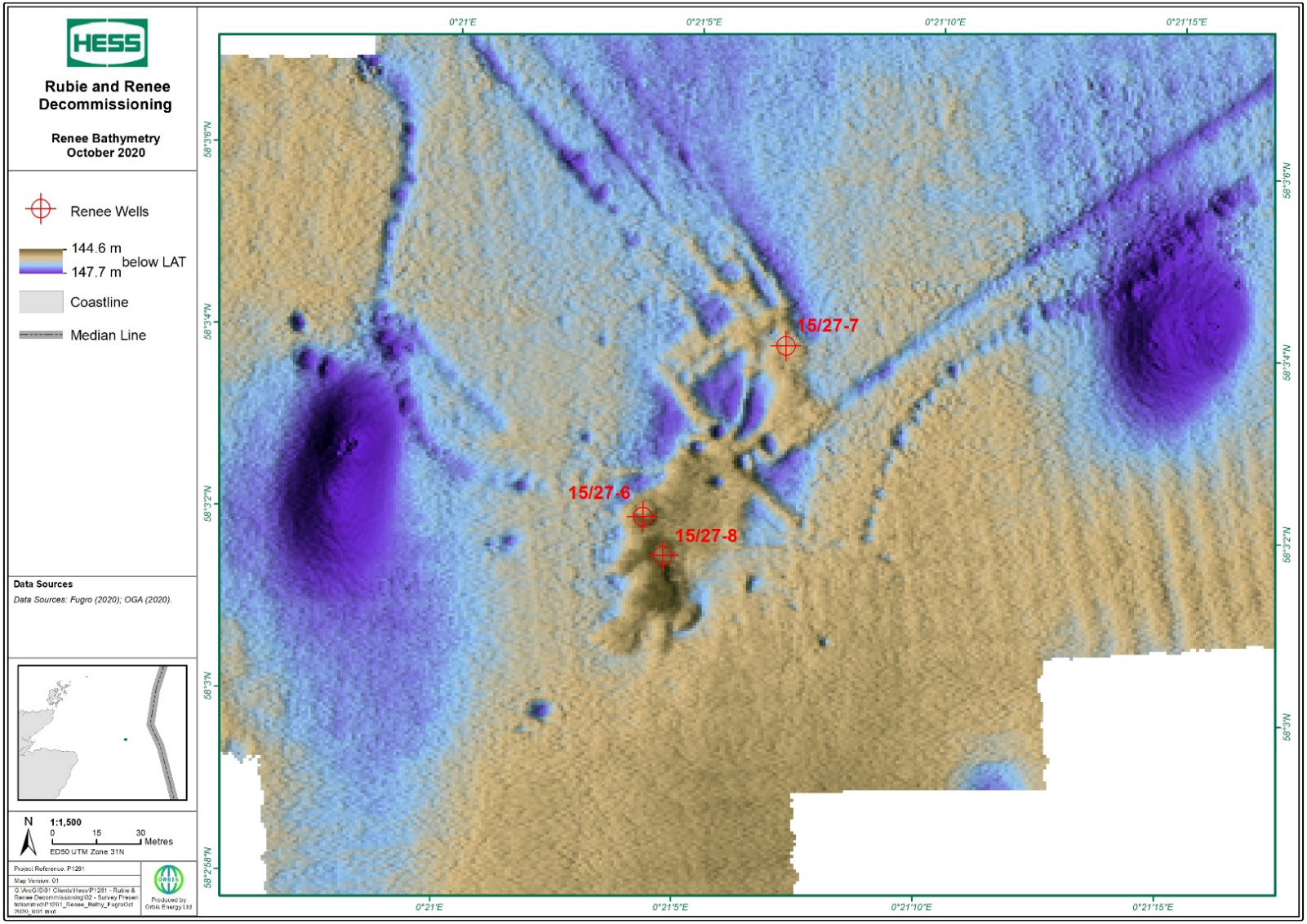


Figure 5.5: The Sidescan Sonar Site Survey at Renee (Fugro, 2020)

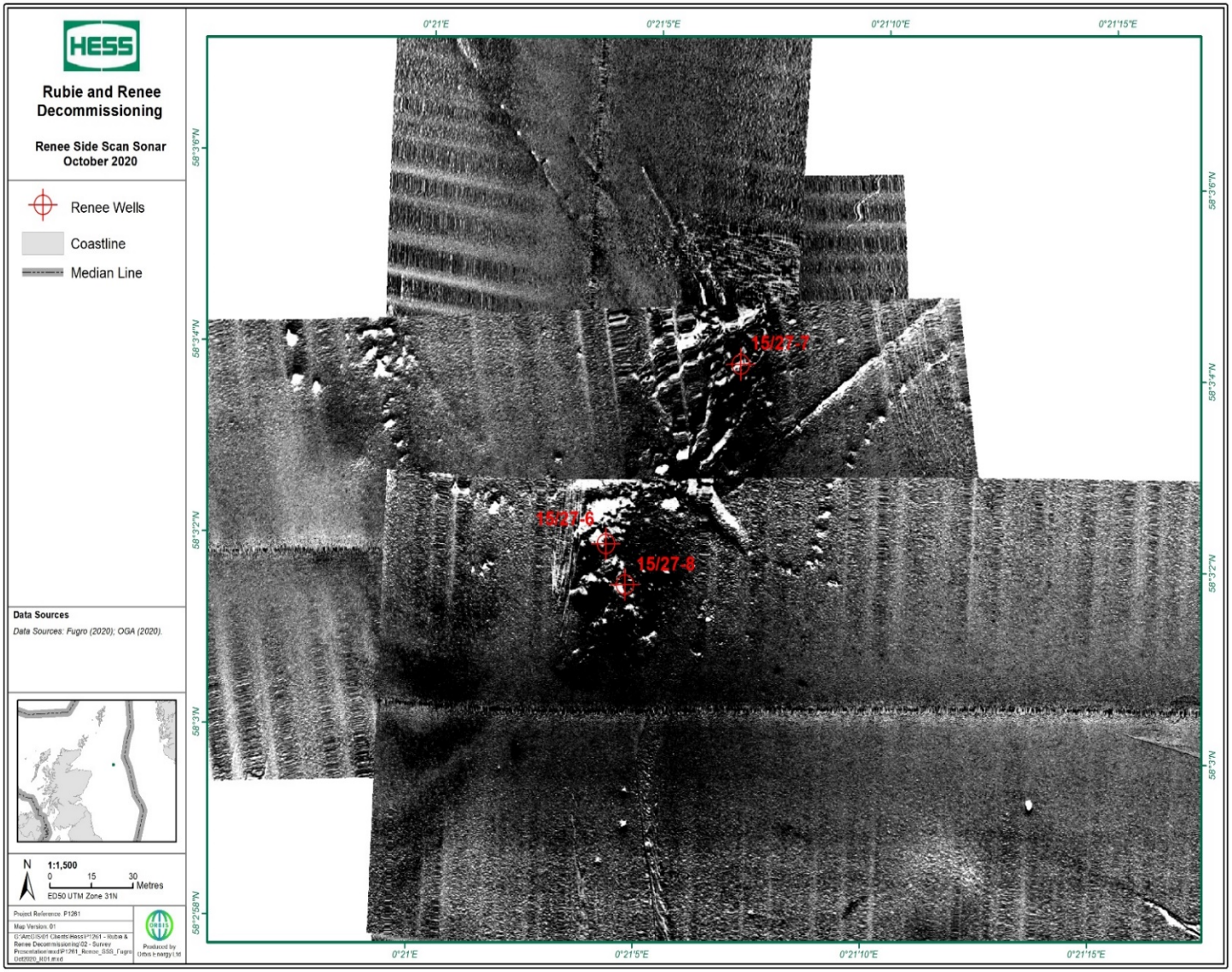


Figure 5.6: The Multibeam Bathymetry Site Survey at Rubie (Fugro, 2020)

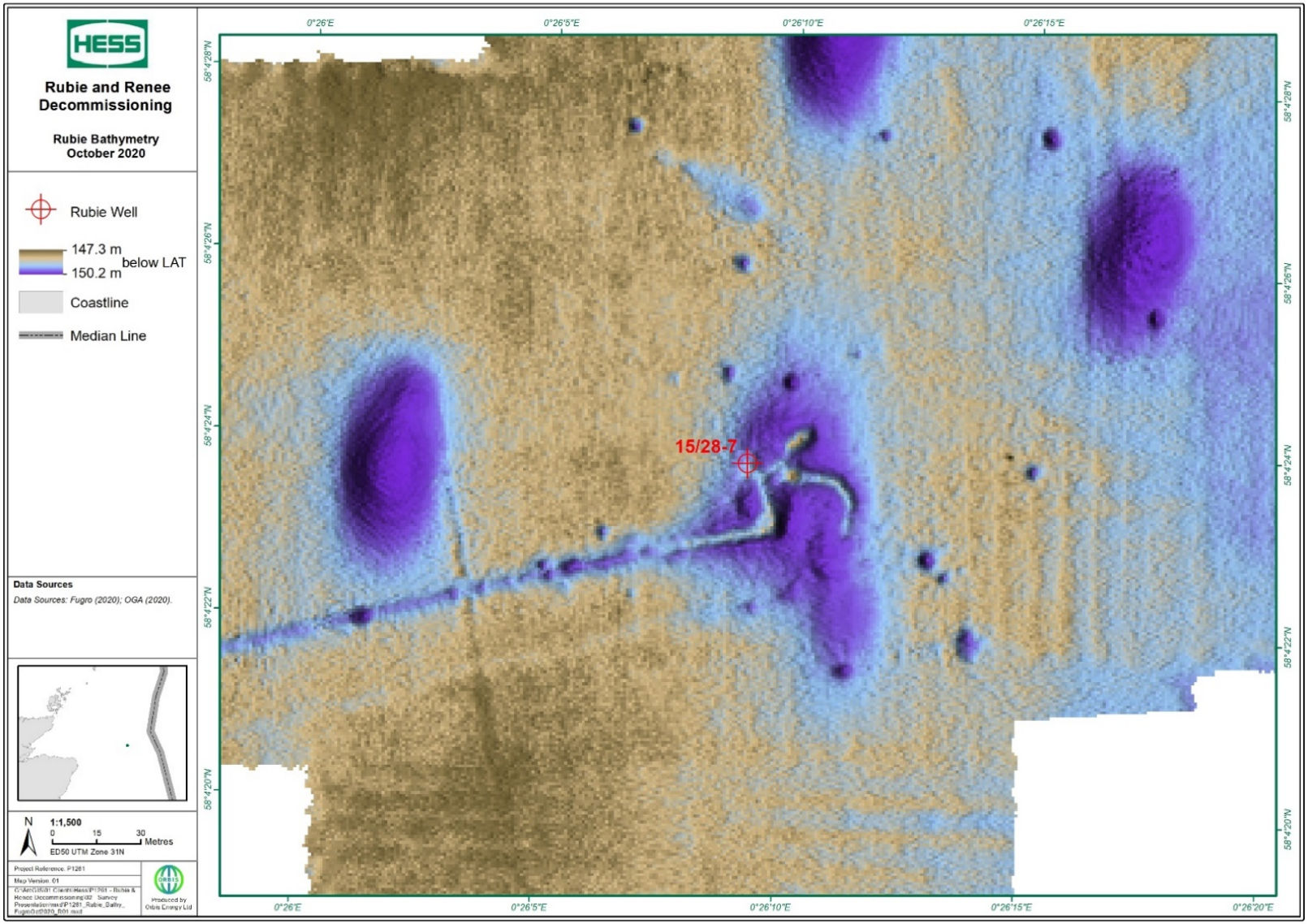
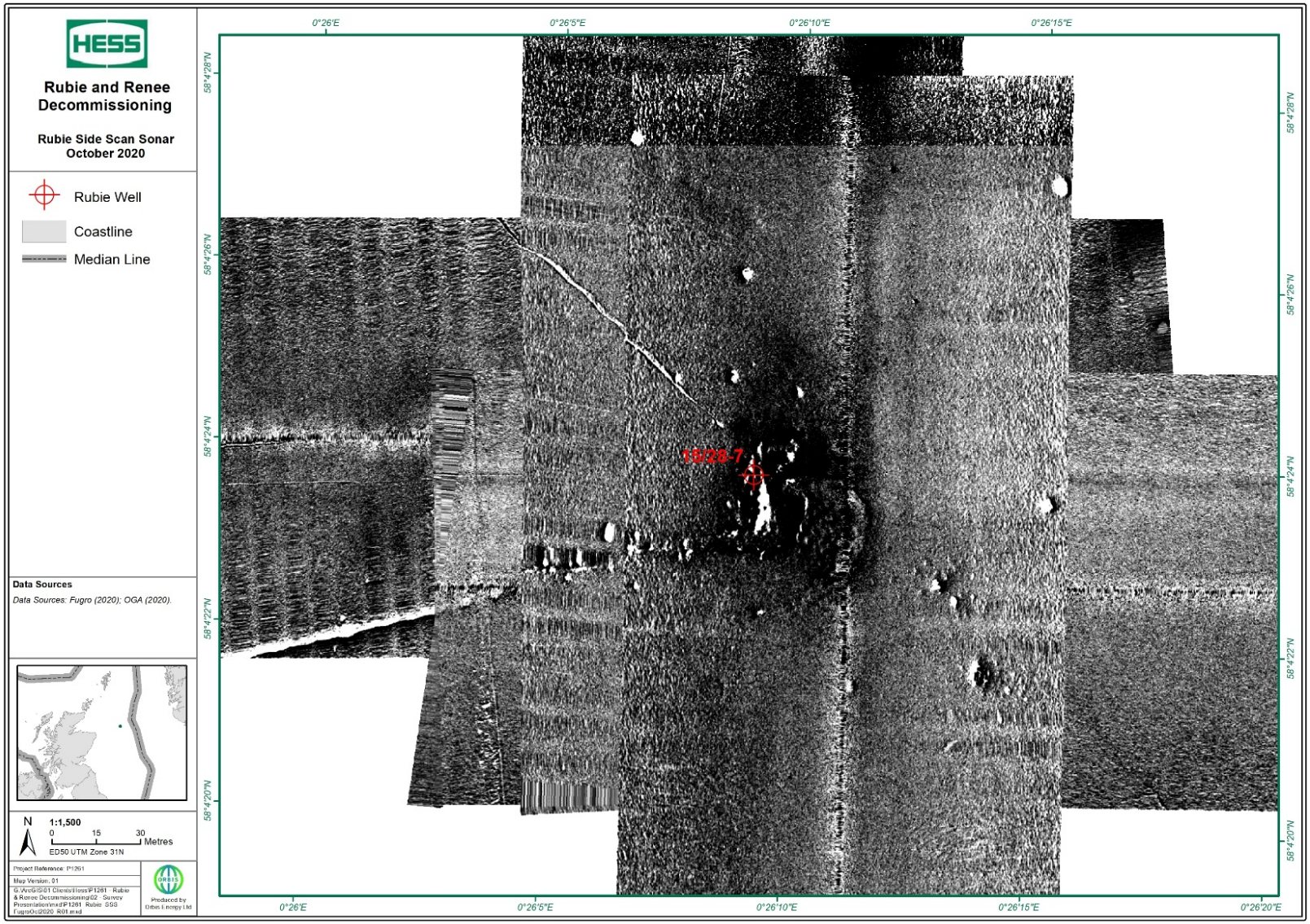


Figure 5.7: The Sidescan Sonar Site Survey at Rubie (Fugro, 2020)



5.1.5 Post Decommissioning Environmental Survey

On the instruction of HESS, Fugro performed an environmental survey for the decommissioning of the Renee (Fugro, 2021a) and Rubie (Fugro, 2021b) fields. The survey was conducted using the MV Fugro Venturer during the survey period 1st to 10th October 2020. The survey was designed to be an exact replica of the 2010 EBS (see Section 5.1.1) and as such the sampling stations (15) for the 2020 survey were exactly the same in both number and locations (Figures 5.12 and 5.13).

5.1.5.1 Renee

Sediment Characterisation

The sediment composition at all stations was described as either medium or coarse silt (Wentworth, 1922), indicating a relatively homogenous sediment. Fines was the dominant fraction followed by sand and little to no gravel. Although this is in contrast to the sidescan sonar data interpretation (which stated areas of gravel were present), it should be noted that the sidescan sonar interpretation is based on surface texture, however the grab samples showed that this is not the case.

Sediment organic and inorganic carbon measurements (total organic carbon (TOC), total organic matter (TOM) and carbonate) displayed low variability throughout the survey area. The sediment characteristics are typical of those recorded in this part of the Central North Sea (CNS).

The sediment physical and chemical characteristics recorded in 2020 are very similar to those found previously at the site during the pre-decommissioning survey of the Renee development conducted in 2010 (HESS, 2010) indicating that decommissioning of the development infrastructure has not altered the seabed environment in the vicinity of the well site (Fugro, 2021a). Table 5.1 shows the sediment characteristics at the Renee location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The TOM and fines increased slightly between 2010 and 2020 and both are above the typical CNS mean and 95% of it to varying degrees (Table 5.1). The data here show that at these 4 stations, the sediment characteristics were comparable between both surveys, further supporting that that decommissioning of the development infrastructure has not altered the seabed environment.

Table 5.1: The Sediment Characteristics at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Renee (HESS, 2010; Fugro, 2020)

Station and Year of Survey	Distance (m)	Bearing (°)	TOM (%)	TOC (%)	Carbonate (%)	Fines (%)
RE01 (2010)	150	0	5.5	0.58	21.8	66.1
RE01 (2020)	150	0	8.93	0.89	24.1	67.26
RE02 (2010)	150	90	4.8	0.75	23.1	66.6
RE02 (2020)	150	90	6.48	0.74	22.8	68.87
RE03 (2010)	150	180	5.6	0.88	22.1	65.4
RE03 (2020)	150	180	6.29	0.87	23.7	65.5
RE04 (2010)	150	270	2.5	0.86	30.4	67.2
RE04 (2020)	150	270	7.17	0.73	29.5	69.41
Key:	**Below CNS Background Mean**		**Above CNS Background Mean**		**Above CNS Background 95th Percentile**	
2010 Survey Data in Red Text						
Central North Sea Background (UKOAA, 2001)						
Mean			1.63	-	-	17.38
95th Percentile			4.48	-	-	77.56

Sediment Hydrocarbons

The gas chromatographic profiles were typical of background sediments in the CNS, displaying low-level weathered petroleum residues commonly found in CNS sediments. Higher proportions of low molecular weight hydrocarbon components (mainly nC12 to nC16) were observed for a small number (6) of the stations located within 500 m of the well site, indicating the presence of synthetic paraffin drilling fluids originating from historic drilling activities. For nC12-36, four of the stations exceeded the CNS background threshold and one station exceeded the 95th percentile thresholds. This type of fluid was widely used in the North Sea in the mid-to-late 1990s (at the time of drilling the Renee wells) therefore these compounds will have originated from drilling operations at the site. Similar inputs were observed in the chromatograms recorded from the 2010 pre-decommissioning survey, where stations located on the north-south axis had signs of synthetic paraffin drilling fluid at higher concentrations. It is important to note that for both surveys, the drilling fluid components contributed only a very small proportion of the total hydrocarbons present in the sediment. A cluster of peaks around nC21 was present at all stations. This signature is often seen in sediments from the CNS and thought to be branched isoprenoids of biogenic origin.

The total hydrocarbon content (THC) values recorded in 2020, ranging from 3.0 µg/g to 15.5 µg/g, were comparable to background concentration for the CNS and lower than values recorded previously at the Renee field, indicating ongoing biodegradation and weathering of the hydrocarbons over time. The THC values recorded within 250 m of the well site in 2020 were lower than those recorded in 2010 (ranging from 4.1 µg/g to 13.2 µg/g compared to 20.0 µg/g to 56.8 µg/g) indicating that a reduction in hydrocarbon concentration has occurred over the 10 years between surveys, possibly due to on-going biodegradation and weathering of the hydrocarbons present. It should be noted that the concentrations of hydrocarbons recorded around the Renee well site are considerably lower than those recorded at similar distances from larger North Sea installations (Fugro, 2021b), this is consistent with the fact that only 3 wells were drilled at the site. There were three stations (Table 5.2) during the 2020 survey where the CNS background levels were exceeded, however none of the 95th percentiles thresholds were exceeded. The recorded levels are also well below the 50 µg/g THC effects range low (ERL) value, above which adverse effects on the seabed macrofauna community may be detected. The survey data collected in 2010 and 2020 show that THC levels have decreased from pre-decommissioning to post-decommissioning, and decommissioning activities have not spread hydrocarbon contamination from the immediate vicinity of the infrastructure into the wider area (Figure 5.8).

The total 2 to 6 ring polycyclic aromatic hydrocarbon (PAH) concentrations recorded in 2020, ranging from 0.123 µg/g to 0.578 µg/g, were broadly comparable to background concentrations for the CNS. The total 2 to 6 ring PAH concentrations recorded across the Renee survey area were comparable to the reference station REN15, suggesting that values from the current survey are similar to levels observed in the wider area. Sediment PAH levels were slightly lower than those recorded at the same stations during the 2010 pre-decommissioning survey, where concentrations ranged from 0.185 µg/g to 0.960 µg/g. However, three stations during the 2020 survey did exceed the CNS background levels threshold and one station exceeded the 95th percentile threshold.

The total 2 to 6 ring PAH values recorded in 2020 showed a moderate degree of spatial variability but results were not influenced by distance from the well site. The US EPA has identified 16 priority PAHs to be monitored and the Coordinated Environmental Monitoring Programme (CEMP) specifies 9 PAHs of specific concern, which primarily reflect inputs from anthropogenic combustion sources (Fugro, 2021a).

The United States Environmental Protection Agency 16 (US EPA 16) and alkylated PAH concentrations were below their respective ERL values at all stations. When normalised to 2.5 % TOC, the mean sum of the Oslo and Paris Commission (OSPAR) comparable 2 to 6 ring PAH concentrations was below the OSPAR background assessment concentration (BAC) suggesting that sediment PAH concentrations were close to background.

From nine samples (stations REN02 HCA2, REN05 HCA2, REN08 HCA2, REN09 HCA2, REN11 HCA2, REN12 HCA2, REN13 HCA2, REN14 HCA2 and REN15 HCA2) concentrations of at least two of the following individual PAHs exceeded their respective OSPAR BACs: naphthalene, phenanthrene, pyrene,

benzo(a)anthracene, chrysene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and benzo(ghi)perylene (Fugro, 2021a). Concentrations that exceed BAC values are considered to be 'above background' but at levels where it can be assumed that little or no risks are posed to the environment and its living resource at the population or community level (Fugro, 2021b). This is likely a natural feature of the sediment in this part of the North Sea and not due to contamination of the sediments (Fugro, 2021a). Comparisons between these data and the 2010 survey data could not be made, as only the total of the 2 to 6 ring PAHs were analysed for the 2010 survey.

Table 5.2 shows the hydrocarbon analysis at the Renee location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The data are also compared against the CNS background thresholds.

Table 5.2: A Summary of Sediment Hydrocarbon Analysis at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Renee (HESS, 2010; Fugro, 2020)

Concentrations Expressed as µg/g Dry Sediment																
Station and Year of Survey	Distance (m)	Bearing (°)	THC	UCM	n-alkanes			CPI Ratio			Pristane	Phytane	Pr/Ph Ratio	GC-MS	
					nC12-20	nC21-36	nC12-36	nC12-20	nC21-36	nC12-36				2 to 6 Ring PAH	%NPD: Total PAH
RE01 (2010)	150	0	48.6	38.2	4.15	1.07	5.22	0.77	3.32	1.01	0.047	0.032	1.5	0.85	25
RE01a (2020)	150	0	8.8	4.9	0.51	0.31	0.81	0.71	2.6	1.13	0.0102	0.0029	3.55	0.223	19
RE01b (2020)	150	0	13.2	10.4	0.17	0.35	0.53	0.75	2.41	1.6	0.0149	0.0033	4.59	0.251	16
RE02 (2010)	150	90	56.8	26.9	0.73	1.92	2.65	1.09	1.7	1.5	0.043	0.019	2.2	17.2	23
RE02a (2020)	150	90	6.5	3.5	0.05	0.35	0.4	0.8	2.54	2.15	0.0102	0.0013	7.8	0.21	14
RE02b (2020)	150	90	11.3	7	0.14	0.71	0.84	0.81	2.59	2.1	0.019	0.0035	5.5	0.468	14
RE03 (2010)	150	180	52	40.5	4	1.28	5.28	0.78	2.75	1.04	0.037	0.023	1.6	0.96	42
RE03a (2020)	150	180	7.8	3.1	0.81	0.22	1.03	0.79	2.31	0.98	0.0114	0.0031	3.64	0.227	18
RE03b (2020)	150	180	9.1	5.2	1.22	0.4	1.62	0.72	2.73	0.99	0.0355	0.005	7.03	0.277	16
RE04 (2010)	150	270	25.7	20.4	0.16	1.42	1.58	1.01	2.74	2.44	0.025	0.007	3.4	0.716	24
RE04a (2020)	150	270	5.4	2.9	0.06	0.28	0.34	0.77	2.05	1.7	0.0089	0.002	4.43	0.187	15
RE04b (2020)	150	270	4.1	2.5	0.06	0.27	0.33	0.91	2.43	2.01	0.0078	0.0012	6.2	0.194	13
Key:	**Below CNS Background Mean**						**Above CNS Background Mean**					**Above CNS Background 95th Percentile**			
2010 Survey Data in Red Text – Samples were combined for the 2010 report and therefore only one sample result is provided for the 2010 data															
Central North Sea Background (UKOAA, 2001)															
Mean			9.51	-	-	-	0.40	-	-	2.04	-	-	-	0.233	-
95th Percentile			40.10		-	-	1.18	-	-	2.79	-	-	-	0.736	-
OSPAR 2006															
Effects Low Range (ERL)			50	-	-	-	-	-	-	-	-	-	-	-	-

Sediment Metals

There were differences in the methodologies processing the metals between the 2010 and 2020 surveys. The 2010 samples were treated with aqua-regia (AR) acid digestion followed by multi-element analysis using inductively coupled plasma-optical emission spectroscopy (ICP-OES), whereas, the 2020 metals concentrations were determined using ICP-MS except mercury, which was determined by CV-AFS. This difference was a forced change due to COVID and the availability of safe working in the laboratory. However, the Survey Contractor and laboratory confirmed the analytical techniques comparable between the two surveys.

For most metals, the overall degree of spatial variation recorded within the survey area in 2020 was low with the highest concentrations being recorded in sediment collected at REN01 (150 m 0°). The largest spatial variations were observed for mercury and barium where concentrations measured at stations located close to the well site were notably higher than the other stations. This is likely due to the presence of small quantities of drilling mud deposits originating from drilling activity at the site.

This indicates that decommissioning operations have not greatly changed the distribution of sediment metals around the Renee well site. This is corroborated by comparison to the reference station REN15, where metals concentrations were broadly comparable to the Renee survey area. With the exception of barium (discussed further below), the sediment metals concentrations recorded in 2010 and 2020 (including at stations located near the well site where slightly higher levels were measured) were broadly comparable or slightly higher than CNS background values and well below the OSPAR ERL thresholds. This indicates that the metals present in the sediment do not pose a risk to the environment and its living resources at the population or community level (Fugro, 2021a).

The sediment barium concentrations recorded around the Renee well site (ranging from 179 µg/g to 2,330 µg/g in 2020 and 117 µg/g to 3,800 µg/g in 2010) and the high barium concentrations in samples collected ≤ 500 m to the well site (and slightly increased concentrations of hydrocarbons, mercury and zinc) suggests the presence of traces of drilling mud in the sediment located close to the well site, particularly on the north-south axis. It is important to note that the quantities present are low, and the concentrations are below levels that would have a negative impact on seabed communities (Fugro, 2021a).

In summary, the metal concentrations recorded in 2020 were broadly comparable to those recorded as part of the 2010 pre-decommissioning survey and there were no spatial and temporal trends observed across the stations. This is because it is considered that the relatively small between-survey variations may be related to slight differences in analytical methodologies used rather than any influence of activities at the site. In both surveys (2010 and 2020) there was no evidence to indicate major changes in the sediments (chemical, physical or biological characteristics) located close to the installation compared to those further away; this is a clear indication that operations had not greatly impacted seabed sediments in the area.

Table 5.3 shows the metals analysis at the Renee location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The data are also compared against the CNS background and OSPAR thresholds.

It should also be noted that in both surveys, the results were all similar to reported background North Sea concentrations and can be considered as being typical of uncontaminated sediments from this part of the North Sea (Fugro, 2021a), as shown in Table 5.3. The concentrations of the various parameters studied were all well below the concentrations that would be expected to have a negative impact on marine organisms (as confirmed by the macrobenthos analysis included in these surveys) and no samples were greater than the OSPAR Effects Low Range (ERL) (Table 5.3).

Table 5.3: A Summary of Sediment Metals Analysis at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Renee (HESS, 2010; Fugro, 2020)

Concentrations Expressed as µg/g Dry Sediment																
Station and Year of Survey	**Distance (m)**	**Bearing (°)**	**Al**	**As**	**Ba**	**Cd**	**Cr**	**Cu**	**Fe**	**Pb**	**Mn**	**Hg**	**Ni**	**Sr**	**V**	**Zn**
RE01 (2010)	150	0	-	2.6	3,800	0.099	29.8	9.21	15,600	13.3	237	0.09	13.4	261	31.8	70.8
RE01 (2020)	150	0	19400	5.1	2,130	0.1	42.2	8.1	15,600	15.5	320	0.05	18.4	378	45.8	46.3
RE02 (2010)	150	90	-	1.68	482	0.059	29.5	5.54	12,200	8.12	208	0.012	12.9	216	27	35.3
RE02 (2020)	150	90	18200	3.8	513	< 0.10	38	5.6	14,000	11.1	268	0.04	16.8	306	39	35.8
RE03 (2010)	150	180	-	3.86	840	0.161	27	12	15,500	11.8	224	0.041	14.3	243	39.3	52.5
RE03 (2020)	150	180	17600	4.3	1,690	< 0.10	37.9	6.8	14,800	12.1	273	0.03	17.7	312	40.9	38
RE04 (2010)	150	270	-	1.45	283	0.036	25.5	5.26	12,700	7.97	188	0.008	13.1	218	25.9	34.6
RE04 (2020)	150	270	17400	4	593	< 0.10	37	5.5	13,600	11.3	275	0.02	16.6	314	37.9	34.8
Key:	**Below CNS Background Mean**				**Above CNS Background Mean**				**Above CNS Background 95th Percentile**					**Above ERL (OSPAR)**		
2010 Survey Data in Red Text																
Central North Sea Background (UKOAA, 2001)																
Mean			-	-	178.20	0.03	9.13	2.41	4,725	6.75	-	0.03	7.31	-	-	13.48
95th Percentile			-	-	523.20	0.12	31.04	6.00	11,160	16.70	-	0.12	19.00	-	-	32.59
CEMP Assessment Criteria (OSPAR, 2014)																
Effects Low Range (ERL)			-	-	-	1.20	81.00	34.0	-	47.0	-	0.15	-	-	-	150

Macrofauna

The infaunal community of the Renee survey area was broadly homogenous. The most abundant and dominant taxa of the macrofaunal community were the polychaetes *Paramphinome jeffreysii* and *Levinsenia gracilis*, with the gastropod *Retusa umbilicata* also identified in abundance. The community present is found widely within sandy mud and mud habitats within the CNS.

Annelids were the most diverse and abundant phyla at all stations, excluding station REN14 where molluscs had the highest abundance (108) followed by annelids (105). Arthropods or molluscs in all cases (excluding station REN14) followed polychaetes in terms of the abundance of taxa and individuals present. Across the survey area the most abundant and dominant taxa was the polychaete *P. jeffreysii* which inhabits muddy and sandy bottoms at depths of up to 5,000 m and has previously been recorded as the dominant species in such sediments at depths below 50 m in the northern and central North Sea.

Comparison of the current Renee community to that identified from the Renee pre-decommissioning baseline survey 2010 showed strong similarities between taxa, with the polychaete *P. jeffreysii* the dominant species, with the highest abundance at 14 stations. From the top ten most abundant taxa across the current Renee dataset, both the mollusc *Adontorhina similis* and polychaete *P. jeffreysii* were present in the top five taxa at all stations in the pre-decommissioning baseline survey. Both surveys reported a distinct annelid dominance overall, with these contributing 40.1 % to 47.9 % of faunal abundance. Additionally, other common taxa across the surveys included the polychaetes *Lumbrineris gracilis* and *Heteromastus filiformis*, both of which are common in this area of the North Sea. This indicated that the macrofaunal composition within the Renee survey area is typical of the region, and comparable to that reported from the Renee pre-decommissioning baseline survey 2010.

There was no evidence to suggest that drilling, production and decommissioning activities within the Renee field had impacted its benthic infauna (Fugro, 2021a).

Seabed Habitats

The community present at all stations within the Renee survey area closely resembled that of the biotope '*L. gracilis* and *H. filiformis* in offshore circalittoral mud and sandy mud', which is reported to occur in offshore areas of the CNS and northern North Sea.

The habitats within the area were assessed to evaluate their potential as the priority marine feature (PMF) 'Burrowed mud'; from the seabed still photographic data sea pens occurred at densities classified as 'Occasional' or 'Frequent' from most transects and burrows were generally 'Common'. Therefore, these could be classed as a PMF. The metrics calculated for sea pens and burrows suggest the presence of a stable habitat unimpacted by physical disturbances such as trawling.

As no photographic data were obtained during the 2010 pre-decommissioning survey, quantitative comparison (nor a PMF assessment) cannot be made to the density of the sea pen and burrowing megafauna community that may have been present at this time, although both *Virgularia mirabilis* and *P. phosphorea* were reported from grab samples.

The area was also assessed for its potential to contain the PMF 'Ocean quahog aggregations'; no adult *Arctica islandica* were reported, but juvenile specimens were recorded from grab samples. No trend of the Ocean quahog between the 2010 and 2020 survey could be made, as no photographs were taken during the 2010 survey.

No other Annex I habitats or Annex II species, OSPAR threatened and/or declining species and habitats or UK Biodiversity Action Plan priority habitats and species were reported within the survey area.

Conclusion

The aim of the Renee Survey was to evaluate the existing physical, chemical and biological components in the marine environment within the Renee survey area and to compare these data with those obtained from the 2010 pre-decommissioning survey. A review of the environmental data in context with other cited studies from the region and estimated sediment effects threshold values (UKOOA, 2001; OSPAR, 2006; 2014) was also undertaken.

Based on the overall assessment of the survey area, the following key conclusions can be stated:

- Overall, there was no pattern or trend of spatial and temporal differences observed;
- There was a general decrease in the 2020 data, when compared to the 2010 survey, although some values did exceed the CNS background thresholds;
- All sediments were dominated by the fine particle classes and are typical of natural sediments found in the Fladen Ground area. There was no evidence of differences in sediment characteristics close to the well site that would indicate the physical presence of cuttings or drilling mud mounds on the seabed (although this is not related to sediment contamination from drilling muds). The survey data were similar to pre-decommissioning values indicating that decommissioning of the development infrastructure has not altered the seabed environment;
- The hydrocarbon distributions in the sediments collected within the survey area were generally typical of background North Sea sediments (some thresholds were exceeded) and contained a range of natural compounds and low-level weathered petroleum residues. Traces of synthetic paraffin drilling fluid originating from historic drilling activities were recorded at some stations located within 500 m from the well site. THC values were below levels that would cause adverse effects on the seabed macrofauna and similar to the background concentration for the CNS area. THC values were slightly lower than those recorded in the area prior to decommissioning suggesting that some degradation/weathering of the sediment hydrocarbons has taken place since 2010;
- Total 2 to 6 ring PAH concentrations were also generally comparable to CNS background levels (some thresholds were exceeded) and similar to the values reported in the 2010 pre-decommissioning survey of the area. The concentrations of the individual CEMP-listed PAH compounds were all well below ERL threshold concentrations;
- The sediment metals concentrations recorded in 2020 were slightly higher or broadly comparable to CNS mean background values and pre-decommissioning levels recorded in 2010. Higher barium concentrations were recorded at several of the stations located within 500 m of the Renee well site in both 2010 and 2020 indicating the presence of small quantities of drilling deposits in this area;
- The macrofaunal community identified throughout the Renee survey area was characterised by a diverse range of polychaete taxa. The community present closely resembled that of the biotope '*L. gracilis* and *H. filiformis* in offshore circalittoral mud and sandy mud' which is reported to occur in offshore areas of the central and northern North Sea;
- The habitats within the area were assessed to evaluate their potential as the PMF 'Burrowed mud'. From the seabed still photographic data sea pens occurred at densities classified as 'Occasional' or 'Frequent' from most transects and burrows were generally 'Common', suggesting that the Renee area has some potential to be considered an example of this PMF. The area was also assessed for its potential to contain the PMF 'Ocean quahog aggregations'; no adult *A. islandica* were reported, but juvenile specimens were recorded from grab samples. No other sensitive habitats or species were reported within the survey area;

The majority of the physical, chemical, and biological parameters studied as part of the post-decommissioning survey of the Renee well site were consistent with the natural background conditions found in the area. The data indicated the presence of very low levels of contamination of the seabed within 500 m of the well site originating from historic drilling activities, but the concentrations of hydrocarbons and metals recorded were all below levels that would have a negative impact on seabed communities. Comparison with pre-decommissioning data collected in 2010 showed that there was no substantial change in seabed characteristics arising from decommissioning operations at the site (Fugro, 2021a).

5.1.5.2 Rubie

Sediment Characterisation

There was little spatial variation in the seabed sediments collected throughout the Rubie area (all sediments were classified on the Wentworth scale as medium silt) with fine particle classes (< 63 µm diameter) accounting for 66.84 % to 76.42 % of the total weight of sediment. Of the sediment organic and inorganic carbon measurements, TOC and carbonate content were relatively consistent across the stations sampled, while TOM content was moderately variable. The TOM for the 2010 and 2020 surveys all exceed the background mean and all but one for the 95th percentile for the CNS UKOAA, however they did reduce between 2010 and 2020. For the fines, there has been a decrease between 2010 and 2020 but they still remain above the mean and in some cases the 95% of the mean of typical background CNS sediment composition.

The sediment characteristics are typical of those recorded in this part of the CNS and were very similar to those found previously at the site during the pre-decommissioning survey of the Rubie development conducted in 2010, indicating that decommissioning of the development infrastructure has not altered the seabed sediment composition (Fugro, 2021b). Table 5.4 shows the sediment characteristics at the Rubie location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The data here show that at these 4 stations, the sediment characteristics were comparable between both surveys, further supporting that that decommissioning of the development infrastructure has not altered the seabed environment.

Table 5.4: The Sediment Characteristics at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Rubie (HESS, 2010; Fugro, 2020)

Station and Year of Survey	Distance (m)	Bearing (°)	TOM (%)	TOC (%)	Carbonate (%)	Fines (%)
RU01 (2010)	150	0	9.2	1.3	18.6	80.9
RU01 (2020)	150	0	5.75	0.87	27.2	74.8
RU02 (2010)	150	90	7.6	1.3	21.3	81.4
RU02 (2020)	150	90	5.54	0.83	23.5	72.59
RU03 (2010)	150	180	8.9	0.86	17.8	81.6
RU03 (2020)	150	180	4.46	0.88	23.2	66.84
RU04 (2010)	150	270	10.1	0.95	17.7	84.2
RU04 (2020)	150	270	6.27	0.8	23.8	72.88
Key:	**Below CNS Background Mean**		**Above CNS Background Mean**		**Above CNS Background 95th Percentile**	
2010 Survey Data in Red Text						
Central North Sea Background (UKOAA, 2001)						
Mean			1.63	-	-	17.38
95th Percentile			4.48	-	-	77.56

Sediment Hydrocarbons

The gas chromatographic profiles obtained for the sediments collected around the Rubie well shared a common hydrocarbon distribution typical of low-level weathered petroleum residues commonly found in North Sea sediments. These sediments are characterised by a high molecular weight UCM from approximately nC19 to nC36, with a homologous series of n-alkanes ranging in carbon number from approximately nC12 to nC36, typically dominated by the odd carbon numbered compounds nC29, nC31 and nC33. Evidence of higher proportions of low molecular weight hydrocarbon components (mainly nC12 to nC16) were observed at three stations (stations RUB01, RUB03 and RUB05) located within 500 m of the well site indicating the presence of a synthetic paraffin drilling fluids in these sediments; similar GC-FID profiles were observed at stations RUB01 and RUB03 in the 2010 survey. These types of fluid

were widely used in the North Sea in the mid-to late 1990s (at the time of drilling at the Rubie well) therefore these compounds will have originated from drilling operations at the site. It is important to note that for both surveys, the drilling fluid components contributed only a very small proportion of the total hydrocarbons present in the sediment. A cluster of peaks around nC21 was present at all stations. This signature is often seen in sediments from the CNS and thought to be branched isoprenoids of biogenic origin.

The THC values recorded in 2020, ranging from 2.9 µg/g to 13.8 µg/g, were comparable to, or lower than, the background mean concentration for the CNS (except RU01a, which was slightly above the CNS mean) and there was no evidence of any concentration gradients around the well site. The mean value recorded in 2020 was lower than recorded in 2010 (4.9 µg/g compared to 17.7 µg/g), most notably at stations within 250 m of the well site. This indicates that a reduction in hydrocarbon concentration has occurred over the 10 years between surveys, possibly due to on-going biodegradation and weathering of the hydrocarbons present. It should be noted that the concentrations of hydrocarbons recorded around the Rubie well are considerably lower than those recorded at similar distances from larger North Sea installations (Fugro, 2021b); this is consistent with the fact that only one well was drilled at the site. The recorded THC values are also well below the OSPAR EET of 50 µg/g, above which adverse effects on the seabed macrofauna community may be detected (OSPAR, 2006). The survey data collected in 2010 and 2020 show that THC levels have decreased from pre-decommissioning to post-decommissioning, and decommissioning activities have not spread hydrocarbon contamination from the immediate vicinity of the infrastructure into the wider area.

The total 2 to 6 ring PAH concentrations recorded in 2020, ranging from 0.122 µg/g to 0.639 µg/g, were broadly comparable to background concentrations for the CNS (there were two stations that exceeded the CNS mean). The concentration reported from reference station RUB15 was comparable to the wider survey area. As was the case for THC, sediment PAH levels were lower than those recorded at the same stations during the 2010 pre-decommissioning survey, where concentrations ranged from 0.235 µg/g to 1.02 µg/g. The 2 to 6 ring PAH values recorded in 2020 showed a moderate degree of spatial variability but results were not influenced by distance from the well, as evident from the lack of correlation between distance from the Rubie well and total 2 to 6 ring PAH concentrations. The total concentration of the US EPA 16 PAHs recorded in each sediment sample ranged from 56.0 ng/g to 291 ng/g and the results followed the same spatial variability observed for total 2 to 6 Ring PAH values.

The mean concentrations of the individual CEMP listed PAH compounds in both surveys were all well below published ERL concentrations. When normalised to 2.5 % TOC, the mean sum of OSPAR comparable 2 to 6 ring PAH concentrations was below the OSPAR BAC. From four samples concentrations of at least two of the following individual PAHs exceeded their respective OSPAR BACs: naphthalene, benzo(a)anthracene, chrysene, indeno(1,2,3-cd)pyrene and benzo(ghi)perylene (Fugro, 2021b). Concentrations that exceed BAC values are considered to be 'above background' but at levels where it can be assumed that little or no risks are posed to the environment and its living resource at the population or community level (Furgo, 2021a). As these compounds are listed individually in the Table 5.5, the OSPAR thresholds have not been presented. This is likely a natural feature of the sediment in this part of the North Sea and not due to contamination of the sediments (Fugro, 2021a). Comparisons between these data and the 2010 survey data could not be made, as only the total of the 2 to 6 ring PAHs were analysed for the 2010 survey. Several of the stations during the 2010 and 2020 surveys had alkane C12-36, THC and 2-6 ring PAHs above the CNS background mean and 95 percentile. However, there was an overall reduction in the hydrocarbons measured between the 2010 and 2020 surveys.

Table 5.5 shows the hydrocarbon analysis at the Rubie location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The data are also compared against the CNS background thresholds.

Table 5.5: A Summary of Sediment Hydrocarbon Analysis at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Rubie (HESS, 2010; Fugro, 2020)

Concentrations Expressed as µg/g Dry Sediment																
Station and Year of Survey	Distance (m)	Bearing (°)	THC	UCM	n-alkanes			CPI Ratio			Pristane	Phytane	Pr/Ph Ratio	GC-MS	
					nC12-20	nC21-36	nC12-36	nC12-20	nC21-36	nC12-36				2 to 6 Ring PAH	%NPD: Total PAH
RU01 (2010)	150	0	32.4	26	0.35	1.6	1.95	0.99	2.59	2.14	0.027	0.011	2.5	0.850	25
RU01a (2020)	150	0	10.3	6.7	0.14	0.61	0.75	0.9	1.97	1.69	0.0218	0.0028	7.7	0.506	15
RU01b (2020)	150	0	5.3	3.3	0.06	0.36	0.42	0.8	2.18	1.84	0.0101	0.0014	7.1	0.214	15
RE02 (2010)	150	90	21.9	17	0.15	1.34	1.48	1.03	2.85	2.53	0.02	0.007	2.9	0.700	22
RE02a (2020)	150	90	4.3	2.7	0.05	0.34	0.39	0.83	2.55	2.18	0.0072	0.0013	5.52	0.189	16
RE02b (2020)	150	90	3.7	2.2	0.04	0.3	0.33	0.71	2.28	1.99	0.0056	0.0008	7.02	0.151	15
RE03 (2010)	150	180	34.7	24.9	1.72	1.42	3.13	0.76	2.63	1.3	0.044	0.025	1.8	1.02	32
RE03a (2020)	150	180	9.4	5.8	0.45	0.48	0.94	0.74	2.33	1.31	0.0202	0.0055	3.67	0.381	19
RE03b (2020)	150	180	4.3	2.7	0.19	0.23	0.43	0.72	2.26	1.32	0.0084	0.0025	3.41	0.150	18
RE04 (2010)	150	270	25.8	19.9	0.15	1.57	1.72	1.13	2.39	2.23	0.049	0.01	4.8	0.774	23
RE04a (2020)	150	270	3.5	2.1	0.04	0.28	0.32	0.82	2.15	1.9	0.007	0.001	6.77	0.145	18
RE04b (2020)	150	270	4.4	2.6	0.04	0.32	0.36	0.84	2.12	1.92	0.0089	0.0009	10.4	0.188	13
Key:	**Below CNS Background Mean**						**Above CNS Background Mean**					**Above CNS Background 95th Percentile**			
2010 Survey Data in Red Text – Samples were combined for the 2010 report and therefore only one sample result is provided for the 2010 data															
Central North Sea Background (UKOAA, 2001)															
Mean			9.51	-	-	-	0.40	-	-	2.04	-	-	-	0.233	-
95th Percentile			40.10		-	-	1.18	-	-	2.79	-	-	-	0.736	-

Sediment Metals

For most metals, the overall degree of spatial variation recorded within the survey area in 2020 was low. The largest spatial variation was observed for barium where concentrations measured at several stations located close to the well were notably higher than the other stations, likely due to the presence of small quantities of historic drilling mud deposits originating from drilling activity at the site. Overall, the concentrations recorded in 2020 were comparable to those recorded as part of the 2010 pre-decommissioning survey and the spatial trends observed were broadly similar.

This indicates that decommissioning operations have not greatly changed the distribution of sediment metals around the well site. This is corroborated by comparison to the reference station RUB15, where metals concentrations were broadly comparable to the Rubie survey area. The sediment metals concentrations recorded throughout the Rubie survey typically fell within the background range expected for the CNS (however, a number did exceed the CNS mean and 95th percentile). Concentrations of barium were notably elevated at certain stations within 250 m of the Rubie well (compared with the 2010 survey) and there was some indication of slightly increased levels of nickel and lead at the same stations. As with the barium, the increased levels of nickel and lead are likely to be attributed to the use of historic drilling muds and cuttings, especially given the locations of the stations, which were near the well.

The sediment barium concentrations recorded around the Rubie well site (ranging from 245 µg/g to 1,660 µg/g in 2020 and 103 µg/g to 1,160 µg/g in 2010) indicate the presence of drilling mud deposits on the seabed within 500 m of the well. It is important to note that the quantities present are low and the concentrations of hydrocarbons and other metals associated with the drilling mud are below levels that would have a negative impact on seabed communities (Fugro, 2021b).

In summary, as with the Renee results, the Rubie metal concentrations recorded in 2020 were broadly comparable to those recorded as part of the 2010 pre-decommissioning survey and the spatial and temporal trends observed were broadly similar. This is because it is considered that the relatively small between-survey variations may be related to slight differences in analytical methodologies used rather than any influence of activities at the site. In both surveys (2010 and 2020) there was no evidence to indicate major changes in the sediments (chemical, physical or biological characteristics) located close to the installation compared to those further away; this is a clear indication that operations had not greatly impacted seabed sediments in the area.

Table 5.6 shows the metals analysis at the Rubie location at the four closest stations (all of which are at 150m from the well location) from both the 2010 and 2020 surveys. The data are also compared against the CNS background and OSPAR thresholds.

It should also be noted that in both surveys, although some of the results exceeded the the CNS and 95th percentile background means, they were still similar to reported background CNS concentrations, as shown in Table 5.6. The concentrations of the various parameters studied were all well below the concentrations that would be expected to have a negative impact on seabed communities and no samples were greater than the OSPAR Effects Low Range (ERL) (Table 5.6).

Table 5.6: A Summary of Sediment Metals Analysis at Stations 1 – 4 from the 2010 and 2020 Site Surveys at Rubie (HESS, 2010; Fugro, 2020)

Concentrations Expressed as µg/g Dry Sediment																
Station and Year of Survey	**Distance (m)**	**Bearing (°)**	**Al**	**As**	**Ba**	**Cd**	**Cr**	**Cu**	**Fe**	**Pb**	**Mn**	**Hg**	**Ni**	**Sr**	**V**	**Zn**
RU01 (2010)	150	0	-	3.16	407	0.058	27.1	7.3	15,300	11.3	205	0.019	16.1	236	27.2	42.7
RU01 (2020)	150	0	18500	5.7	790	< 0.10	39.8	7.5	15,600	16.9	287	0.02	19	356	45.9	39.6
RU02 (2010)	150	90	-	1.75	474	0.058	31.3	6.53	14,400	12.9	207	0.012	16.1	232	29.6	40.8
RU02 (2020)	150	90	19600	3.4	585	< 0.10	41.6	6.3	14,900	13.5	296	0.02	19.2	370	44.3	38.3
RU03 (2010)	150	180	-	3.42	1,160	0.068	36.1	11.2	17,100	11.5	229	0.017	17.4	235	42.2	46.5
RU03 (2020)	150	180	20600	4.8	1,660	< 0.10	43.6	8	16,200	15.9	297	0.03	19.3	374	49.9	40.7
RU04 (2010)	150	270	-	1.96	170	0.056	32	6.55	14,800	10.7	214	0.011	16.4	238	31	41.8
RU04 (2020)	150	270	17900	4.2	245	< 0.10	38.3	5.9	14,000	13.4	279	0.02	17.7	345	40.8	35.4
Key:	**Below CNS Background Mean**				**Above CNS Background Mean**				**Above CNS Background 95th Percentile**					**Above ERL (OSPAR)**		
2010 Survey Data in Red Text																
Central North Sea Background (UKOAA, 2001)																
Mean			-	-	178.20	0.03	9.13	2.41	4,725	6.75	-	0.03	7.31	-	-	13.48
95th Percentile			-	-	523.20	0.12	31.04	6.00	11,160	16.70	-	0.12	19.00	-	-	32.59
CEMP Assessment Criteria (OSPAR, 2014)																
Effects Low Range (ERL)			-	-	-	1.20	81.00	34.0	-	47.0	-	0.15	-	-	-	150

Macrofauna

The infaunal community of the Rubie survey area was broadly homogenous.

The macrofaunal community identified throughout the Rubie survey area was dominated by polychaetes. Of the eleven most abundant and dominant taxa recorded, six were polychaetes, with the remaining dominant taxa comprising two molluscs (*R. umbilicata* and the bivalve *A.similis*), two crustaceans (Ostracoda and *Harpinia crenulata*) and nemertean worms. The most abundant taxon overall, *R. umbilicata*, is a mobile predator which is found throughout UK waters; this species does occur in shallow nearshore waters but is typically reported at higher abundance on finer sediments offshore.

The dominant taxa identified from the current survey were closely comparable to those reported from the 2010 pre-decommissioning survey, although *P. jeffreysii* was generally more abundant during the earlier survey (it was the dominant taxon at most stations) and *R. umbilicata* less abundant. It is possible that this may be related to the recovery of the sites sediments between the pre- and post-decommissioning surveys with *P. jeffreysii* known to be tolerant of, or even to favour, hydrocarbon enriched sediments. The most abundant and dominant taxon overall was the gastropod *R. umbilicata*.

There was no evidence to suggest that drilling, production and decommissioning activities within the Rubie field had impacted its benthic infauna (Fugro, 2021b).

Seabed Habitats

The community present at all stations within the Rubie survey area closely resembled that of the biotope '*L. gracilis* and *H. filiformis* in offshore circalittoral mud and sandy mud', which is reported to occur in offshore areas of the CNS and northern North Sea.

The habitats within the area were assessed to evaluate their potential as the PMF 'Burrowed mud'. From the seabed still photographic data sea pens occurred at densities classified as 'Frequent' from most transects and burrows were generally 'Common', suggesting that the survey area could potentially be considered an example of this PMF. As no photographic data were obtained during the 2010 pre-decommissioning survey, quantitative comparison (nor a PMF assessment) cannot be made to the density of the sea pen and burrowing megafauna community that may have been present at this time, although both Virgularia mirabilis and P. phosphorea were reported from grab samples.

The area was also assessed for its potential to contain the PMF 'Ocean quahog aggregations'; no adult *A. islandica* were reported, but juvenile specimens were recorded from grab samples. No trend of the Ocean quahog between the 2010 and 2020 survey could be made, as no photographs were taken during the 2010 survey.

No other sensitive habitats or species were reported within the survey area (Fugro, 2021b).

Conclusion

The aim of this report has been to evaluate the existing physical, chemical and biological components in the marine environment within the Rubie survey area and to compare these data with those obtained from the 2010 pre-decommissioning survey. A review of the environmental data in context with other cited studies from the region and estimated sediment effects threshold values (UKOOA, 2001; OSPAR, 2006; 2014) was also undertaken.

Based on the overall assessment of the survey area, the following key conclusions can be stated:

- Overall, there was no pattern or trend of spatial and temporal differences observed;
- There was a general decrease in the 2020 data, when compared to the 2010 survey, although some values did exceed the CNS background thresholds;
- All sediments were dominated by the fine particle classes and are typical of natural sediments found in the Fladen Ground area. There was no evidence of differences in sediment characteristics close to the well site that would indicate the physical presence of cuttings or drilling mud mounds on the seabed (although this is not related to sediment contamination from drilling muds). The survey data were similar to pre-decommissioning

values indicating that decommissioning of the development infrastructure has not altered the seabed environment;

- The hydrocarbon distributions in the sediments collected within the survey area were typical of background CNS sediments and contained a range of natural compounds and low level weathered petroleum residues (when compared to histrionic CNS background levels) (Fugro, 2021b). Some hydrocarbons exceeded the CNS background and 95th percentile means. Traces of synthetic paraffin drilling fluids originating from historic drilling activities were recorded at three stations located within 500 m from the well site. Total hydrocarbon concentrations were below levels that would cause adverse effects on the seabed macrofauna and similar to the background concentration for the CNS area. The results were slightly lower than those recorded in the area prior to decommissioning suggesting that some degradation/weathering of the sediment hydrocarbons has taken place since 2010.;
- Total 2 to 6 ring PAH concentrations were also broadly comparable to CNS background levels (some thresholds were exceeded) and slightly lower than the values reported in the 2010 pre-decommissioning survey of the area. The concentrations of the individual CEMP-listed PAH compounds were all well below ERL threshold concentrations;
- The sediment metals concentrations recorded in 2020 were comparable to CNS background values and pre-decommissioning levels recorded in 2010. Elevated barium concentrations were recorded at four stations located within 500 m of the well site in both 2010 and 2020 indicating the presence of small quantities of drilling deposits in this area. None of the OSPAR ERL thresholds were exceeded;
- The macrofaunal community identified throughout the Rubie survey area was characterised by a diverse range of polychaete taxa. The community present closely resembled that of the biotope '*L. gracilis* and *H. filiformis* in offshore circalittoral mud and sandy mud' which is reported to occur in offshore areas of the central and northern North Sea;
- The habitats within the area were assessed to evaluate their potential as the PMF 'Burrowed mud'; from the seabed still photographic data sea pens generally occurred at 'Frequent' density and burrows were generally 'Common' suggesting that this PMF potentially occurs within the Rubie area. The area was also assessed for its potential to contain the PMF 'Ocean quahog aggregations'; no adult *A. islandica* were reported, but juvenile specimens were recorded from grab samples. No other sensitive habitats or species were reported within the survey area.

The majority of the physical, chemical, and biological parameters studied as part of the post-decommissioning survey of the Rubie well site were consistent with the natural background conditions found in the area. The data indicated the presence of very low levels of contamination of the seabed within 500 m of the well site originating from historic drilling activities, but the concentrations of hydrocarbons and metals recorded were all below levels that would have a negative impact on seabed communities. Comparison with pre-decommissioning data collected in 2010 showed that there was no substantial change in seabed characteristics arising from decommissioning operations at the site (Fugro, 2021b).

Figure 5.8: The Sampling Locations at Renee 2020 EBS

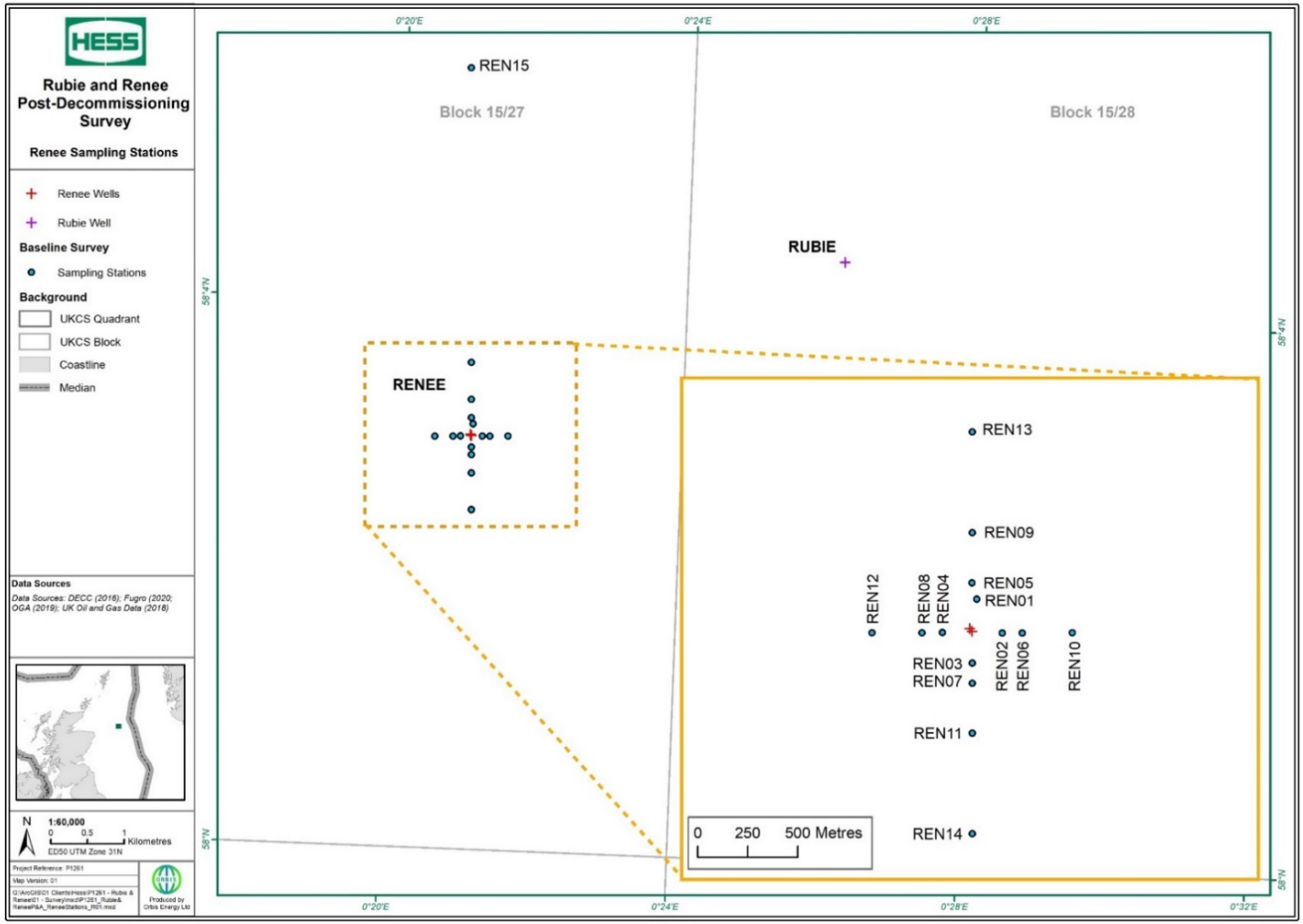
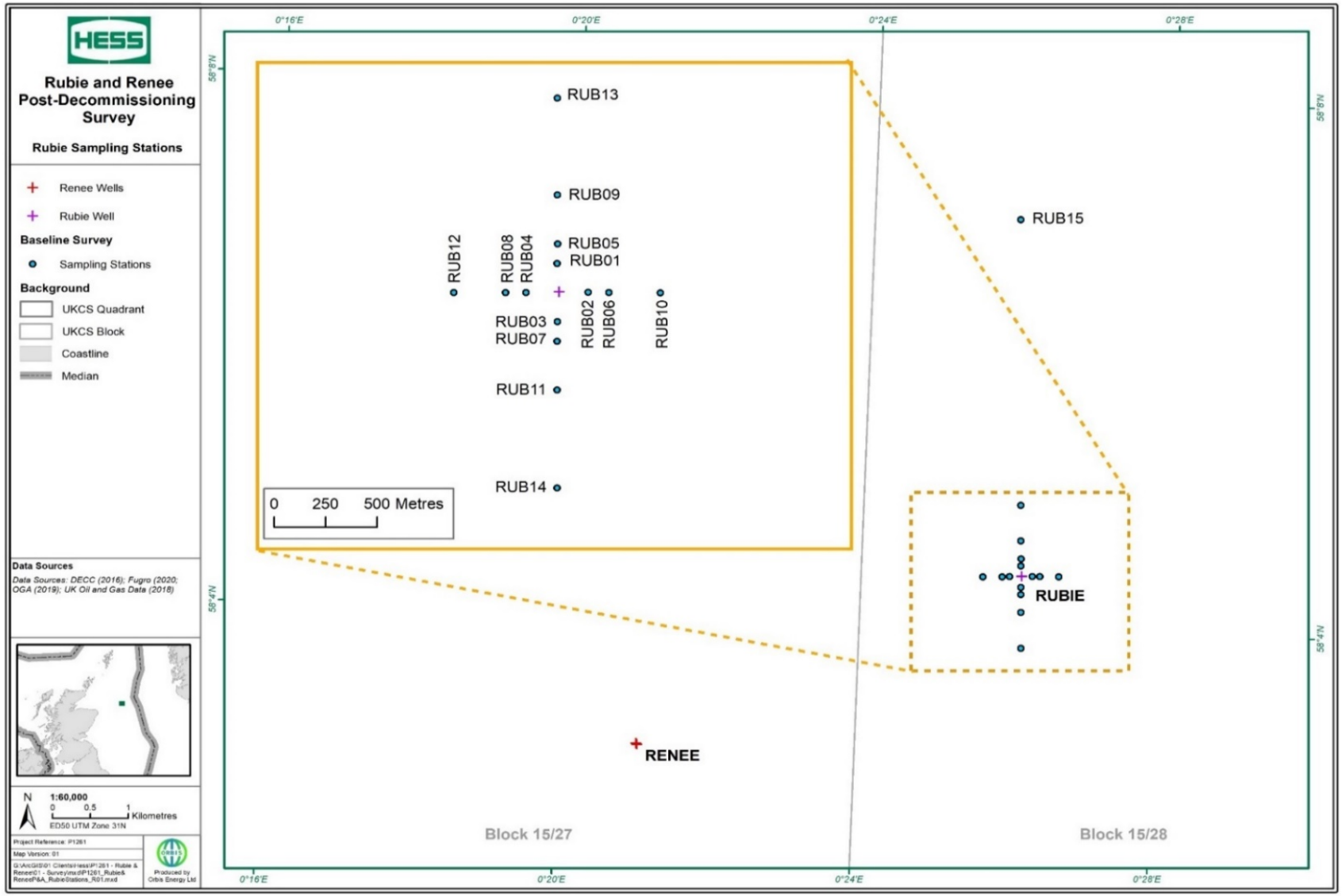


Figure 5.9: The Sampling Locations at Rubie 2020 EBS

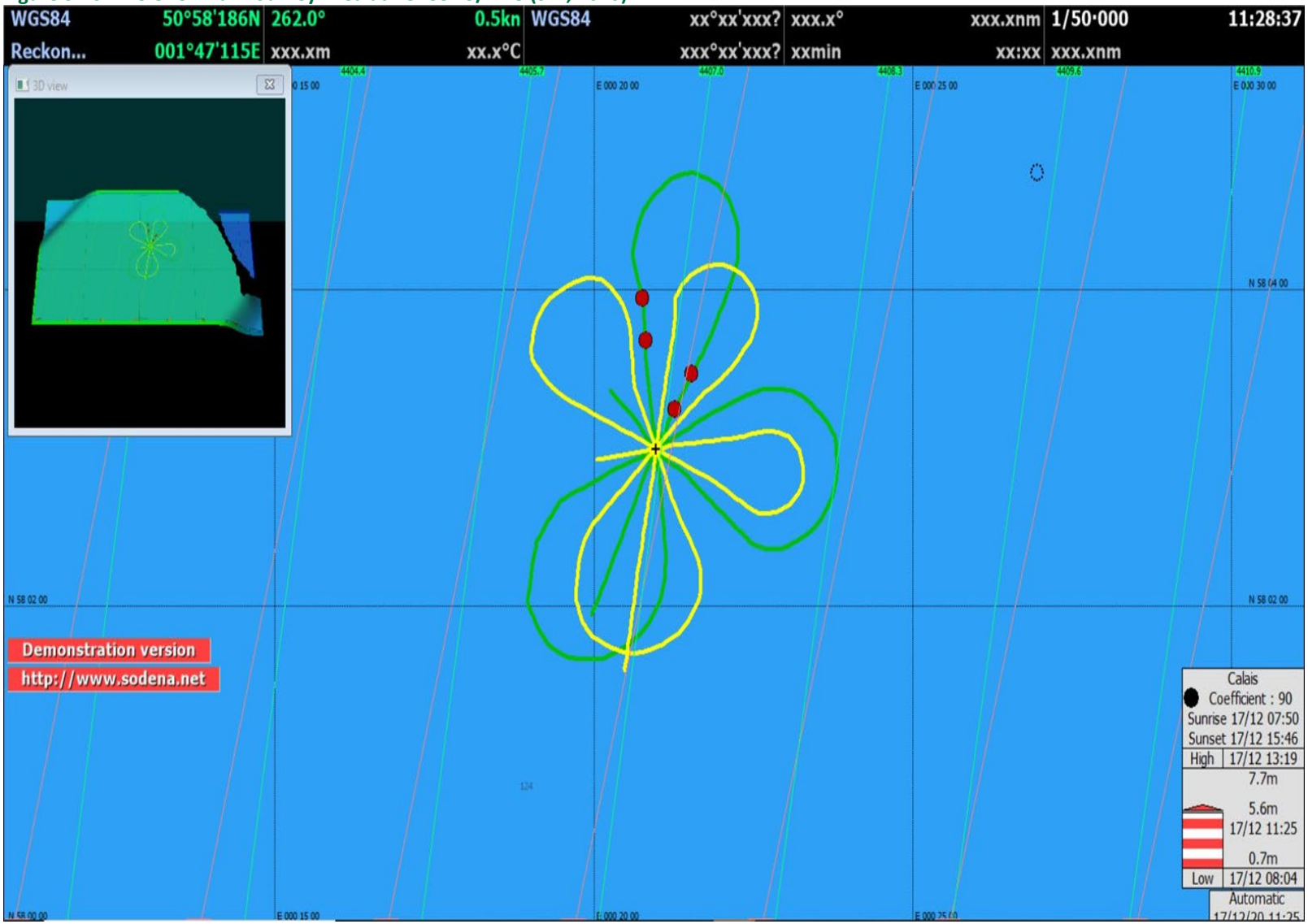


5.1.6 SFF Over-Trawl Survey

An overtrawl survey was conducted at the 15/27-8 well by SFF Services Ltd using a trawl sweep vessel; Ocean Trust FR 152 on the 12th October 2020. Fishing gear was deployed from the vessel. The use of chain mats was not required.

The overtrawl survey at the 15/27-8 well was run on a 100m x 100m box, centred on the well (Figure 5.10). SFF Services Ltd confirmed that overtrawl survey was successful and free from obstructions that could cause a hazard to fishing / trawling. SFF Services Ltd reported that there was no damage to fishing gear and issued a Sweep Certificate to HESS (Appendix A). To further support the results survey, there has been trawling in the area of Renee since 2016.

Figure 5.10: The Over Trawl Survey Area at Renee 15/27-8 (SFF, 2020)



6 Waste

6.1 Phase I

6.1.1 Disposal of Recovered Items

The decommissioning operations were conducted using a waste hierarchy of re-use; recycling; recovery; and lastly disposal or leaving in place.

The approved Decommissioning Programme specified how this policy was to be applied to all of the facilities. The 'fates' of all the recovered facilities are presented in Table 6.1.

The Renee COS was donated to the Fort William Underwater Centre for diver training.

Table 6.1: The Rubie and Renee Marine Licence Recovery 'Fates' of Facilities Report to DECC (EEUK, 2015)

Item	Fate of Goods			Comments
	Number of Items	Reuse (tonnes)	Scrap/ Landfill (tonnes)	
Concrete mattresses	226	956	0	All Mattresses sent to Augean North Sea Services for cleaning prior to reuse as sea defences Peterhead and the Norfolk coast
Plinths	6	31.5	20.5	3 Plinths sent to Augean North Sea Services for cleaning prior to reuse
Slabs	6	32.7	12.3	3 Slabs sent to Augean North Sea Services for cleaning prior to reuse
Pipeline bundles	103	0	337	All pipeline sections sent to John Williamson. Coatings stripped (sent to landfill) and remaining pipeline to scrap for possible recycling.
Debris in baskets	4	0	58	All sent to John Williamson. Coatings stripped (sent to landfill) and remaining metal to scrap for possible recycling.
Structures/ manifolds	16	17	194.7	The RPM was sent to John Williamson. Coatings were removed (sent to landfill) and remaining metal to scrap for recycling. The COS is now being used by Fort William Underwater Centre for diver and ROV training.
Umbilical sections = ~1000 m	3	0	30	All sent to John Williamson. Coatings stripped (sent to landfill)

				and remaining metal to scrap for recycling.
Concrete gabions	2	0	2	All sent to John Williamson
Wooden beams	6	0	18	All sent to John Williamson
Transponder tripod	1	0	5	All sent to John Williamson
Totals	**373**	**1,037.2**	**677.5**	

6.2 Phase II

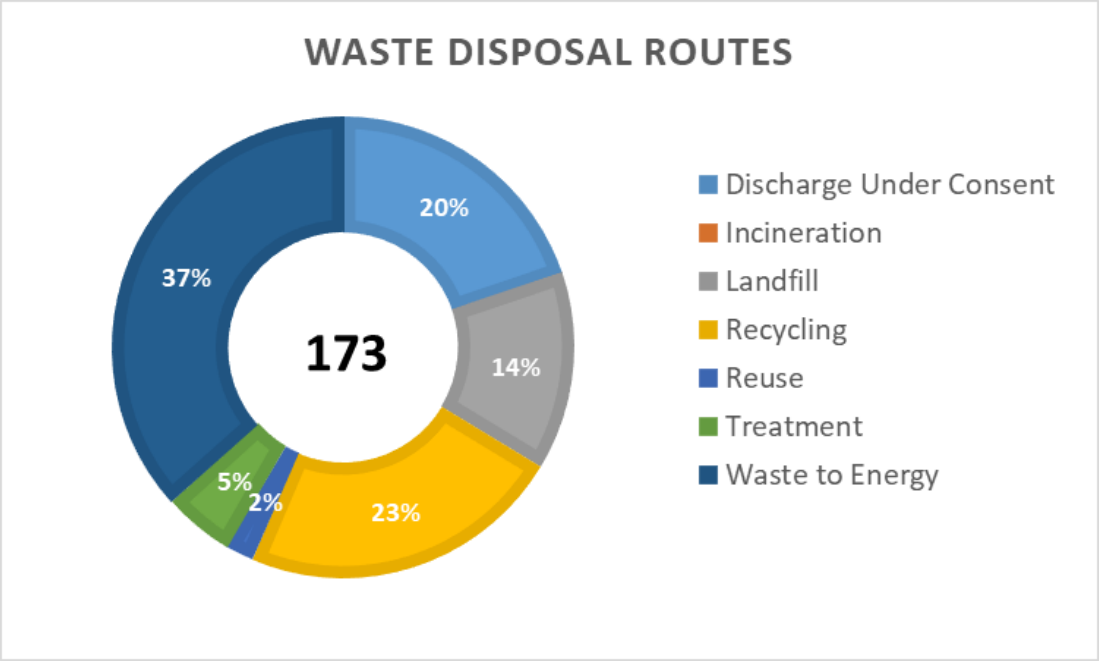
A number of items were recovered from the seabed during the Phase II Decommissioning Operations at Rubie and Renee. Table 6.2 gives a breakdown of the waste recovered and its fate.

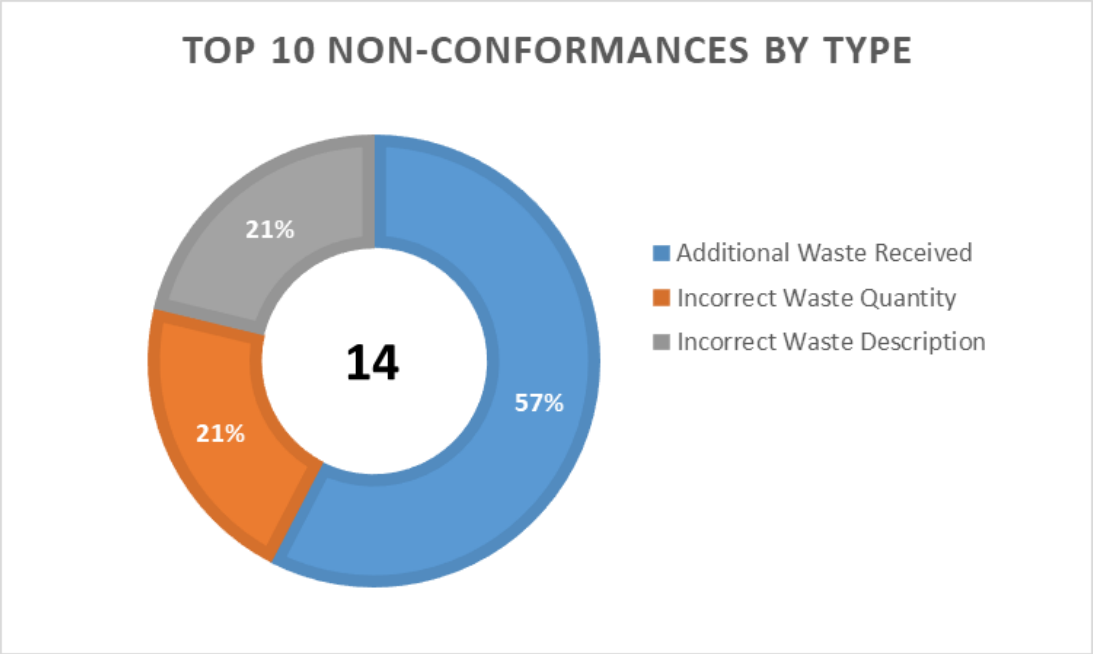
Table 6.2: The Renee & Rubie – Phase II Waste Summary

Item Description	Fate of goods			Comments
	Number of items	Reuse / recycle (Tonnes)	Landfill (Tonnes)	
Subsea Protection structures (and associated steelwork)	3	24.36	0	3 x Protection structures recovered by vessel DSV Rever Topaz as part of pre-rig preparation work. Transported to John Lawrie's for recycling.
Xmas Trees	3	79.68	0	Transported to John Lawries for recycling
Wellheads	4	33.30	0	Transported to John Lawries for recycling
Permanent Guide Bases (PGBs)	4	37.09	0	3 x PGBs transported to John Lawries for recycling. 15/28b-7z PGB forwarded to John Williamsons for recycling.
Tubulars (Casing, Tubing, Liners etc.)	N/A	392.30	0	All transported to John Lawries for recycling
Concrete (PGB)	1		9.4	9.4 tonnes of concrete were removed from the 15/27-8 Well PGB – 6 tonnes offshore and a further 3.4 tonnes on arrival onshore. Forwarded to landfill.
Miscellaneous steelwork	N/A	52.49	0	All transported to John Lawries for recycling
Totals		**619.22**	**9.4**	

The waste disposal routes for waste returned to the drilling rig during P&A are displayed in Figure 6.1.

Figure 6.1: The Waste Disposal Routes from the Rubie and Renee Decommissioning Operations (waste returned to the drilling rig – 173 tonnes)





7 Comparison of Costs for Decommissioning

The estimated costs against actual costs for both Phase I and Phase II of the Rubie and Renee decommissioning are shown in Table 7.1.

Table 7.1: Estimated Costs against Actual Costs for Both Phase I and Phase II of the Rubie and Renee Decommissioning

Programme of Work	Estimated Cost (£ million)	Actual Cost (£ million)
Phase I		
Pipeline(s) and umbilical(s) infrastructure decommissioning	4.4	4.4
Subsea installation(s) and stabilisation features	8.7	11.97
Phase II		
P&A Operations	36.8	34.6
Continuing liability – Any future pipeline and environmental survey requirements.	2.0	0.3 (£300k)
Total	**51.9**	**51.27**

8 Conclusion

Following completion of the Rubie and Renee decommissioning operations, HESS has reviewed all activities to ensure that the scope has been fully executed in accordance with the approved Decommissioning Programme, that risks to other sea users have been removed or reduced as far as reasonably possible and all regulatory requirements have been met. Where any variations to the Decommissioning Programme have arisen, these have been documented in this close out report.

As a result of reviewing the recorded data, HESS is confident that all residual risks to other sea users have effectively been removed and that a programme of future field infrastructure surveys would not provide any useful information in this regard. This is supported by the overtrawl clearance certificate (Appendix A), which was conducted over the 15/27-8 well showing that there were no obstructions to fishing activity.

Analysis of environmental survey data demonstrates that the local environment is already returning to a state typical of the wider CNS region and with no further site specific anthropogenic inputs, it is expected that this trend will continue. In addition, the survey data showed all indicators at all stations were under OSPAR ERL thresholds. Therefore, HESS believes that no additional site and environmental surveys or inspections of remaining features in the Rubie and Renee area are necessary.

HESS is seeking formal approval from the BEIS Decommissioning Team to enable full project close-out. This close out report is provided in order to help inform the decision making process.

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Appendix A: Trawl clearance certificate

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Date: 13/10/2020

HESS : RENEE WELL 15/27-8
POST DECOMMISSIONING VERIFICATION TRAWL SWEEPS

This is to certify that the MV "Ocean Trust" FR152 has carried out a post decommissioning sea bed / trawl verification sweep of the Renee Well 15/27-8 has found, using best endeavours and practice available, that there are no oil-related obstructions remaining that will affect current fishing activity in the defined area. The swept area is therefore considered safe to allow normal fishing operations to proceed.

Signed for on behalf of the Owners of MV "Ocean Trust" FR152

Mark Stephen, Skipper

Signed for on behalf of SFF Services Limited

Andrew Third, Industry Advisor

Appendix B: Status of Rubie/Renee Pipeline, Flowline and Umbilical Facilities as of 1st August 2015 (EEUK, 2015)

Description	Pipeline No. (as per PWA)	Diameter (inches/ mm)	Length	Composition	Pre-Decommissioning Status	Pre-Decommissioning Condition	Status as of 1st August 2015	Residual Contents As of 1st August 2015
Renee Pipeline/ Flowline/ Umbilical Information								
Oil test production pipeline	PL1616	85/8/ 219.1	21.6 km*	Steel Plastic Aluminium 37mm SPU coating	Suspended in place (160 m in wet storage)	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. RX-2030 (Chemicals in line)
COS to RBM spool	PL1616 connector	85/8/ 219.1	40 m	Steel Plastic Aluminium 37mm SPU coating	Removed to wet storage	Surface laid	Removed and recovered	
COS to PL1616 Spool	PL1616 connector	85/8/ 219.1	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
RPM to PL1616 Spool	PL1616 connector	85/8/ 219.1	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
Oil production pipeline	PL1617	85/8/ 219.1	21.6 km*	Steel Plastic Aluminium 37mm SPU coating	Suspended in place (160 m in wet storage)	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. RX-2030 (Chemicals in line)
COS to RBM spool	PL1617	85/8/ 219.1	40 m	Steel Plastic	Removed to wet storage	Surface laid	Removed and recovered	
Aluminium 37mm SPU coating								
COS to PL1617 Spool	PL1617 connector	85/8/ 219.1	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
RPM to PL1617 Spool	PL1617 connector	85/8/ 219.1	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
Gas lift pipeline piggybacked on PL1620	PL1618	4½ / 114.3	21.6 km*	Steel Plastic Aluminium 3LPP coating	Suspended in place (160 m in wet storage)	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. RX-2030 (Chemicals in line)

COS to RBM spool	PL1618	4½ / 114.3	40 m	Steel Plastic Aluminium 3LPP coating	Removed to wet storage	Surface laid	Removed and recovered	
COS to PL1618 Spool	PL1618 connector	4½ / 114.3	45 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
RPM to PL1618 Spool	PL1618 connector	4½ / 114.3	55m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
Two methanol umbilicals	PL1619.1 to PL1619.2	¾/ 19.05	21.6 km	Steel Copper Plastic	Suspended in place	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. Potable water
Six chemicals umbilicals	PL1619.3 to PL1619.8	½ / 12.7	21.6 km	Steel Copper Plastic	Suspended in place	Trenched and buried	Trenched and buried + ends cut	Flushed. Potable water
Water injection pipeline	PL1620	85/8/ 219.1	21.6 km*	Steel Plastic Aluminium 3LPP coating	Suspended in place (160 m in wet storage)	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. RX-2030 (Chemicals in line)
COS to RBM spool	PL1620	85/8/ 219.1	60 m	Steel Plastic Aluminium 3LPP coating	Removed to wet storage	Surface laid	Removed and recovered	
Wellhead production jumper	PL1621	65/8/ 168.3	37 m	Steel Plastic Aluminium 3LPP coating	Suspended in place	Surface laid	Removed and recovered	
Flexible jumper	PL1622	23/8/ 60.3	37 m	Steel Plastic Aluminium 3LPP coating	Suspended in place	Surface laid	Removed and recovered	
Two wellhead chemical jumpers	PL1623.1 and PL1623.2	¾/ 19.05	37 m	Steel Plastic Copper	Suspended in place	Surface laid	Removed and recovered	
Rubie Pipeline/ Flowline/ Umbilical Information								
Oil production pipeline	PL1624	85/8/ 219.1	5.6 km*	Steel Plastic	Suspended in place	Trenched and buried	Trenched and buried + ends	Flushed. RX-2030

				Aluminium 37mm SPU coating			cut (See Appendix C)	(Chemicals in line)
Rubie wellhead to PL1624 Spools	PL1624 connector	85/8/ 219.1 and 65/8/ 168.3	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
PL1624 to RPM Spool	PL1624 connector	85/8/ 219.1	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
Gas lift pipeline	PL1625	3½/ 88.9	5.6 km*	Steel Plastic 3LPP coating	Suspended in place	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed. RX-2030 (Chemicals in line)
Rubie wellhead to PL1625 Spools	PL1625 connector	3½/ 88.9 and 23/8/ 60.3	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
PL1625 to RPM Spool	PL1625 connector	3½/ 88.9	20 m	Steel Plastic	Suspended in place	Surface laid	Removed and recovered	
Two methanol umbilicals	PL1626.1 to PL1626.2	¾/ 19.05	5.6 km*	Steel Plastic Copper	Suspended in place	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed: Potable water
Six chemicals umbilicals	PL1626.3 to PL1626.8	½ / 12.7	5.6 km*	Steel Plastic Copper	Suspended in place	Trenched and buried	Trenched and buried + ends cut (See Appendix C)	Flushed: Potable water

Appendix C: Status of Rubie and Renee Pipelines 'as-left' Data (EEUK, 2015)

Buried Pipelines Start and End Points		
Pipeline ID	**Pipeline Easting**	**Pipeline Northing**
PL1618 & PL1620	330260	6453965
PL1618 & PL1620	343684.28	6437673.29
PL1616	330255	6453965
PL1616	343642	64376.65
PL1617	330255	6453965
PL1617	343658	6437682.21
PL1619	330437.31	645409.23
PL1619	343553.61	6437738.33
PL1624 & PL1625	343760	6437610
PL1624 & PL1625	347665	6439843.4
PL1626	343875.25	6437666.13
PL1626	348766	6439839.16
Location Coordinate System: 4326 (Lat/Long, WGS84)		
Depth of cover >0.6m confirmed by diver survey as being >= 0.6m FishSafe database updated accordingly October 2015		