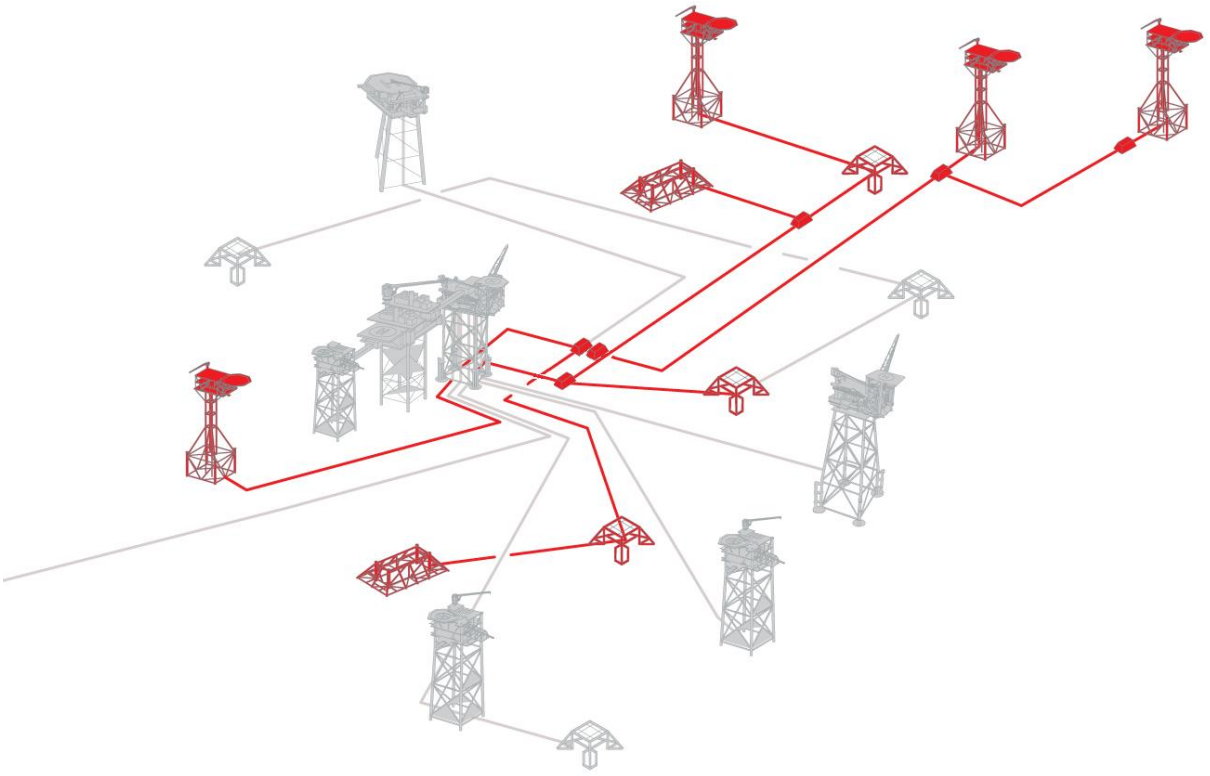


Decommissioning Programmes for Caister-Murdoch System III Installations and Pipelines, CDP2

Boulton BM, Boulton HM, Hawksley EM, Katy KT, Kelvin TM, McAdam MM, Munro MH, Murdoch K.KM, Watt QM & Associated Pipelines

DOCUMENT CONTROL

Document Number		CYR-SNS-C-XX-P-PM-12-00002	
Document Classification		Public	
Document Ownership		Decommissioning	
Prepared by	S. Axon	Date: 28/02/22	S. Axon
Reviewed by	C. Marston	Date: 28/02/22	C. Marston
Approved by	M. Burnett	Date: 28/02/22	M. Burnett

REVISION RECORD

Revision No	Description of Revision	Date
A1	Issued for comment to OPRED	09/02/21
A2	Issued for comment to OPRED	10/12/21
A3	Issued for Statutory Consultation	28/02/22

DISTRIBUTION

Name	Position	Company	No. of Copies
R. Tocher	Decommissioning Mgr	Chrysaor Production (U.K.) Limited	1 electronic
C. Watts	Joint Venture Advisor	Neptune E&P UK Ltd	1 electronic
K. Yule	Projects Manager	Premier Oil E&P UK Limited	1 electronic
F. Uliana	Decommissioning Manager	Tullow Oil PLC	1 electronic
F. Livingston	Senior Decommissioning Mgr	OPRED	1 electronic
I. Rowe	General Manager	NFFO	1 electronic
S. Alexander	Managing Director	SFF	1 electronic
R. James	Secretary	NIFPO	1 electronic
A. Riddell	Permitting Manager	Global Marine Group	1 electronic

TABLE OF CONTENTS

FIGURES AND TABLES

TABLE OF TERMS AND ABBREVIATIONS

Abbreviation	Explanation
~	Approximately
AB	Deprecated term 'Abandoned' but included in Table 2.4.1 to indicate extent to which wells have been decommissioned (Phase 1, Phase 2, etc.)
approaches	Refer to pipelines or umbilicals as they come nearer to the risers or j-tubes on the installations
CA	Comparative Assessment (Report)
Cavendish Subsea Pigging Skid	Refer PSSL
Chrysaor	Chrysaor Production (UK) Limited
CMS	Caister-Murdoch System
CMS III	Caister-Murdoch System excluding Caister CM and Murdoch MA, MC, and MD
CO_2	Carbon Dioxide
CoP	Cessation of Production
COSHH	Control of Substances Hazardous to Health
CSV	Construction Support Vessel
Cut and lift	The 'cut and lift' method of removing trenched and buried pipelines would involve excavating the pipelines from within the seabed and thereafter cutting the pipeline into recoverable and transportable lengths
CWC	Concrete Weight Coated
DCA	Decommissioning Operations Application
DNO	DNO North Sea (ROGB) Limited
DOC	The blue line on the burial profiles shows the profile of cover. The area between the blue line and maroon line (DOL) shows the depth of sediment above the top of the pipeline
DOL	Pipeline trench profile; depth of lowering to top of pipe
DP	Decommissioning Programme
EA	Environmental Appraisal
EL.	Elevation (height) relative to LAT
EMS	Environmental Management System
EPS	European Protected Species
ESDV	Emergency Shutdown Valve
EU	European Union
EUNIS	European Nature information System
Exposure	An exposure occurs when the 'crown' of a pipeline or umbilical can be seen.
FBE	Fusion Bonded Epoxy
F	Location of pipeline flange connection as shown in various approach schematics. Should be treated as indicative only and subject to change
FishSAFE	The FishSAFE database contains a host of oil & gas structures, pipelines, and potential fishing hazards. This includes information and changes as the data are reported for pipelines and cables, suspended wellheads pipeline spans, surface & subsurface structures, safety zones& pipeline gates (www.fishsafe.eu)
FOCI	Feature of Conservation Importance
FPAL	First Point Assessment Limited (UK)
Freespan	Sometimes referred to as a 'span'. Similar to an exposure except that the whole of the section of pipeline is visible above the seabed rather than just part of it. Once the height and length dimensions meet or exceed certain criteria it becomes a potential snagging hazard, and the span becomes reportable to FishSAFE and is called a 'reportable span'
Full removal	The full removal options for decommissioning the pipelines would involve using the 'cut and lift' method of removal especially for the larger pipeline and the presence of concrete weight coating and piggyback clamps on the platform approaches

Abbreviation	Explanation
GJ	Giga Joules (unit of energy in the International System of Units)
GMG	Global Marine Group
HAT	Highest Astronomical Tide
HLV	Heavy Lift Vessel
HSE	Health & Safety Executive
HVAC	Heating Ventilation and Air Conditioning
ID	Inside Diameter
in	Inch (1in = 25.4mm)
Ineos	INEOS UK SNS Limited
Infield	Term used to describe route of pipeline between and outside of 500m safety zones
Ithaca	Ithaca Energy (UK) Limited
JUWB	Jack Up Work Barge
Kelvin PMA	Kelvin Pigging Manifold Assembly (also see KPMA)
Kelvin STA	Kelvin Subsea Tee Assembly (also see KSTA)
kg	kilogram
km	kilometre
K-MSPS	Kelvin-Murdoch Subsea Pigging Skid (PL2430 & PLU2431 upstream of PSSL)
KP	Kilometre Point, usually measured from point of origin, the start of the pipeline
KPMA	Kelvin Pigging Manifold Assembly
KSTA	Kelvin Subsea Tee Assembly
LAT	Lowest Astronomical Tide
LDPE	Low Density Polyethylene
Leave *in situ*	Leave *in situ* for pipelines would involve leaving trenched and buried pipelines *in situ* and risk assessing any exposures and spans
LOD	Limit of Detection
m, µm	metres, micrometre (1m = 1,000,000µm)
m	metres
MAT, SAT	Master Application Template, Supplementary Application Template
MCV	Multipurpose Construction Vessel
MCZ	Marine Conservation Zone
MEG	Monoethylene Glycol
MeOH	Methanol
mg/l	milligrams per litre
MLWM	Mean Low Water Mark (1.341km to 'Gas Line Termination' at TGT)
Murdoch Installation	The Murdoch Installation comprises Murdoch MA, Murdoch MC, and Murdoch MD. All installations are bridge linked.
n/a	Not Applicable
N,S,E,W	North, South East & West
Neptune	Neptune E&P UKCS Limited
NFFO	National Federation of Fishermen's Organisations
NIFPO	Northern Ireland Fish Producers Organisation
NORM	Naturally Occurring Radioactive Material
NUI	Normally Unattended Installation
Ø	Diameter
OD	Outside Diameter
OGA	Oil and Gas Authority
OGUK	Oil and Gas United Kingdom
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSPAR	Oslo-Paris Convention

Abbreviation	Explanation
PAH	Polycyclic aromatic hydrocarbon
Partial removal	The partial removal decommissioning option for pipelines would involve excavating trenched and buried pipelines local to the exposed ends of the pipeline and thereafter effecting removal of the section of pipeline using the 'cut and lift' method. Typically, the excavated locations and cut pipeline ends in the seabed may need to be remediated in some way, either by back-filling the excavated material or by depositing rock
Perenco	Perenco UK Limited
Pipeline Crossing	A pipeline with a higher identification number will cross over the top of a pipeline with a lower identification number. Typically, pipeline crossings might be protected with concrete mattresses and overlain with deposited rock
PL, PLU	Pipeline or Umbilical identification numbers (Except for PLU2431, which is a pipeline)
Platform	Installation, typically comprising topsides and jacket
PMA	Pigging Manifold Assembly
PON	Petroleum Operations Notice
Premier	Premier Oil E&P UK Limited
PSNL	Pigging Skid Northern Lobe (PL1922 & PL1925, PL1923 & PL1926)
PSSL	Pigging Skid Southern Lobe or Cavendish Subsea Pigging Skid (PL2430 & PLU2431, PL1924 & PL1927)
PWA	Pipeline Works Authorisation
Reportable span	A reportable span is a significant span which meets set criteria (FishSAFE criteria) of height above the seabed and span length (10m long x 0.8m high)
Riser	Pipe that connects the pipeline to the topsides' pipework
SAC	Special Area of Conservation
SACFOR	The semi-quantitative SACFOR abundance scale (super-abundant, abundant, common, frequent, occasional, rare) was developed to support the observation of marine habitats, communities and species and is widely used in the UK
SAT	Subsidiary Application Template
SEI	Significant Environmental Impact
SFF	Scottish Fishermen's Federation
Shell	Shell U.K. Limited
SNS	Southern North Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SPA	Special Protection Area
Span	Sometimes referred to as a 'free-span'. Similar to an exposure except that the whole of the section of pipeline is visible above the seabed rather than just part of it. Once the height and length dimensions meet or exceed certain criteria it becomes a potential snagging hazard, and the span becomes reportable to FishSAFE and is called a 'reportable span'
SPS	Subsea Pigging Skid (Murdoch/Kelvin)
SSCV	Semi-Submersible Crane Vessel
STA	Subsea Tee Assembly (Kelvin)
SUTU	Subsea Umbilical Termination Unit
Tampnet AS	Owners of the 36km long MCCS fibre-optic cable between two platforms in the Southern North Sea, and the NorSea Com 1 fibre-optic cable, connecting Draupner, Ula, Ekofosk, Valhal and Murdoch platforms to Lowestoft in Suffolk, UK and Kårstø, Rogaland, Norway. https://www.tampnet.com/about
Te	Tonne(s)
Tee	Section of pipeline furnished with additional valves and pipework to allow for future expansion. It is also provided with a protection structure with its own protection and stabilisation features such as mattresses and deposited rock"
TGT	Theddlethorpe Gas Terminal (WGS84 Degrees: 53.362438° N .237783° E)
THC	Total Hydrocarbon Content

Abbreviation	Explanation
Trenched and buried	Pipeline installed into a trench and covered in seabed sediment. Refer Figure 1.1.1
TUTU	Topsides Umbilical Termination Unit
UHB	Upheaval Buckling' the vertical-upwards displacement of a pipeline
UK	United Kingdom
UK BAP	UK Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
UNO	Unless Noted Otherwise
UTM	Universal Transverse Mercator (Coordinate System)
WGS84	World Geodetic System 84 is the reference coordinate system used by the Global Positioning System
Wintershall	Wintershall Noordzee B.V.
x	Number of (e.g. 16x = 16 in Number)

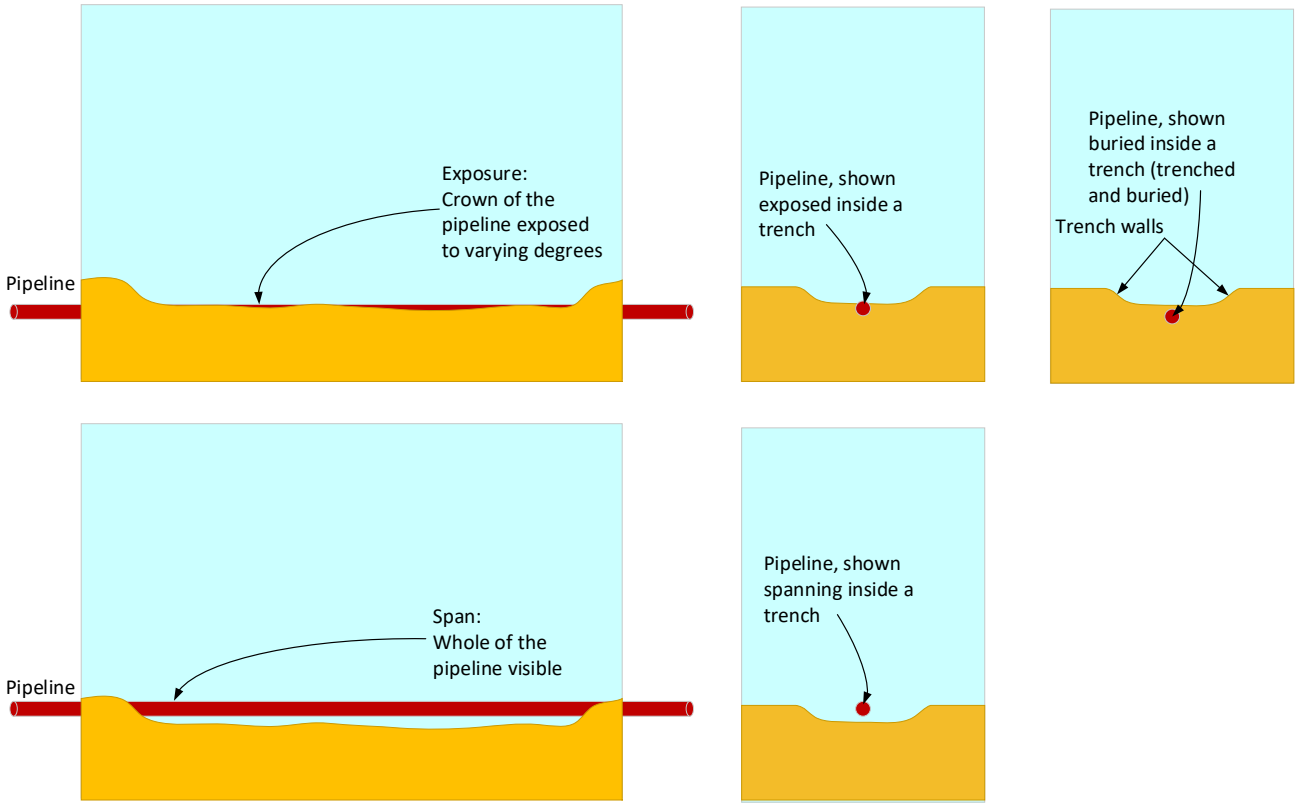


Figure 1.1.1: The difference between pipeline burial, exposures, and spans[1]

[1] Trench walls may or may not be prominent.

1 Executive summary

1.1 Combined Decommissioning Programmes

This document contains eleven Decommissioning Programmes, one for each set of notices under Section 29 of the Petroleum Act 1998. The Decommissioning Programmes are:

Installations

- Boulton BM;
- Katy KT;
- Kelvin TM;
- Munro MH;
- CMS III Satellites (Subsea) Installations including Boulton HM, Hawksley EM, McAdam MM, Murdoch K.KM and Watt QM.

Pipelines

- Boulton BM pipelines (PL1436 & PL1437);
- Katy KT pipelines (PL2894 & PL2895);
- Kelvin TM pipelines (PL2430 & PLU2431);
- Munro MH pipelines (PL2109 & PL2110);
- CMS satellites northern pipelines including Hawksley EM (PL1922 & PL1925, PLU4685), McAdam MM (PLU4686), Murdoch K.KM (PL1923 & PL1926, PLU4890), Boulton HM (PLU4888) and Watt QM (PLU4889);
- CMS III satellites southern pipelines including Boulton HM (PL1924 & PL1927).

Although decommissioning of these installations and pipelines is being treated in this document as a standalone project, the operational phase is being carried out as part of a wider decommissioning campaign in the CMS area. Chrysaor Production (U.K.) Limited (Chrysaor) shall also continue to explore cost saving synergies with other projects.

1.2 Requirement for Decommissioning Programmes

Installations: In accordance with the Petroleum Act 1998, Chrysaor, as operator of the CMS Joint Facilities Installations and Murdoch MD installation, and on behalf of the Section 29 notice holders listed in Table 1.4.3, Table 1.4.4, Table 1.4.5 and Table 1.4.6, is applying to the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED) to obtain approval for decommissioning the installations detailed in Section 2 of this document. Partner letters of support will be included in the Decommissioning Programme following statutory consultation.

Pipelines: In accordance with the Petroleum Act 1998, Chrysaor, as operator of the CMS trunklines, and on behalf of the Section 29 notice holders listed in Table 1.4.8, Table 1.4.9, Table 1.4.10, Table 1.4.11, Table 1.4.12, Table 1.4.13 and Table 1.4.14 is applying to OPRED to obtain approval for decommissioning the pipelines detailed in Section 2 of this document. Partner letters of support will be included in the Decommissioning Programme following statutory consultation.

In conjunction with public, stakeholder and regulatory consultation, the Decommissioning Programmes are submitted in compliance with national and international regulations and OPRED decommissioning guidance notes [13]. The schedule outlined in this document is for a decommissioning project with the well decommissioning, and preparatory work associated with the removal of the CMS III installations and decommissioning of the CMS III infield pipelines commencing in 2021. Decommissioning of the facilities will continue for a further 8 years until completion in 2029. The Murdoch MA, MC and MD installations and the CMS trunklines PL929 and PL930 are out of scope and are addressed in the CDP3 Decommissioning Programmes [3].

1.3 Introduction

1.3.1 Overview of Murdoch installation and CMS

Chrysaor's Caister-Murdoch System joint facilities development consists of Murdoch installation which is a single 'gas gathering' and controls complex that collected gas from a total of 8 'satellite' platforms and 8 subsea centres up to ~45km from the main Murdoch installation. Some of the platforms and subsea centres are operated and owned by companies other than Chrysaor.

The Murdoch installation is located in UKCS block 44/22a and comprises three independent platforms MA, MC, and MD that are bridge linked. Only MA and MD support the pipeline and umbilical infrastructure. MA provided the electrohydraulic power for the umbilicals, while Murdoch MD received gas and exported it to TGT, Murdoch MD also imported methanol from TGT and distributed it to the various satellites and beyond. MD was built and installed in 1993, MC was built and installed in 1996 and MA was built and installed in 2002. First production was achieved in 1993. Production ceased in 2018. It is located ~160km North-East-East of Easington on the East Riding of Yorkshire Coast, England.

The surface installation wells that are tied back to Murdoch MD (44/22a) include Boulton BM (44/21a), Caister CM (44/23a), Katy KT (44/19b), Kelvin TM (44/18 & 44/23b), and Munro MH (44/17b). The subsea wells that are tied back to Murdoch include Murdoch K (KM) (44/22a), McAdam (MM) (44/17c), Hawksley (EM) (44/17a), Boulton H (HM) (44/22b) and Watt (QM) (44/22b). Collectively when Caister and Murdoch are included this is called the CMS. Excluding Caister and Murdoch it is referred to herein as CMS III. These are shown in Figure 1.3.1.

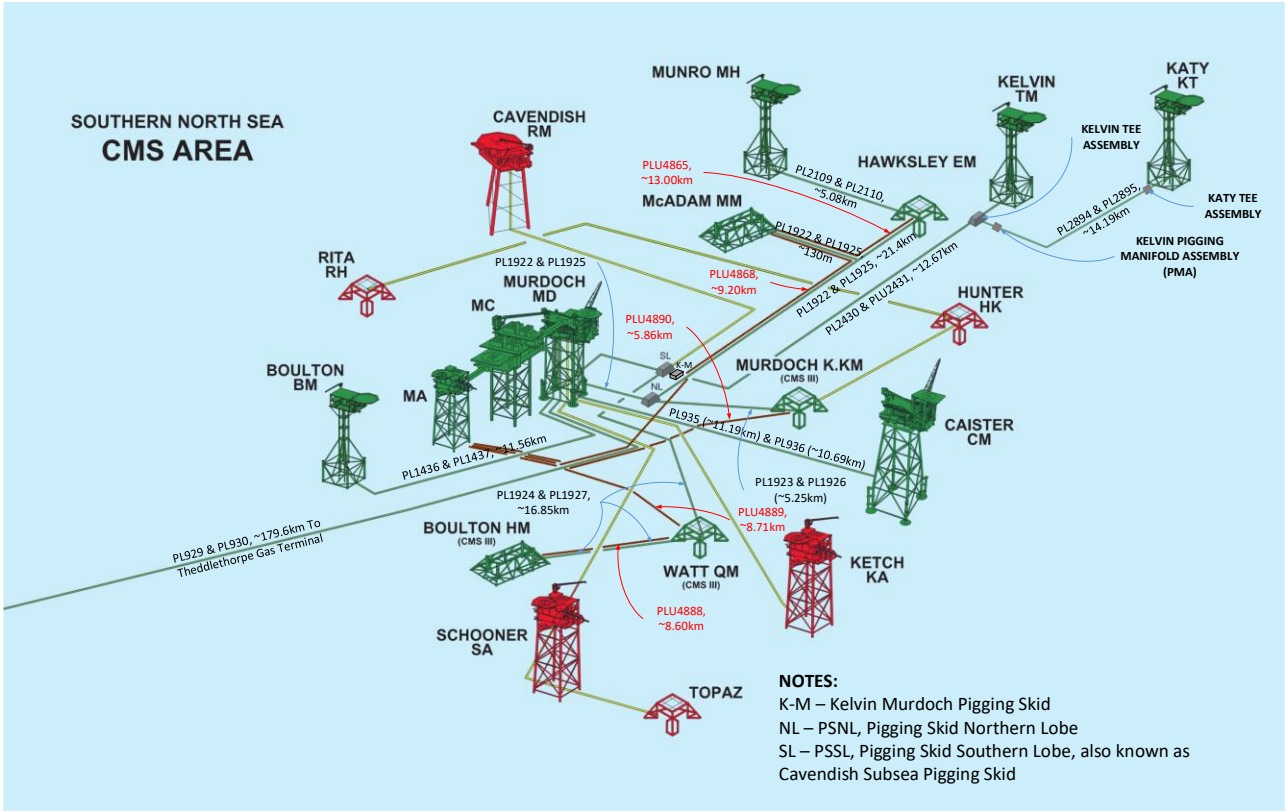


Figure 1.3.1: Murdoch and CMS area installations and pipelines

The pipelines are all now shutdown, but gas used to be exported from CMS via Murdoch MD to TGT using the 26in gas pipeline PL929. PL930 is a 4in methanol pipeline originating from TGT and tied into Murdoch MD which used to supply to the various satellite installations using 3in pipelines. It lies in a separate trench to PL929 although it crosses over PL929 about 20km from mean low water mark (MLWM). Most of the smaller 3in MeOH pipelines are piggybacked to the larger gas pipeline for each facility. The exception to this is the 3in Caister pipeline PL936 that was buried in a separate trench to its sister 16in gas pipeline PL935.

There are pipelines from other installations (e.g. Cavendish RM, Hunter HK, Rita RH, Ketch KA, and Schooner SA) that also tie into Murdoch, but these are subject to separate Decommissioning Programmes being prepared by others and are out of scope. The Decommissioning Programmes for all these are available on the regulator's website. The Cavendish Decommissioning Programmes were approved June 2020, while Ketch and Schooner were approved August 2019. The Hunter and Rita Decommissioning Programmes were approved April 2021.

The Decommissioning Programmes for the Caister installation (CDP1a) [1], Caister pipelines (CDP1b) [2] , and Murdoch installation and associated trunklines (CDP3) are addressed in Decommissioning Programmes submitted separately [3]. The Decommissioning Programme for the Caister installation was approved in March 2020, and the installation has been removed.

The application for Cessation of Production of the Murdoch and CMS fields (including Boulton, Munro, McAdam, Kelvin, and Katy) was accepted by OGA on 10 May 2018. For Caister the CoP application was accepted by OGA on 04 May 2016, for Hawksley, the CoP application was accepted by OGA on 10 February 2011 and for Watt the CoP application was accepted by OGA on 11 November 2009. Production and export from Murdoch MD ceased in 2018.

1.3.2 Murdoch MA

Murdoch MA acts as origin for three umbilicals. The decommissioning of these is dealt with in this Decommissioning Programme:

- PLU4686 96mm diameter electrohydraulic umbilical to McAdam MM ~9.2km long;
- PLU4889 88mm diameter electrohydraulic umbilical to Watt QM ~8.7km long;
- PLU4890 82mm diameter electrohydraulic umbilical to Murdoch K.KM ~5.9km long;

All these umbilicals are out of use. The chemical cores have been flushed and filled with seawater. The hydraulic cores have been left filled with environmentally friendly hydraulic fluids.

1.3.3 Murdoch MD

As well as being the hub for PL929 and PL930, Murdoch acts as host to several pipelines. All these pipelines are out of use and have been flushed, cleaned, and filled with seawater but they remain connected to their respective risers. The decommissioning of these pipelines and risers is addressed in the Decommissioning Programmes for CDP3. Only the decommissioning of the Boulton BM risers (PL1436 & PL1437) and Boulton HM risers (PL1924 & PL1927) is within the scope of this Decommissioning Programme document (CDP2).

1.3.4 CMS III surface installations

The CMS III surface installations are all Normally Unattended Installations and comprise Boulton BM, Katy KT, Kelvin MH, and Munro MH. Given the complexity of the infrastructure they are summarised in Table 1.3.1 below.

Table 1.3.1 CMS III surface installations tied back to Murdoch MD

Facility	Export route	Type	UKCS Block	First production
Boulton BM	Direct	4-leg piled steel tower	44/21a	January 1998
Katy KT	VIA PSSL	3-leg piled steel tower	44/19b	January 2013
Kelvin TM	VIA PSSL	3-leg piled steel tower	44/18b & 44/23b	November 2007
Munro MH	VIA PSNL	3-leg piled steel tower	44/17b	August 2005

1.3.5 CMS III subsea installations

The CMS III subsea installations comprise either single or dual slot wellhead protection structures that are all controlled using an umbilical that is tied back to Murdoch MA and they include Boulton HM, Hawksley EM, McAdam MM, Murdoch K.KM and Watt QM. Given the complexity of the infrastructure they are summarised in Table 1.3.2.

Table 1.3.2 CMS III subsea installations tied back to Murdoch MD				
Facility	**Export route**	**Type**	**UKCS Block**	**First production**
Boulton HM	VIA PSSL	Two-slot WHPS	44/21	March 2004
Hawksley EM	VIA PSNL	WHPS	44/17a	September 2002
McAdam MM	VIA PSSL	Two-slot WHPS	44/17c	October 2005
Murdoch K.KM	VIA PSNL	WHPS	44/22a	November 2002
Watt QM	VIA PSSL	WHPS	44/22b	October 2005

1.3.6 CMS III pigging manifolds and tees

Although these are not classed as installations and given the complexity of the infrastructure, for completeness the subsea tees and subsea pipeline pigging manifolds used to connect the pipelines are summarised in Table 1.3.3.

Table 1.3.3 CMS III subsea tees and pigging manifolds		
Facility	**Approx. location**	**Pipeline involved**
Katy Tee	Katy KT	PL2894 & PL2895
Kelvin/Murdoch Subsea Pigging Skid	Murdoch MD	PL2430 & PLU2431
Kelvin PMA	Kelvin TM	PL2894 & PL2895
Kelvin STA	Kelvin TM	PL2430 & PLU2431, PL2894 & PL2895
McAdam Tee	McAdam MM	PL1922 & PL1925
PSNL	Murdoch MD	PL1922 & PL1925, PL1923 & PL1926
PSSL	Murdoch MD	PL1924 & PL1927, PL2430 & PLU2431

1.3.7 Submission of Decommissioning Programmes

Following public, stakeholder and regulatory consultation, the Decommissioning Programmes will be submitted without derogation and in full compliance with the OPRED decommissioning guidance notes [13]. The Decommissioning Programmes explain the principles of the removal activities and are supported by an Environmental Appraisal [4] and a Comparative Assessment [5].

1.4 Decommissioning overview

1.4.1 Installations

Table 1.4.1 Installations being decommissioned

Field names		Quad / Block	Wells	Drill cuttings	Surface installations					Distances	
Fields	Water Depth (LAT)	UKCS Block(s)	No. of Wells	No./Vol (m^3)	Qty	Function	Type	Topsides Mass (Te)	Jacket Mass (Te)[3]	Distance to Median (Netherlands)	Distance from Easington, UK
Boulton	~36.5m	44/21a	4	n/a	1	Wellhead platform	4-leg piled steel tower	351.0	807.8	~41.4km	~149.0km
Katy	~26.4m	44/19b	1	n/a	1	Wellhead platform	3-leg piled steel tower	353.4	832.3	~7.2km	~186.6km
Kelvin	~31.7m	44/18b & 44/23b	1	n/a	1	Wellhead platform	3-leg piled steel tower	288.6	696.7	~18.9km	~172.5km
Munro	~27.8m	44/17b	1	n/a	1	Wellhead platform	3-leg piled steel tower	210.9	550.2	~30.6km	~166.8km

Field names		Quad / Block	Wells	Drill cuttings	Subsurface installations			Distances	
					Qty	Type	Mass (Te)		
Boulton	~37.8m	44/22b	1	n/a	1	Two-slot WHPS	118.4	~38.8km	~150.2km
Hawksley	~18.3m	44/17a	1	n/a	1	WHPS	70.0	~27.2km	~172.2km
McAdam	~33.2m	44/17c	2	n/a	1	Two-slot WHPS	118.4	~26.6km	~165.8km
Murdoch (K)	~39.9m	44/22a	1	n/a	1	WHPS	93.4	~26.3km	~162.6km
Watt	~42.4m	44/22b	1	n/a	1	WHPS	93.4	~30.3km	~157.9km

NOTES:
1. All production is gas condensate;
2. No drill cuttings present;
3. Jacket mass includes the mass of the piles.

Table 1.4.2: Installation Section 29 Notice Holder details – Boulton BM		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	46.00%
Neptune E&P UKCS Limited	03386464	44.50%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	9.50%

Table 1.4.3: Installation Section 29 Notice Holder details – Katy KT		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	50.00%
Neptune E&P UKCS Limited	03386464	27.50%
Tullow Oil SK Limited	05287330	22.50%

Table 1.4.4: Installation Section 29 Notice Holder details – Kelvin TM		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	50.00%
Neptune E&P UKCS Limited	03386464	27.50%
Tullow Oil SK Limited	05287330	22.50%

Table 1.4.5: Installation Section 29 Notice Holders details – Munro MH		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	46.00%
Neptune E&P UKCS Limited	03386464	39.00%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	15.00%

Table 1.4.6: Installation Section 29 Notice Holder details – CMS Satellites (Subsea)		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	59.50%
Neptune E&P UKCS Limited	03386464	26.40%
Tullow Oil SK Limited	05287330	14.10%
Tullow Oil PLC	03919249	-
NOTES: 1. CMS Satellites (Subsea) Installations include: Boulton HM, Hawksley EM, McAdam MM, Murdoch K.KM and Watt QM.		

1.4.2 Pipelines

Table 1.4.7: Pipelines being decommissioned		
Field	**Number of pipelines**	
Boulton BM pipelines (PL1436 & PL1437)	2	
Katy KT pipelines (PL2894 & PL2895)	2	
Kelvin TM pipelines (PL2430 & PLU2431)	2	
Munro MH pipelines (PL2109 & PL2110)	2	
CMS III satellites northern pipelines	9	
CMS III satellites southern pipelines	2	Refer Table 2.3.1

NOTES:
1. CMS III Satellites northern pipelines include: Boulton HM (PLU4888), Hawksley EM (PL1922 & PL1925, PLU4685), McAdam MM (PLU4686), Murdoch K.KM (PL1923 & PL1926, PLU4890) and Watt QM (PLU4889);
2. CMS III southern pipelines include: Boulton HM (PL1924 & PL1927).

Table 1.4.8: Pipeline Section 29 Notice Holder details – Boulton BM		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	46.00%
Neptune E&P UKCS Limited	03386464	44.50%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	9.50%

NOTES:
1. This refers to ownership of PL1436 and PL1437;
2. PL1311 and PL1312 are the risers for these pipeline on the Murdoch MD jacket. These are out of scope of CDP2 Decommissioning Programmes but are included in CDP3 [3].

Table 1.4.9: Pipeline Section 29 Notice Holder details – Katy KT		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	50.00%
Neptune E&P UKCS Limited	03386464	27.50%
Tullow Oil SK Limited	05287330	22.50%

Table 1.4.10: Pipeline Section 29 Notice Holder details – Kelvin TM		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	50.00%
Neptune E&P UKCS Limited	03386464	27.50%
Tullow Oil SK Limited	05287330	22.50%

Table 1.4.11: Pipeline Section 29 Notice Holder details – Munro MH		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	46.00%
Neptune E&P UKCS Limited	03386464	39.00%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	15.00%

Table 1.4.12: Pipeline Section 29 Notice Holder details – CMS III Satellites northern		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	59.50%
Neptune E&P UKCS Limited	03386464	26.40%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	14.10%

Table 1.4.13: Pipeline Section 29 Notice Holder details – CMS III Satellites southern		
Section 29 Notice Holders	**Registration number**	**Equity interest**
Chrysaor Production (U.K.) Limited	00524868	59.50%
Neptune E&P UKCS Limited	03386464	26.40%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	14.10%
NOTE 1. Ownership extends from Boulton HM up to but not including PSSL; 2. Premier Oil E&P UK Limited and Chrysaor (U.K.) Beta Limited only have interest in the PSSL and the section between PSSL and Murdoch MD and this is documented in Table 1.4.14.		

Table 1.4.14: Pipeline Section 29 Notice Holder details – Boulton HM pipeline (part)		
Section 29 Notice Holders	**Registration Number**	**Equity Interest**
Chrysaor Production (U.K.) Limited (Operator)	00524868	31.75%
Chrysaor (U.K.) Beta Limited	02316577	15.00%
Neptune E&P UK Ltd	03386464	16.25%
Premier Oil E&P UK Limited	02761032	20.00%
Tullow Oil PLC	03919249	-
Tullow Oil SK Limited	05287330	17.00%
NOTE 1. The Boulton HM pipelines are part of the CMS III Satellites southern pipelines. This table has been included to differentiate ownership from PSSL to Murdoch MD. Ownership in this table includes PSSL.		

1.5 Summary of proposed Decommissioning Programmes

Table 1.5.1: Summary of Decommissioning Programmes	
Proposed decommissioning solution	**Reason for selection**
1. Topsides (Boulton BM, Katy KT, Kelvin TM, Munro MH)	
Complete removal and recycling. The topsides will be removed and recovered to shore and recycled. Environmental permit applications required for work associated with removal of the topsides will be applied for.	Allows jacket to be removed and maximises recycling of materials.
2. Jackets (Boulton BM, Katy KT, Kelvin TM, Munro MH)	
Complete removal and recycling. The leg piles will be cut 3.0m below seabed and each jacket, along with all the risers will be removed and recovered to shore for recycling. Environmental permit applications required for work associated with removal of the jackets will be applied for.	To comply with OSPAR requirements leaving unobstructed seabed. Removes a potential obstruction to fishing operations and maximises recycling of materials.
4. Subsea installations (Boulton HM, Hawksley EM, McAdam MM, Murdoch K.KM, Watt QM)	
Complete removal and recycling. Environmental permit applications required for work associated with the removal of the subsea installations will be applied for.	To comply with OSPAR requirements leaving unobstructed seabed. Removes a potential obstruction to fishing operations and maximises recycling of materials.
5a. Pipelines (Boulton BM, Katy KT, Kelvin TM, Munro MH)	
PL1436 & PL1437, PL2894 & PL2895, PL2430 & PLU2431 have been flushed and filled with seawater and will be left buried *in situ*. PL2109 & PL2110 have been flushed and the first 1,5km of the pipelines starting at Munro MH will be removed to shore with the remainder being left buried *in situ*. For all pipelines, the surface laid ends of the pipelines and overlying mattresses will be fully recovered up to the point where they enter burial, either under deposited rock or at transition depth in the seabed (PL2109 & PL2110 only). At the point of burial near rock, the deposition of a small quantity of additional rock will be covered by a deposit consent. Local excavations to access pipeline cuts at trench transition in the seabed may be remediated with a small quantity of deposited rock to ensure that the pipeline end remains buried. Where identified it is intended that mattresses be fully recovered to shore. However, should practical difficulties ensue OPRED will be consulted. All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate. The quantity of rock deposited over the pipelines is nominally up to 25Te per location. Environmental permit applications required for work associated with decommissioning of the pipelines will be applied for.	Outside the 500m safety zones the pipelines will already have been exposed to fishing activity and the situation would be no different to what it is now. Once the 1.5km length of PL2109 &PL2110 has been removed all pipelines exhibit good burial and stability and so the comparative assessment recommends that the pipelines be left *in situ*. Materials will be recovered to shore and will be reused or recycled. Minimal seabed disturbance, lower energy usage, reduced risk to personnel engaged in the activity. Reduces the requirement for the introduction of new material such as deposited rock to the Dogger Bank Special Area of Conservation (SAC). Monitoring to confirm the pipelines remain buried will be completed to a schedule agreed with OPRED.
5b. Pipelines (CMS III satellites northern lines)	
Leave *in situ*. PL1922 & PL1925, PL1923 & PL1926 have been flushed and left filled with seawater and will be left buried *in situ*;	Outside the 500m safety zones the pipelines will already have been exposed to fishing activity and the situation would be no different to what it is now.

Table 1.5.1: Summary of Decommissioning Programmes	
Proposed decommissioning solution	**Reason for selection**
For all pipelines, the surface laid ends of the pipelines and overlying mattresses will be fully recovered up to the point where they enter burial under deposited rock. At the point of burial, the deposition of a small quantities of additional rock will be covered by a deposit consent. Leave *in situ*. All umbilicals except for short-exposed sections of PLU4685 will be left *in situ*. The chemical cores of PLU4685, PLU4686, PLU4888 PLU4889 and PLU4890 have been flushed and filled with seawater and the hydraulic cores are left filled with hydraulic fluid. For all the umbilicals, the surface laid ends and overlying mattresses will be fully recovered up to the end of transition inside the trench at trench depth. Local excavations to access pipeline cuts at trench transition in the seabed may be remediated with a small quantity of deposited rock to ensure that the pipeline end remains buried. For PLU4685 cut the ends of the exposed or free spanning umbilical between KP0.222 and KP0.280 between the buried ends at the extremities and remove a total length ~52m to shore. The short-exposed section ~7m long at KP0.028 near Hawksley EM will be removed along with the surface laid section of the umbilical. Where identified it is intended that mattresses be fully recovered to shore. However, should practical difficulties ensue OPRED will be consulted. All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate. The quantity of rock deposited over the pipelines is nominally up to 25 Te per location. Environmental permit applications required for work associated with decommissioning of the pipelines will be applied for.	All the pipelines exhibit good burial and stability and so the comparative assessment recommends that the pipelines be left *in situ*. Materials will be recovered to shore and will be reused or recycled. Minimal seabed disturbance, lower energy usage, reduced risk to personnel engaged in the activity. Reduces the requirement for the introduction of new material such as deposited rock to the Dogger Bank Special Area of Conservation (SAC). Monitoring to confirm the pipelines remain buried will be completed to a schedule agreed with OPRED.
5c. Pipelines (CMS III satellites southern pipelines)	
PL1924 & PL1927 have been flushed and left filled with seawater and will be left buried *in situ*; For all pipelines, the surface laid ends of the pipelines and overlying mattresses will be fully recovered up to the point where they enter burial under deposited rock. At the point of burial, the deposition of a small quantities of additional rock will be covered by a deposit consent. Where identified it is intended that mattresses be fully recovered to shore. However, should practical difficulties ensue OPRED will be consulted. All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate. The quantity of rock deposited over the pipelines is nominally up to 25Te per location. Environmental permit applications required for work associated with decommissioning of the pipelines will be applied for.	Outside the 500m safety zones the pipelines will already have been exposed to fishing activity and the situation would be no different to what it is now. The remaining pipelines exhibit good burial and stability and so the comparative assessment recommends that the pipelines be left *in situ*. Materials will be recovered to shore and will be reused or recycled. Minimal seabed disturbance, lower energy usage, reduced risk to personnel engaged in the activity. Reduces the requirement for the introduction of new material such as deposited rock to the Dogger Bank Special Area of Conservation (SAC). Monitoring to confirm the pipelines remain buried will be completed to a schedule agreed with OPRED.
6. Subsea pipeline structures (pigging skids, tees)	

Table 1.5.1: Summary of Decommissioning Programmes	
Proposed decommissioning solution	**Reason for selection**
The Pigging Skid Southern Lobe (PSSL), Pigging Skid Northern Lobe (PSNL), Kelvin-Murdoch Subsea Pigging Skid (K-MSPS), Kelvin Pigging Manifold Assembly (PMA), Kelvin Subsea Tee Assembly Katy tee and McAdam tee will be completely removed for recycling onshore. Environmental permit applications required for work associated with the removal of the subsea pipeline structures will be applied for.	To comply with OSPAR requirements leaving unobstructed seabed. Removes a potential obstruction to fishing operations and maximises recycling of materials.
7. Risers	
All risers will be completely removed along with their respective jackets. Environmental permit applications required for work associated with the removal of the risers will be applied for.	To comply with requirements leaving unobstructed seabed. Removes a potential obstruction to fishing operations and maximises recycling of materials.
8. Well decommissioning	
Some of the subsea wells have already been partly or fully decommissioned. Nevertheless, all the well decommissioning has been or will be completed in accordance with the version of Oil & Gas UK Well Decommissioning Guidelines relevant at the time and to comply with HSE “Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996”.	Meets the OGA and HSE regulatory requirements.
9. Drill cuttings	
None found.	No drill cuttings piles have been identified by seabed survey.
10. Interdependencies	
The whole of the four surface installations and five subsea installations will be removed. The piles will be cut with seabed sediment potentially being displaced to allow access for cutting. No third-party pipeline crossings outside of the Murdoch 500m zone will be disturbed as a result of the decommissioning proposals. Some third-party pipeline crossings may be disturbed inside the Murdoch 500m zone, and should be the case, the pipeline owners will be informed with any works being addressed via pipeline crossing agreements. Any concrete mattresses and exposed grout bags that are removed to gain access to infrastructure will be removed to shore for reuse, re-cycling, or disposal as appropriate. Grout bags that are exposed will be removed to shore for reuse, re-cycling, or disposal as appropriate. Deposited rock will remain *in situ*.	

1.6 Field location incl. field layout and adjacent facilities

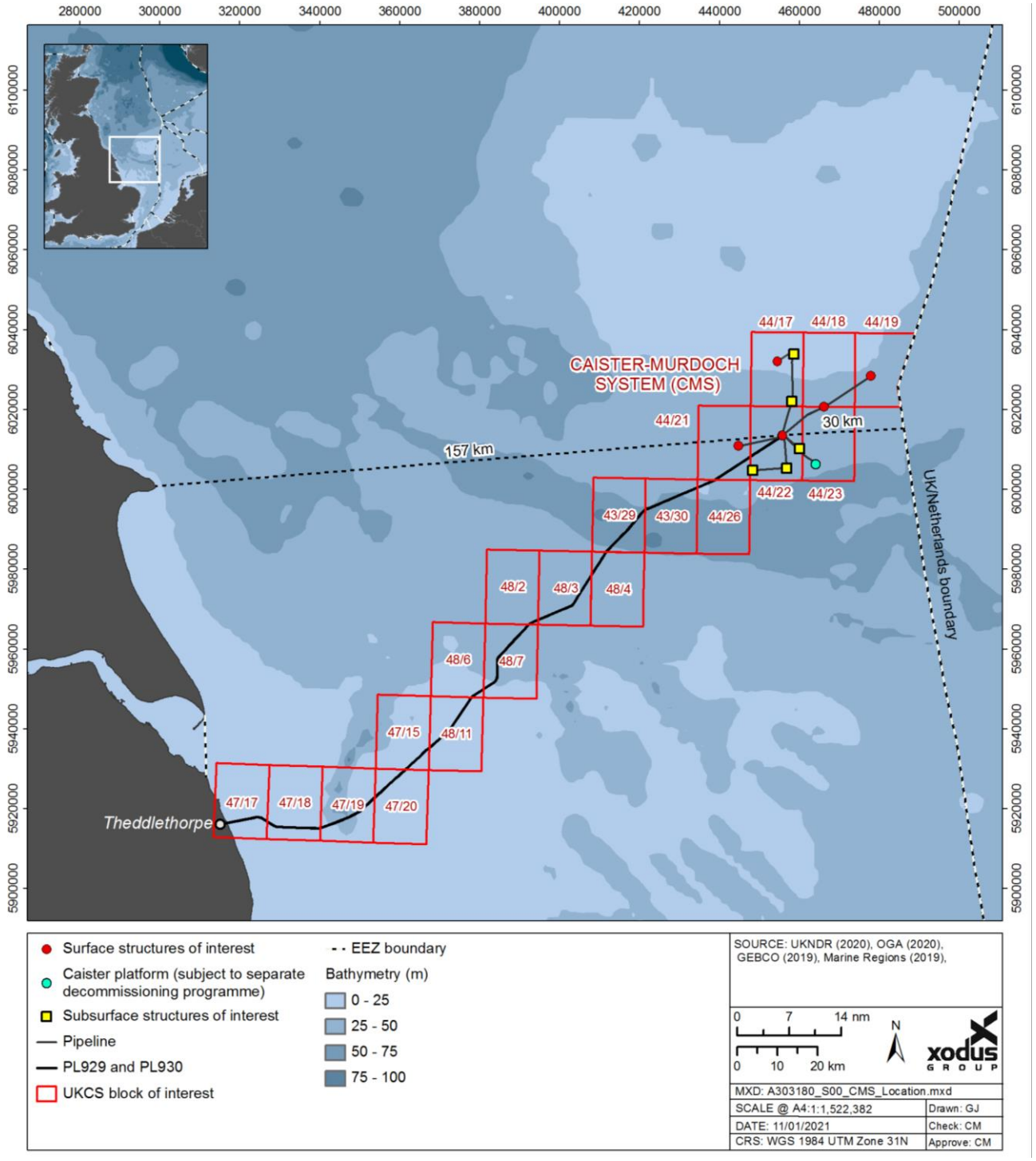


Figure 1.6.1: CMS asset locations in UKCS

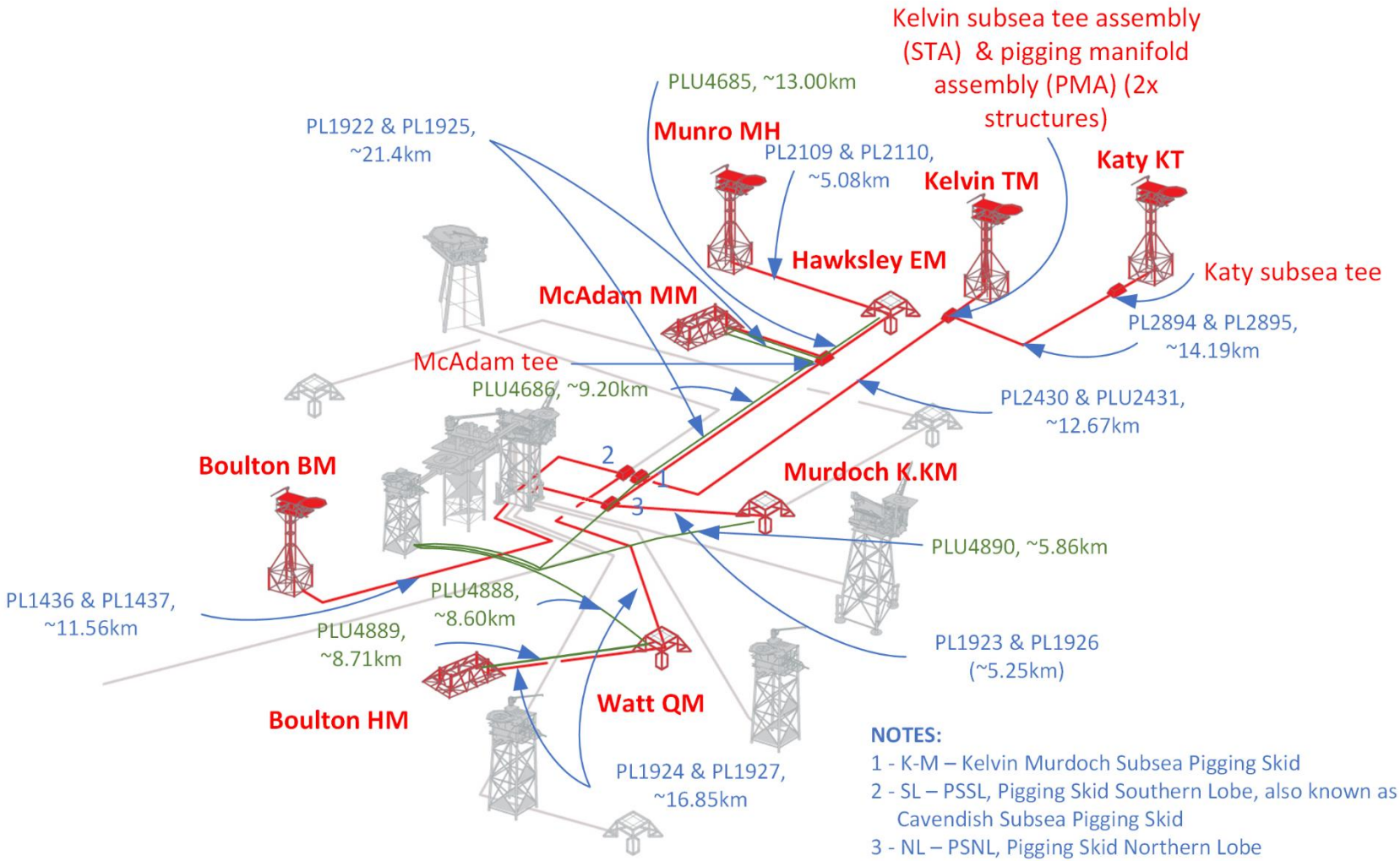
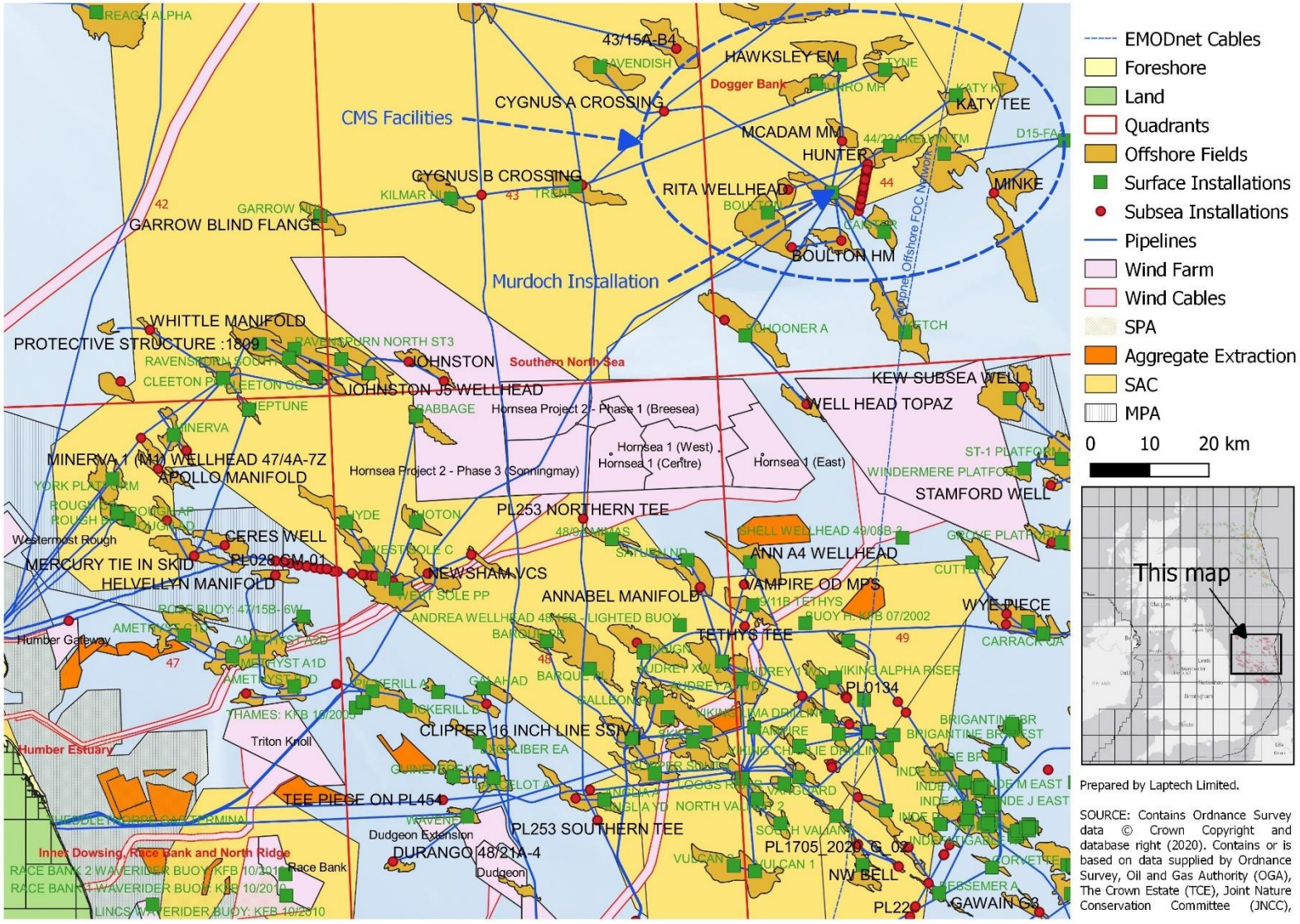


Figure 1.6.2: CMS area layout

Table 1.6.1: List of adjacent facilities								
Owner	**Name**	**Type**	**Boulton BM**	**Katy KT**	**Kelvin TM**	**Munro MH**	**Information**	**Status**
Chrysaor	Murdoch MA	Accommodation Platform	NEE, 11.4km	SW, 26.5km	SW, 12.5km	SSE, 18.4km	Refer DP for CDP3 [3]	Out of use
Chrysaor	Murdoch MC	Compression Platform	NEE, 11.4km	SW, 26.4km	SW, 12.4km	SSE, 18.4km	Refer DP for CDP3 [3]	Out of use
Chrysaor	Murdoch MD	Drilling Platform	NEE, 11.5km	SW, 26.3km	SW, 12.3km	SSE, 18.3km	Refer DP for CDP3 [3]	Out of use
Chrysaor	Murdoch K.KM	WHPS (1-Slot)	E, 15.3km	SSW, 25.5km	SSW, 12.1km	SSE, 22.6km	Addressed in this DP	Out of use
Chrysaor	Boulton BM	Wellhead Platform	n/a	SW, 37.4km	SW, 23.4km	SSW, 23.2km	Addressed in this DP	Out of use
Chrysaor	McAdam MM	WHPS (2-Slot)	NE, 17.4km	WSW, 20.7km	W, 8.1km	SSE, 10.6km	Addressed in this DP	Out of use
Chrysaor	Munro MH	Wellhead Platform	NNE, 23.2km	W, 23.6km	NWW, 16.2km	n/a	Addressed in this DP	Out of use
Chrysaor	Hawksley EM	WHPS (1-Slot)	NNE, 27.6km	W, 20.2km	NW, 15.9km	NE, 5km	Addressed in this DP	Out of use
Chrysaor	Kelvin TM	Wellhead Platform	NE, 23.4km	SW, 14km	n/a	ESE, 16.2km	Addressed in this DP	Out of use
Chrysaor	Katy KT	Wellhead Platform	NE, 37.4km	n/a	NE, 14km	E, 23.6km	Addressed in this DP	Out of use
Chrysaor	Watt QM	WHPS (1-Slot)	ESE, 13.2km	SSW, 31.2km	SSW, 17.9km	SSE, 26.8km	Addressed in this DP	Out of use
Chrysaor	Boulton HM	WHPS (1-Slot)	SE, 7.1km	SW, 37.7km	SW, 23.8km	S, 27.9km	Addressed in this DP	Out of use
Ineos	Cavendish RM	Fixed Platform (NUI)	NWW, 37.4km	W, 60.1km	W, 50.5km	W, 36.5km	DP approved June 2020	Out of use
Chrysaor	PSSL	Pigging skid & protection structure	NEE, 11.6km	SW, 26.3km	SW, 12.2km	SSE, 18.3km	Addressed in this DP	Out of use
Chrysaor	PSNL	Pigging skid & protection structure	NEE, 11.6km	SW, 26.3km	SW, 12.2km	SSE, 18.3km	Addressed in this DP	Out of use
Chrysaor	Kelvin-Murdoch SPS	Pigging skid & protection structure	NEE, 11.6km	SW, 26.2km	SW, 12.2km	SSE, 18.2km	Addressed in this DP	Out of use
Premier	Hunter HK	WHPS	NEE, 19km	SW, 18.6km	SW, 4.5km	SE, 16.2km	DP approved April 2021	Out of use
DNO	Ketch KA	Piled steel jacket	ESE, 30.7km	S, 40.8km	SSE, 31.5km	SSE, 44.4km	DP approved Aug 2019	Out of use
DNO	Schooner SA	Piled steel jacket	S, 21km	SW, 53.8km	SSW, 40.1km	S, 44.1km	DP approved Aug 2019	Out of use
Chrysaor	Kelvin STA	Pipeline Tee Piece	NE, 23.4km	SW, 14km	SE, 0.1km	ESE, 16.3km	Addressed in this DP	Out of use
Chrysaor	Kelvin PMA	Pigging Manifold Assembly	NE, 23.5km	SW, 14km	ESE, 0.1km	ESE, 16.3km	Addressed in this DP	Out of use
Wintershall	Wingate	Satellite Platform	NEE, 31.3km	S, 10.1km	E, 9.2km	ESE, 24.5km		Operational
Chrysaor	Katy Tee	Pipeline Tee Piece	NE, 37.3km	S, 0km	NE, 14km	E, 23.6km	Addressed in this DP	Out of use
Perenco	Tyne	Wellhead Platform	NNE, 31.2km	NWW, 12.7km	N, 12.9km	NEE, 11.8km	DP approved Jan 2019	Out of use
Neptune	Minke	Wellhead Platform	NEE, 38.2km	SSE, 17.7km	ESE, 19.2km	ESE, 35.1km	DP approved Sept 2019	Out of use

Table 1.6.1: List of adjacent facilities								
Owner	**Name**	**Type**	**Boulton BM**	**Katy KT**	**Kelvin TM**	**Munro MH**	**Information**	**Status**
Tampnet	Tampnet fibre-optic cables	Cable crossings	Refer schematics in Appendix 1.1Appendix 2.1Appendix 2.2and Figure A2.1.1 in Appendix 2 for general routing of the Tampnet cables, and the crossing over PL929 & PL930 at KP19.097.				Refer Refer Table 2.3.3, Table 2.3.4Table 2.3.5, Table 2.3.8, Table 2.3.9, Table 2.3.11for Tampnet cable crossing	Operational
Impacts of decommissioning proposals								
The Cavendish, Ketch and Schooner pipeline crossings will be affected by the decommissioning proposals included herein and will need to be dealt with in a coordinated effort. Although some of the pipelines cross over Tampnet communication cables, the proposal is to leave these crossings undisturbed, *in situ*.								



Prepared by Laptech Limited.

SOURCE: Contains Ordnance Survey data © Crown Copyright and database right (2020). Contains or is based on data supplied by Ordnance Survey, Oil and Gas Authority (OGA), The Crown Estate (TCE), Joint Nature Conservation Committee (JNCC),

Figure 1.6.3: Location, adjacent facilities, and environmentally sensitive areas

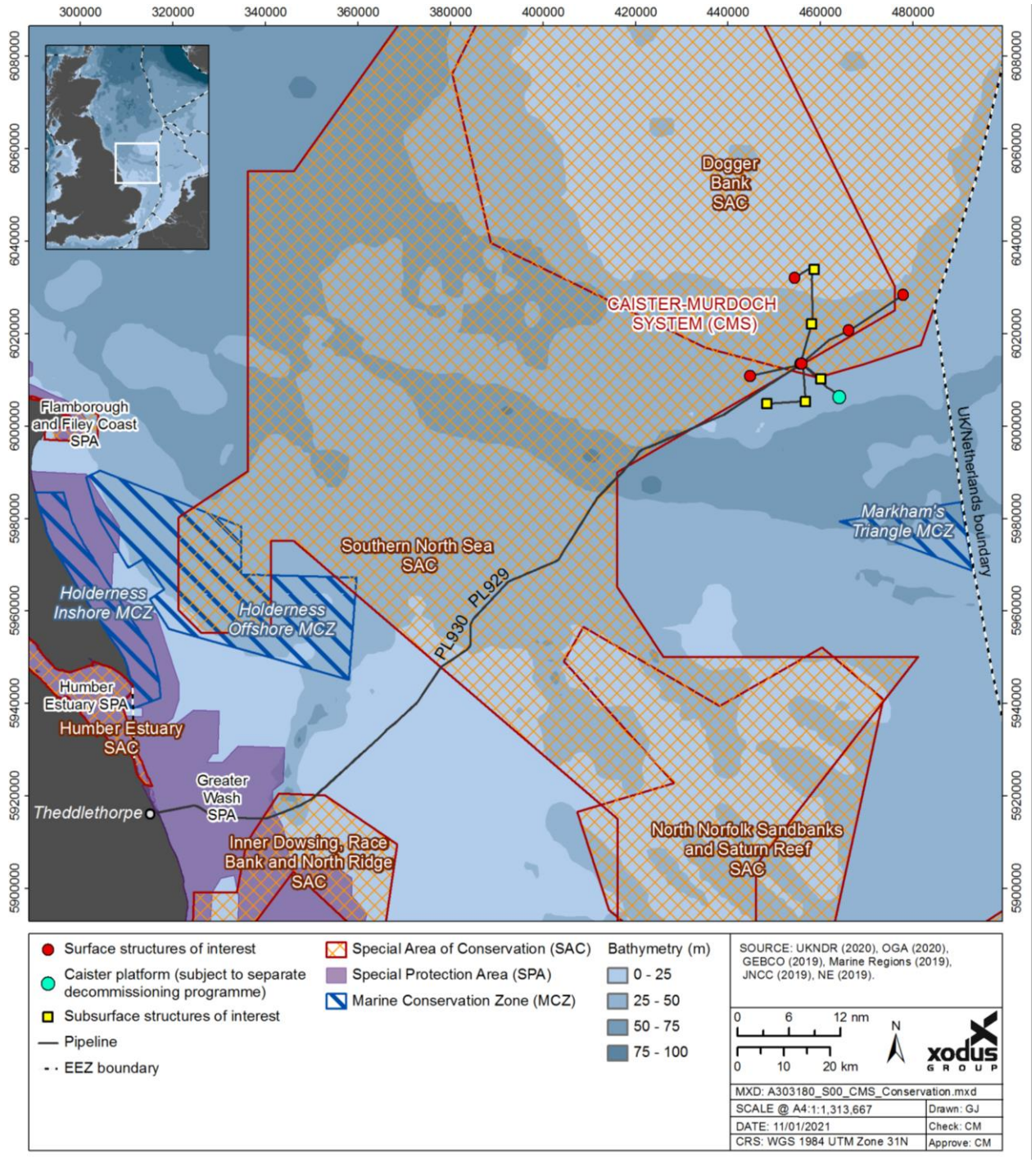


Figure 1.6.4: Location and environmentally sensitive areas

1.7 Industrial implications

It is Chrysaor's intention to develop a contract strategy and Supply Chain Action Plan that will result in an efficient and cost-effective execution of the decommissioning works. Principles of the contracting and procurement strategies to be used by Chrysaor as operator and on behalf of the other Section 29 notice holders, for the decommissioning of the CDP2 related installations and associated pipelines are listed below:

1) Chrysaor participates in the PILOT Share Fair events providing one-to-one sessions with the UK supply chain on the SNS decommissioning programmes and timeline.
2) The First Point Assessment (FPAL) database is the primary source for establishing tender lists for contracts or purchases valued at US$ 100,000 and above, although it is also used under this limit.
3) Chrysaor is committed to competitively bidding all its major contracts where possible and practicable. We are supporters of the UK Supply Chain Code of Practice and our performance in this regard has been acknowledged through Excellence Awards from Oil & Gas UK.
4) Chrysaor are active participants in various industry initiatives including:
    a. Oil & Gas UK Supply Chain Forum;
    b. Inventory sharing initiative (Ampelius);
    c. OGA Decommissioning & Supply Chain Task Forces.

2 Description of Items to be Decommissioned

2.1 Installations: Surface facilities (Topsides and Jackets)

Table 2.1.1: Installations: surface facilities							
Name	Facility type	Location	Topsides / Facilities		Jacket		
		WGS84 Decimal WGS84 Decimal minute	Mass (Te)	No of modules	Mass (Te)[2]	No of legs, piles	Mass of piles (Te)
Boulton BM	Wellhead platform	54.243061° N 2.152678° E 54°14.5837' N 02°9.1607' E	351.0	1	605.1	4, 4	202.7
Katy KT	Wellhead platform	54.403075° N 2.659367° E 54°24.1845' N 02°39.5620' E	353.5	1	580.6	3, 3	251.7
Kelvin TM	Wellhead platform	54.332917° N 2.479342° E 54°19.9750' N 02°28.7605' E	288.6	1	483.6	3, 3	213.1
Munro MH	Wellhead platform	54.433867° N 2.298772° E 54°26.0320' N 02°17.9263' E	210.9	1	384.9	3, 3	165.3

[2] Jacket weight excluding piles.

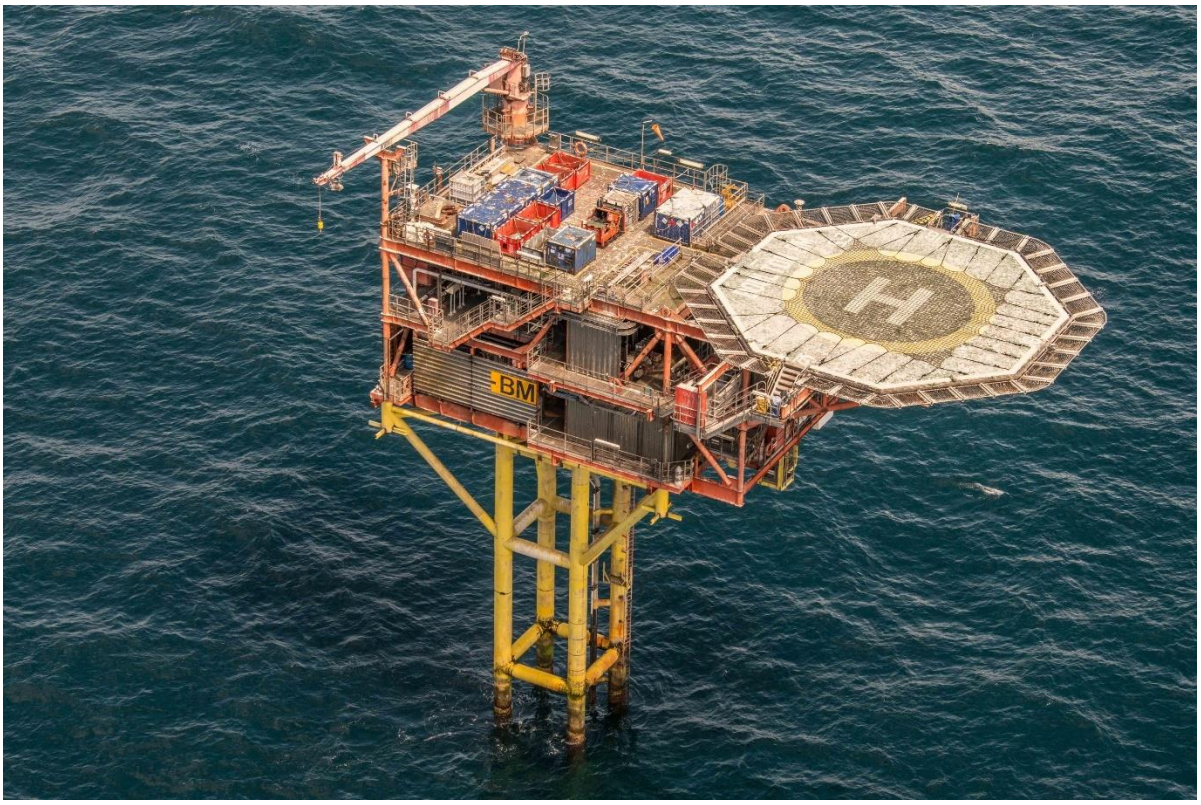


Figure 2.1.1: Photograph of the Boulton BM installation

Figure 2.1.2: Photograph of the Katy KT installation

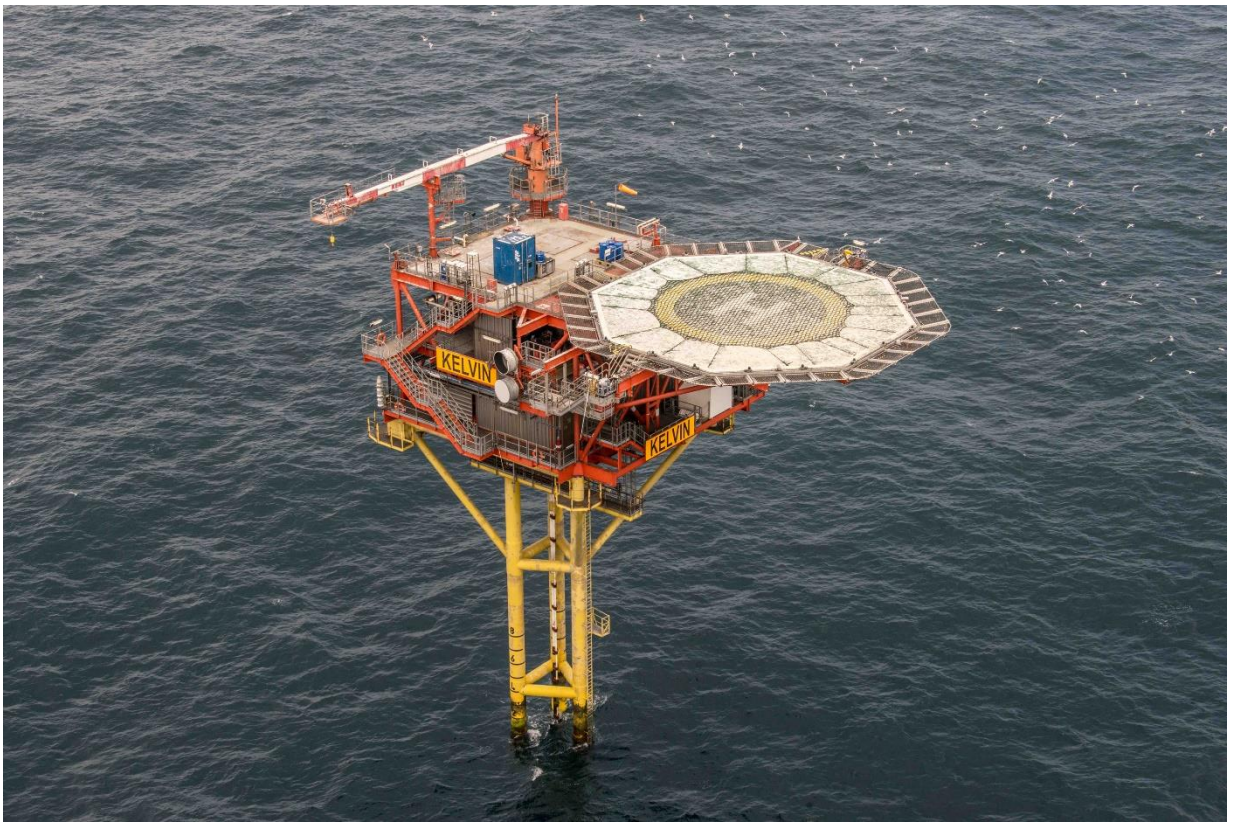


Figure 2.1.3: Photograph of the Kelvin TM installation

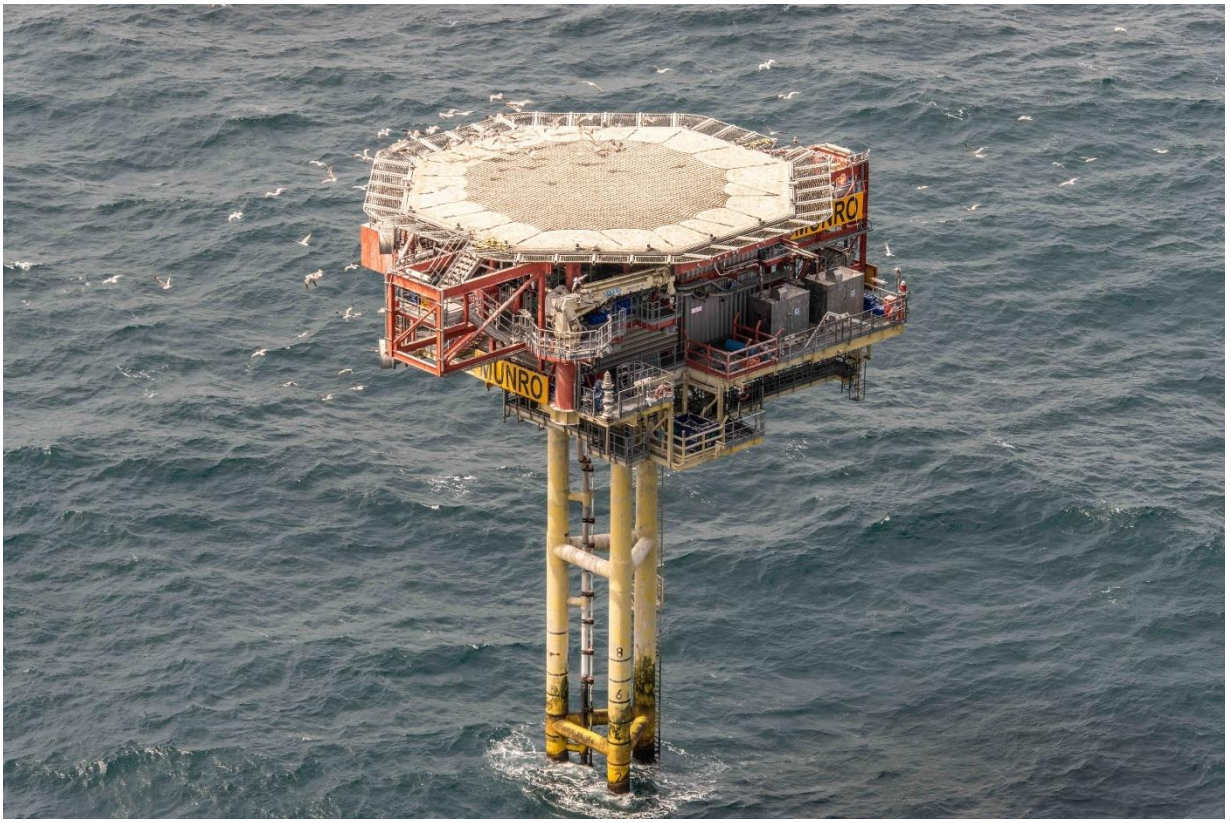


Figure 2.1.4: Photograph of the Munro MH installation

2.2 Installations: Subsea including stabilisation features

Table 2.2.1: Installations: Subsea & stabilisation features				
Subsea installations **Stabilisation features**	**Number**	**Size (m)** **Mass (Te)**	**Location** **WGS84 Decimal** **WGS84 Decimal minute**	**Comments / status**
Boulton HM	1	16.0 x 10.2 x 5.0 118.4Te	54.188556° N 2.209373° E 54°11.3134' N 02°12.5624' E	Piled, 4x 762mm diameter piles
Anchored fronded mattresses	11	5m x 2.5m 0.8Te	As per Boulton HM WHPS	Anchored fronded mattresses
Hawksley EM	1	7.9 x 6.2 x 5.0 70.0Te	54.459081° N 2.362254° E 54°27.5449' N 02°21.7352' E	Not piled. Held in place by self-weight
Concrete fronded Mattresses	4	6.6 x 3 x 0.3m 10.0Te	As per Hawksley EM WHPS	Wet stored
Deposited rock	1	~19m diameter ~949.0	As per Hawksley EM WHPS	
McAdam MM	1	16.0 x 10.2 x 5.0 118.4	54.344658° N 2.356208° E 54°20.6795' N 02°21.3725' E	Piled, 4x 762mm diameter piles
Anchored fronded mattresses	11	5m x 2.5m 0.08Te	As per McAdam MM WHPS	Anchored fronded mattresses
Murdoch K.KM	1	10.2 x 10.2 x 5.0 93.4	54.237468° N 2.388368° E 54°14.2481' N 02°23.3021' E	Piled, 4x 762mm diameter piles
Anchored fronded mattresses	8	5m x 2.5m 0.06Te	As per Murdoch K.KM WHPS	Anchored fronded mattresses
Watt QM	1	10.2 x 10.2 x 5.0 93.4	54.194150° N 2.338275° E 54°11.6490' N 02°20.2965' E	Piled, 4x 762mm diameter piles
Anchored fronded mattresses	6	5m x 2.5m 0.04Te	As per Watt QM WHPS	Anchored fronded mattresses
NOTES: 1. This is no record of stabilisation features such as grout bags other than those listed in this table.				

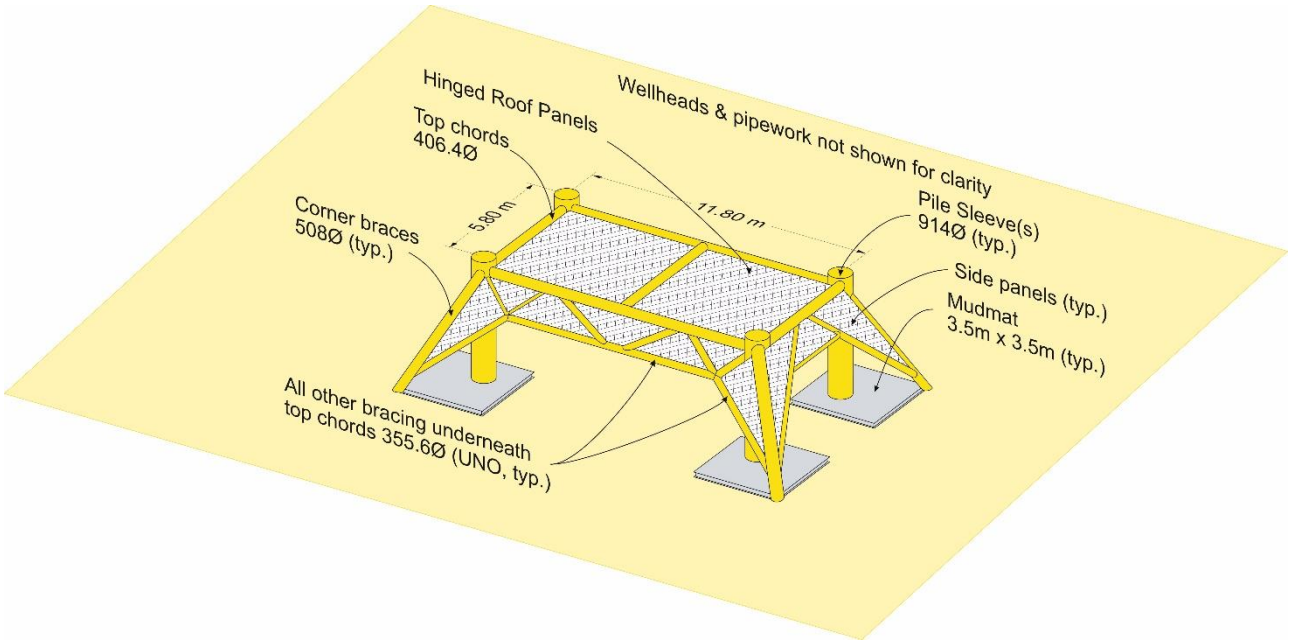


Figure 2.2.1: Perspective of Boulton HM & McAdam MM subsea installations

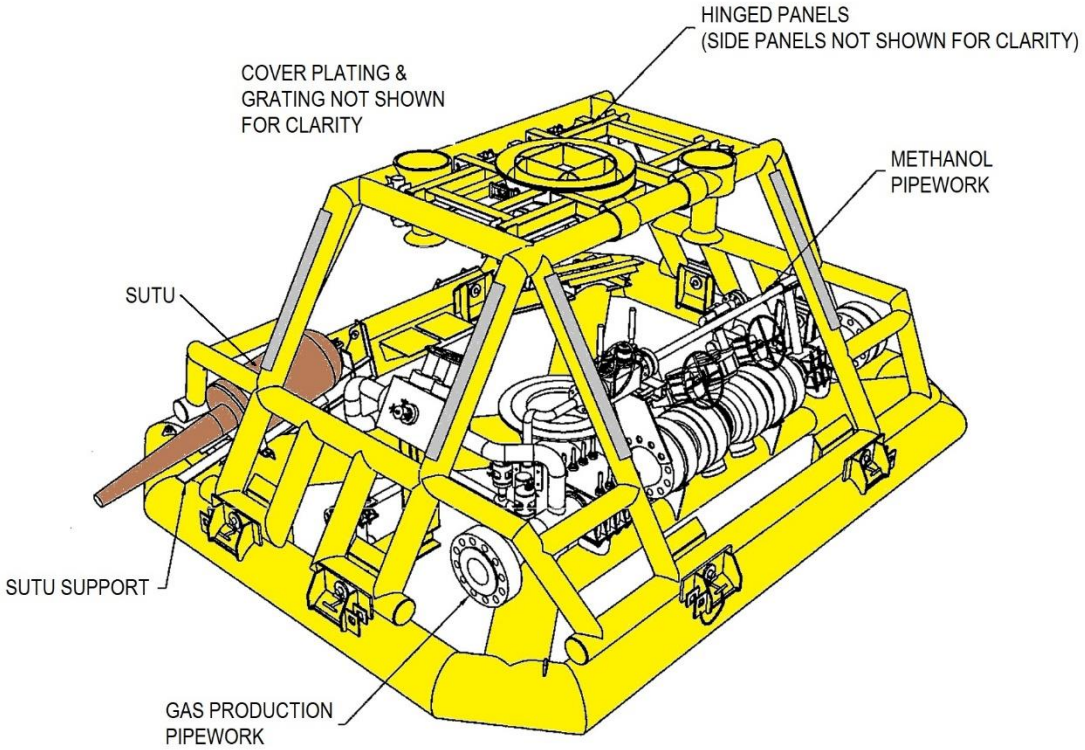


Figure 2.2.2: Perspective of Hawksley EM subsea installation

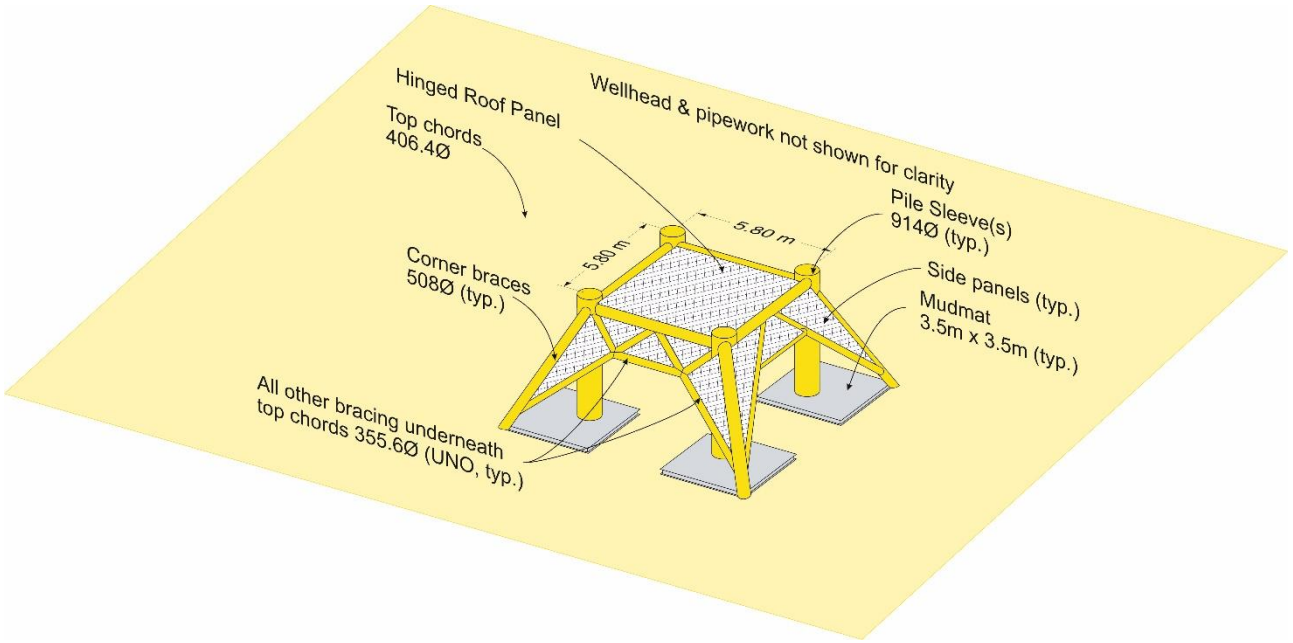


Figure 2.2.3: Perspective of Murdoch K.KM & Watt QM subsea installations

2.3 Pipelines including stabilisation features

2.3.1 Pipeline and umbilical information

Table 2.3.1: Pipeline / flowline / umbilical information

Description	Pipeline No (as per PWA)	Diameter	Length (km)	Description of component parts	Product conveyed	From – to end points	Burial status[1]	Pipeline status	Current content
Gas pipeline	PL1436	10in	11.56	3LPP coated steel pipeline	Natural gas, condensate, water	ESD Valve (Boulton BM) to Riser Tie-in Flange (Murdoch MD Platform)	Trenched and buried, no exposures except for ends overlain with mattresses. PL1436 piggybacked by PL1437	Out of use	Seawater
MeOH pipeline	PL1437	3in	11.56	3LPP coated steel pipeline	Methanol and corrosion inhibitor	Subsea Tie-in Flange (Murdoch MD Platform) to ESD Valve (Boulton BM)		Out of use	Seawater
Gas pipeline[2]	PL1922	10/12in	21.62	PP coated steel pipeline	Natural gas, condensate, water	Hawksley Subsea Well Head to ESDV Valve (Murdoch MD)	Trenched and buried, no exposures except for ends overlain with mattresses. Deposited rock used to mitigate UHB. PL1922 piggybacked by PL1925 between McAdam MM and Murdoch MD	Out of use	Seawater
MeOH pipeline	PL1925	3in	21.53	PP coated steel pipeline	Methanol and corrosion inhibitor	ESDV Valve (Murdoch MD) to Hawksley Subsea Well Head		Out of use	Seawater
Gas pipeline	PL1923	10in	5.25	PP coated steel pipeline	Natural gas, condensate, water	Murdoch K.KM Subsea Manifold to PSNL	Trenched and buried, no exposures except for ends overlain with mattresses. PL1923 piggybacked by PL1926	Out of use	Seawater
MeOH pipeline	PL1926	3in	5.25	PP coated steel pipeline	Methanol and corrosion inhibitor	PSNL to Murdoch K.KM Subsea Well Head		Out of use	Seawater

Table 2.3.1: Pipeline / flowline / umbilical information									
Description	**Pipeline No (as per PWA)**	**Diameter**	**Length (km)**	**Description of component parts**	**Product conveyed**	**From – to end points**	**Burial status[1]**	**Pipeline status**	**Current content**
Gas pipeline	PL1924	10in	16.76	PP coated steel pipeline	Natural gas, condensate, water	Boulton HM Subsea Well Head to ESDV at Murdoch MD	Trenched and buried, except for ends overlain with mattresses. Deposited rock used to mitigate UHB.	Out of use	Seawater
MeOH pipeline	PL1927	3in	16.85	PP coated steel pipeline	Methanol and corrosion inhibitor	ESDV at Murdoch MD to Boulton HM Subsea Well Head		Out of use	Seawater
Gas pipeline	PL2109	10in	5.08	FBE coated steel pipeline coated with CWC for most of its length	Natural gas, condensate, water	Cut Point A at Munro MH to Hawksley EM	Trenched and buried, except for ends overlain with mattresses. Multiple exposures for first 1.5km of pipelines. PL2109 piggybacked by PL2110	Out of use	Seawater
MeOH pipeline	PL2110	3in	5.08	3LPP coated steel pipeline	Methanol and corrosion inhibitor	Hawksley EM to Cut Point A, at Munro MH		Out of use	Seawater
Gas pipeline	PL2430	12in	12.67	3LPP coated steel pipeline	Natural gas, condensate, water	ESDV at Kelvin TM to PSSL	Trenched and buried, no exposures except for ends overlain with mattresses	Out of use	Seawater
MeOH pipeline	PLU2431	3in	12.67	3LPP coated steel pipeline	Methanol and corrosion inhibitor	PSSL to ESDV at Kelvin TM	As per PL2430, piggybacked	Out of use	Seawater
Gas pipeline	PL2894	10in	14.19	3LPP coated steel pipeline	Natural gas, condensate, water	ESDV at Katy KT to Kelvin TM Subsea Tee	Trenched and buried, no exposures except for ends overlain with mattresses. PL2894 piggybacked by PL2895	Out of use	Seawater
MeOH pipeline	PL2895	2in	14.19	3LPP coated steel pipeline	Methanol and corrosion inhibitor	Kelvin TM Subsea Tee to ESDV at Katy KT		Out of use	Seawater
Umbilical	PLU4685	108.5mm	13.00	Electrohydraulic umbilical	Chemicals, hydraulic oil	McAdam MM WHPS SUTU to Hawksley EM WHPS SUTU	Trenched and buried, a few short exposures (total ~59m incl. ~7m exposure on final approach to Hawksley)	Out of use	Seawater, hydraulic oil

Table 2.3.1: Pipeline / flowline / umbilical information									
Description	**Pipeline No (as per PWA)**	**Diameter**	**Length (km)**	**Description of component parts**	**Product conveyed**	**From – to end points**	**Burial status[1]**	**Pipeline status**	**Current content**
							except for the ends overlain with mattresses		
Umbilical	PLU4686	108.5mm	9.20	Electrohydraulic umbilical	Chemicals, hydraulic oil	Murdoch MA TUTU to McAdam MM WHPS SUTU	Trenched and buried, no exposures except for ends overlain with mattresses	Out of use	Seawater, hydraulic oil
Umbilical	PLU4888	82mm	8.60	Electrohydraulic umbilical	Hydraulic oil	Watt QM SUTU to Boulton HM SUTU		Out of use	Hydraulic oil
Umbilical	PLU4889	96mm	8.71	Electrohydraulic umbilical	Hydraulic oil	Murdoch MA TUTU to Watt QM SUTU		Out of use	Hydraulic oil
Umbilical	PLU4890	82mm	5.86	Electrohydraulic umbilical	Hydraulic oil	Murdoch MA TUTU Murdoch KM SUTU		Out of use	Hydraulic oil

NOTES:

1. For further information refer the Comparative Assessment [5]. For pipeline crossings refer 2.3.2;
2. PL1922 the pipeline between Hawksley and McAdam is 12in nominal bore and between McAdam and Murdoch it is 10in nominal bore;
3. Deposited rock was used for all the pipeline transitions and PLU4686 into and out of the trench except for the Munro MH pipelines, PL2109 & PL2110 and the other umbilicals;
4. Length of rock may not be continuous. For example, upheaval buckling, and incidences of shallow cover were mitigated by spot placement rather than continuous placement of deposited rock for PL1922 & PL1925, PL1924 & PL1927, and PLU4888;
5. The data included in this table are based on the following PWA documents and may be subject to change: 354-V-18, 55-V-20, 56-V-19, 251-V-19, 135-V-19, 241-V-19, 243-V-19, 246-V-19, 135-V-19, and 461-V-19.

2.3.2 Pipeline crossings

Summary schematics of the pipeline crossing locations outside and inside the Murdoch 500m zone are presented in Figure A2.1.1 and Figure A2.2.1 respectively. The following pipeline crossing tables are presented in numerical order, based on the pipeline ID of the gas pipeline or umbilical. In an attempt to simply the presentation of data, duplication is avoided, and cross references are made to the more comprehensive tables in section 2.3.4.

Table 2.3.2: Pipeline crossing information (PL1436 & PL1437)

Pipeline, umbilical or cable description	Location	Protection
INSIDE MURDOCH 500M ZONE:		
PLU4686 Murdoch MA to McAdam MM umbilical.	KP -0.027	Refer Table 2.3.24, item no. 135 and Figure A1.1.1.
PLU4888 Watt QM to Boulton HM umbilical.	KP -0.027	
PLU4890 Murdoch MA to Murdoch K.KM umbilical.	KP -0.027	
NOTE 1. Origin of KP for PL1436 & PL1437 taken at the base of the riser at Murdoch MD.		

Table 2.3.3: Pipeline crossing information (PL1922 & PL1925)

Pipeline, umbilical or cable description	Location	Protection
OUTSIDE MURDOCH 500M ZONE		
PL1220/PL1221 Tyne to Trent 20in gas pipeline (PL1922).	KP3.649	Refer Table 2.3.14, item nos. 18 & 19 and Figure A2.1.1.
PL1220/PL1221 Tyne to Trent 20in gas pipeline (PL1925).	KP3.649	Shared with PLU4685. Refer Table 2.3.20. items nos. 89 & 90 and Figure A2.1.1.
PL2528 & PLU2529 Rita to Hunter 8in gas pipeline and Hunter to Rita 100mm diameter umbilical.	KP18.7	Deposited rock; details not known. Refer Figure A2.1.1.
INSIDE MURDOCH 500M ZONE		
Tampnet fibre-optic cable underneath PL1922 & PL1925.	KP21.361	Shared with PLU4686. Refer Table 2.3.21, item no. 100 & 102. Also refer Figure A1.1.1.
PL2430 & PLU2431 Kelvin TM pipelines.	KP 21.565	Refer Table 2.3.18, item no. 75. Also refer Figure A1.1.1.
Tampnet fibre-optic cable underneath PL1922 & PL1925.	KP21.578	1x concrete fronded mattress, included in Table 2.3.14, item no. 35. Also refer Figure A1.1.1.
PLU4686 Murdoch MA to McAdam MM umbilical	KP21.613	1x concrete fronded mattress, included in Table 2.3.21, item no. 98. Also refer Figure A1.1.1.
PL2284 Cavendish CM 10in & 2in pipelines.	KP21.687 & KP21.738	No details. Refer Cavendish decommissioning programmes [12] where it is stated that these will be fully removed. Refer Figure A1.1.1.
Tampnet fibre-optic cable underneath PL1922 & PL1925 on final approach to Murdoch MD.	KP21.747	3x concrete fronded mattresses, included in Table 2.3.14, item no. 34. Also refer Figure A1.1.1.
NOTES 1. Origin of KP for PL1922 (& PL1925) taken at the end of the pipeline at Hawksley EM; 2. Data for PL2528 & PLU2529 obtained from OGA National Data Repository (NDR).		

Table 2.3.4: Pipeline crossing information (PL1923 & PL1926)		
Pipeline, umbilical or cable description	**Location**	**Protection**
INSIDE MURDOCH 500M ZONE		
Tampnet fibre-optic cable underneath PL1923 & PL1926.	KP5.236	Shared with PLU4890. Refer Table 2.3.24, item no. 131 and Figure A1.1.1.
PLU4686 Murdoch MA to McAdam MM umbilical.	KP5.465	Refer Table 2.3.21, item no. 98 and Figure A1.1.1.
NOTE 1. Origin of KP for PL1923 (& PL1926) taken at the end of the pipeline at Murdoch K.KM.		

Table 2.3.5: Pipeline crossing information (PL1924 & PL1927)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE MURDOCH 500M ZONE		
PL1222 & PL1223 Schooner 16in gas and 3in MeOH pipeline.	KP1.581	Shared with PLU4888. Refer Table 2.3.22, item nos. 112 & 113 and Figure A2.1.1.
Tampnet fibre-optic cable underneath both PL1924 & PL1927.	KP8.009	Shared with PLU4888. Refer Table 2.3.22, item nos. 114 & 115 and Figure A2.1.1.
PL1612 & PL1613 Ketch 18in gas and 3in MeOH pipelines.	KP15.351	Refer Table 2.3.16, item nos. 60 & 61 and Figure A2.1.1.
INSIDE MURDOCH 500M ZONE		
Tampnet cable under both PL1924 & PL1927.	KP16.548	Shared with PLU4889. Refer Table 2.3.22, item no. 124 and included in item no. 128. Also refer Figure A1.1.1.
PLU4890 Murdoch MA to Murdoch K.KM umbilical.	KP16.815	Refer Table 2.3.24 item no. 135 and included in 136. Also refer Figure A1.1.1.
PL935 & PL936 Caister CM pipelines.	KP16.879	Included in Table 2.3.15, item no. 63. It is possible that concrete mattresses overly the pipelines but are buried in the rock; they have not been noted in surveys.
PLU4686 Murdoch MA to McAdam MM umbilical.	KP16.892	Refer Table 2.3.21, item no. 98 and Figure A1.1.1.
NOTE 1. Origin of KP for PL1924 (& PL1927) taken at the end of the pipeline at Boulton HM.		

Table 2.3.6: Pipeline crossing information (PL2430 & PLU2431)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE MURDOCH 500M ZONE		
PL2528 Rita to Hunter 8in gas pipeline	KP6.467	Deposited rock; details unknown. Refer Figure A2.1.1.
PLU2529 Hunter to Rita 100mm umbilical	KP6.610	Deposited rock; details unknown. Figure A2.1.1.
INSIDE MURDOCH 500M ZONE		
PL1922 & PL1925 Hawksley EM & McAdam MM 12in & 3in pipelines	KP12.457	Refer Table 2.3.18, item no. 75 & 77.
PLU4686 Murdoch MA to McAdam MM umbilical	KP12.468	
NOTE 1. Origin of KP for PL2430 & PLU2431 taken at the end of the pipeline at Kelvin TM.		

Table 2.3.7: Pipeline crossing information (PLU4685)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE OF MURDOCH 500M ZONE		
PL1220/PL1221 Tyne to Trent 20in gas pipeline.	KP3.665	Refer Table 2.3.20 item nos. 89 & 90 and Figure A2.1.1.
NOTE 1. Origin of KP for the umbilical taken at Hawksley EM.		

Table 2.3.8: Pipeline crossing information (PLU4686)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE MURDOCH 500M ZONE		
PL2528 & PLU2529 PL2528 Rita to Hunter 8in gas pipeline Hunter to Rita 100mm umbilical.	KP5.858	Deposited rock. Details not known.
INSIDE MURDOCH 500M ZONE		
Tampnet fibre-optic cable underneath PL4686.	KP8.104	Refer Table 2.3.21 item no. 99 and Figure A1.1.1.
Tampnet fibre-optic cable underneath PL4686.	KP8.260	Refer Table 2.3.21 item no. 100 and Figure A1.1.1.
Tampnet fibre-optic cable underneath PL4686.	KP8.572	Included in item no. 98 in Table 2.3.21 Refer Figure A1.1.1.
PL2430 & PLU2431 Kelvin TM 12in & 3in pipelines.	KP8.854	Included in item no. 98 in Table 2.3.21 Refer Figure A1.1.1.
PL1922 & PL1925 McAdam MM 10in & 3in pipelines.	KP8.884	Included in item no. 98 in Table 2.3.21 Refer Figure A1.1.1.
PL1923 & PL1926 Murdoch K.KM 10in & 3in pipelines.	KP8.893	Included in item no. 98 in Table 2.3.21 Refer Figure A1.1.1.
PL1924 & PL1927 Boulton HM 10in & 3in pipelines.	KP8.938	Included in item no. 98 in Table 2.3.21 Refer Figure A1.1.1.
PL935 & PL936 Caister CM 16in & 3in pipelines.	KP8.941	Refer Table 2.3.21 item no. 103 and Figure A1.1.1.
PL1612 & PL1613 Ketch 18in & 3in pipelines.	KP8.949	Refer Table 2.3.21 item no. 104 and Figure A1.1.1.
PL1222 & PL1223 Schooner 16in & 3in pipelines.	KP9.023	Refer Table 2.3.21 item no. 105 and Figure A1.1.1.
PL929 & PL930 Murdoch MD 26in & 4in trunklines.	KP9.034	Refer Table 2.3.21 item no. 106 and Figure A1.1.1. Shared with PLU4889 & PLU4890.
PL1436 & PL1437 Boulton BM 10in & 3in pipelines.	KP9.112	Refer Table 2.3.21 item no. 107 and Figure A1.1.1. Shared with PLU4889 & PLU4890.
NOTE 1. Origin of KP for the umbilical taken at McAdam MM.		

Table 2.3.9: Pipeline crossing information (PLU4888)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE MURDOCH 500M ZONE		
PL1222 & PL1223 Schooner 16in gas and 3in MeOH pipelines.	KP1.581	Refer Table 2.3.22 item nos. 112 & 113 and Figure A1.1.1.
Tampnet fibre-optic cable underneath PLU4888	KP8.087	Refer Table 2.3.22 item nos. 114 & 115 and Figure A1.1.1.
NOTE 1. Origin of KP for the umbilical taken at Boulton HM.		

Table 2.3.10: Pipeline crossing information (PLU4889)		
Pipeline, umbilical or cable description	**Location**	**Protection**
OUTSIDE MURDOCH 500M ZONE		
PL1612 & PL1613 Ketch 18in & 3in pipelines.	KP6.971	Refer Table 2.3.23 item nos. 123 & 124 and Figure A2.1.1.
INSIDE MURDOCH 500M ZONE		
PL1612 & PL1613 Ketch 18in & 3in pipelines.	KP8.399	Refer Table 2.3.23 item nos. 125 & 128 and Figure A1.1.1.
PL1222 & PL1223 Schooner 16in gas and 3in MeOH pipelines.	KP8.441	Refer Table 2.3.23 item nos. 126 & 128 and Figure A1.1.1.
PL929 & PL930 26in & 4in trunklines.	KP8.492	Refer Table 2.3.21 item no. 106 and Figure A1.1.1. Shared with PLU4686 (& PLU4890).
PL1436 & PL1437 Boulton BM pipelines.	KP8.505	Refer Table 2.3.21 item no. 106 and Figure A1.1.1. Shared with PLU4686 (& PLU4890).
NOTE 1. Origin of KP for PLU4889 taken from the umbilical end at Watt QM.		

Table 2.3.11: Pipeline crossing information (PLU4890)		
Pipeline, umbilical or cable description	**Location**	**Protection**
INSIDE MURDOCH 500M ZONE		
Tampnet fibre-optic cable underneath umbilical.	KP5.366	Refer Table 2.3.24 item no. 131 and Figure A1.1.1
PL935 & PL936 Caister CM 16in & 3in pipelines.	KP5.532	Refer Table 2.3.24 item nos. 132 & 136 and Figure A1.1.1
PL1612 & PL1613 Ketch 18in & 3in pipelines.	KP5.567	Refer Table 2.3.24 item nos. 133 & 136 and Figure A1.1.1
PL1222 & PL1223 Schooner 16in & 3in pipelines.	KP5.613	Refer Table 2.3.24 item no. 134 & 136 and Figure A1.1.1. Shared with PLU4889.
PL1924 & PL1927 Boulton HM 10in & 3in pipelines and PLU4889 Murdoch MA to Watt QM umbilical.	KP5.549	Refer Table 2.3.24 item nos. 135 & 136 and Figure A1.1.1.
PL929 & PL930 Murdoch MD 26in gas & 4in MeOH trunklines.	KP5.657	Refer Table 2.3.21 item no. 106 and Figure A1.1.1. Shared with PLU4686 (& PLU4889).
PL1436 & PL1437 Boulton BM 10in &n 3in pipelines.	KP5.677	Refer Table 2.3.21 item no. 106 and Figure A1.1.1. Shared with PLU4686 (& PLU4889).
NOTE 1. Origin of KP for PLU4890 is taken at Watt QM.		

2.3.3 Subsea structures & stabilisation features

Table 2.3.12: Subsea structures & stabilisation features				
Subsea installations / **Stabilisation features**	**Number**	**Size (m)** / **Mass (Te)**	**Location** / **WGS84 Decimal** / **WGS84 Decimal minute**	**Comments / status**
Katy Tee Protection Structure	1	8.4 x 4.5 x 3.4	54.402689° N 2.659325° E	Piled, 4x 610mm diameter piles.
		39.0	54°24.1613' N 02°39.5595' E	
Concrete mattresses	5	45.5	Around Katy Tee	6m x 3m x 0.3m
Kelvin/Murdoch Subsea Pigging Skid	1	10.5 x 5.1 x 4.0	54.270711° N 2.324925° E	Not piled. On approach to Murdoch.
		97.6	54°16.2427' N 02°19.4955' E	
Mattresses	n/a	n/a	n/a	Refer PL2430 & PLU2431.
Kelvin PMA	1	9.5 x 6 x 3.4	54.332458° N 2.480250° E	Piled, 4x 610mm diameter piles.
		51.4	54°19.9475' N 02°28.8150' E	
Concrete mattresses	8	37.1	Around Kelvin PMA	6m x 3m x 0.3m.
Kelvin STA	1	10.5 x 4.8 x 2.7	54.332489° N 2.479664° E	Not piled. Ballast plates inside four corner legs.
		77.8	54°19.9493' N 02°28.7798' E	
Concrete mattresses	2	9.3	Around Kelvin STA	6m x 3m x 0.3m.
McAdam Tee[2]	1	3.1 x 1.6 x 1.4	54.346389° N 2.358081° E	Clamped to PL1922.
		40.0	54°20.7833' N 02°21.4849' E	
Fronded mattresses	n/a	n/a	n/a	Refer PL1922 & PL1925.
PSNL	1	5.5 x 5.5 x 3.5	54.270234° N 2.324635° E	Not piled. On approach to Murdoch. Refer Figure 2.3.6.
		153.1	54°16.2140' N 02°19.4781' E	
Anchored fronded mattresses	2	0.14		5m x 5m.
PSSL	1	6.3 x 4.3 x 1.8	54.270338° N 2.324458° E	Not piled. On approach to Murdoch.
		55.5	54°16.2203' N 02°19.4675' E	

NOTES:
1. There is no record of stabilisation features such as grout bags other than those listed in this table;
2. This figure was quoted in the original material take off. However, the mass quoted here seems excessive for the actual structure shown and will likely include the mass of pipework within the boundaries of the protection frame;
3. Total number of mattresses: 15 - concrete mattresses, 2 - anchored fronded mattresses.

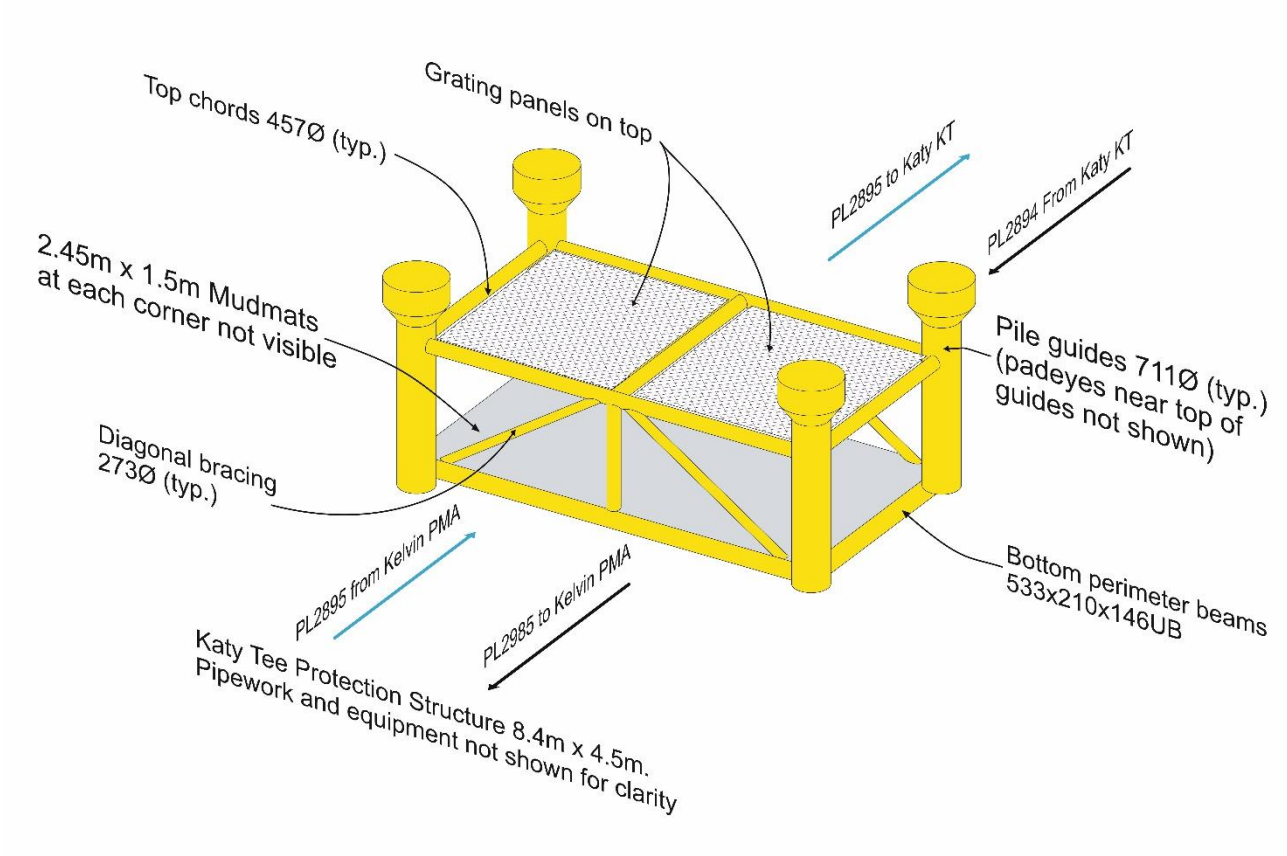


Figure 2.3.1: Perspective of the Katy Tee protection structure

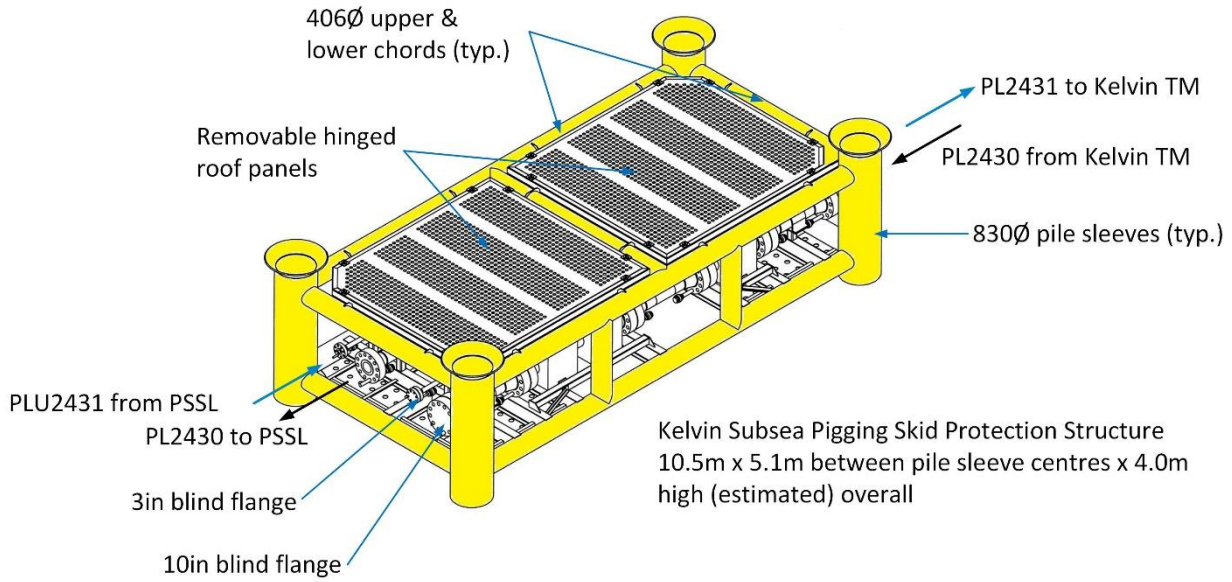


Figure 2.3.2: Perspective of the Kelvin/Murdoch Subsea Pigging Skid protection structure

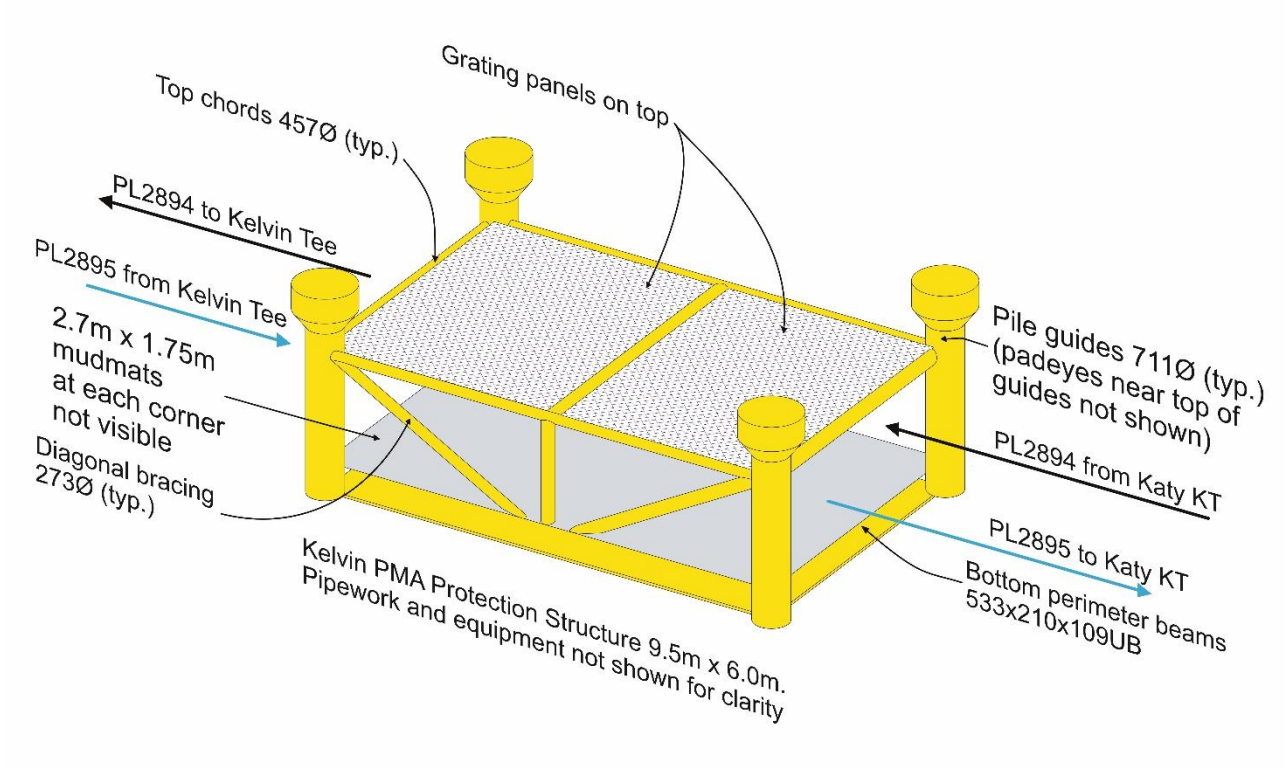


Figure 2.3.3: Perspective of the Kelvin PMA protection structure

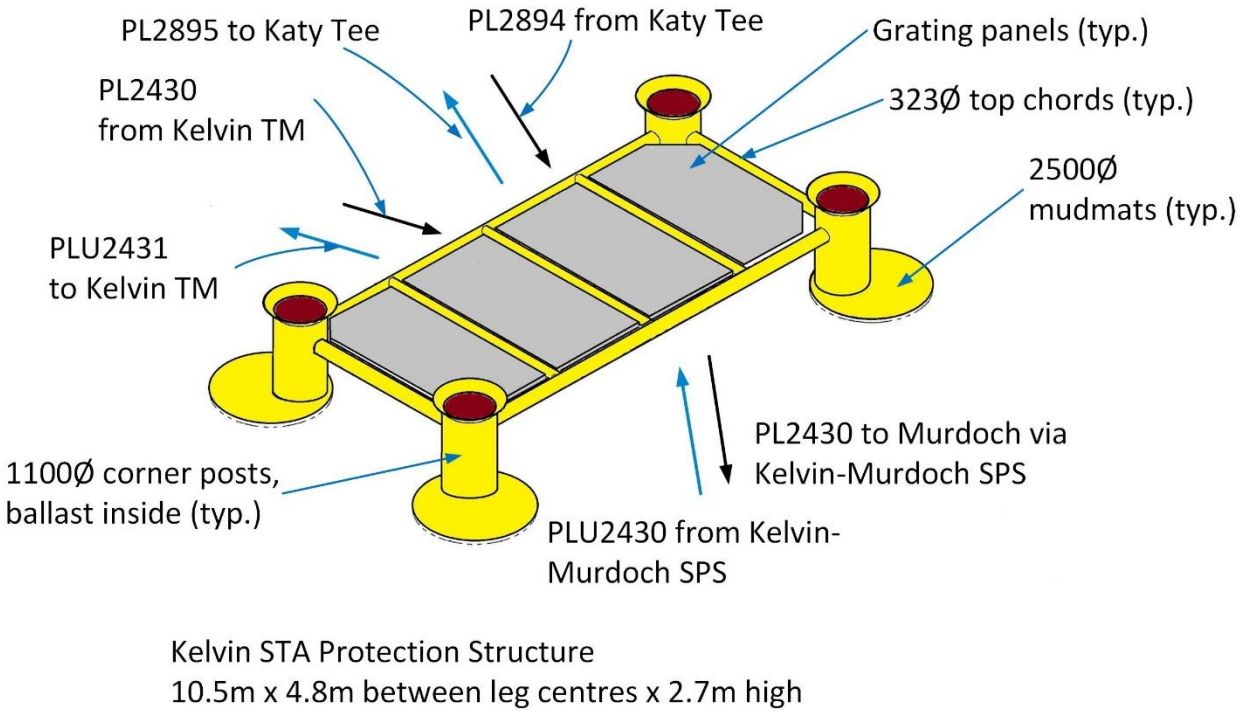


Figure 2.3.4: Perspective of the Kelvin Subsea Tee Assembly protection structure

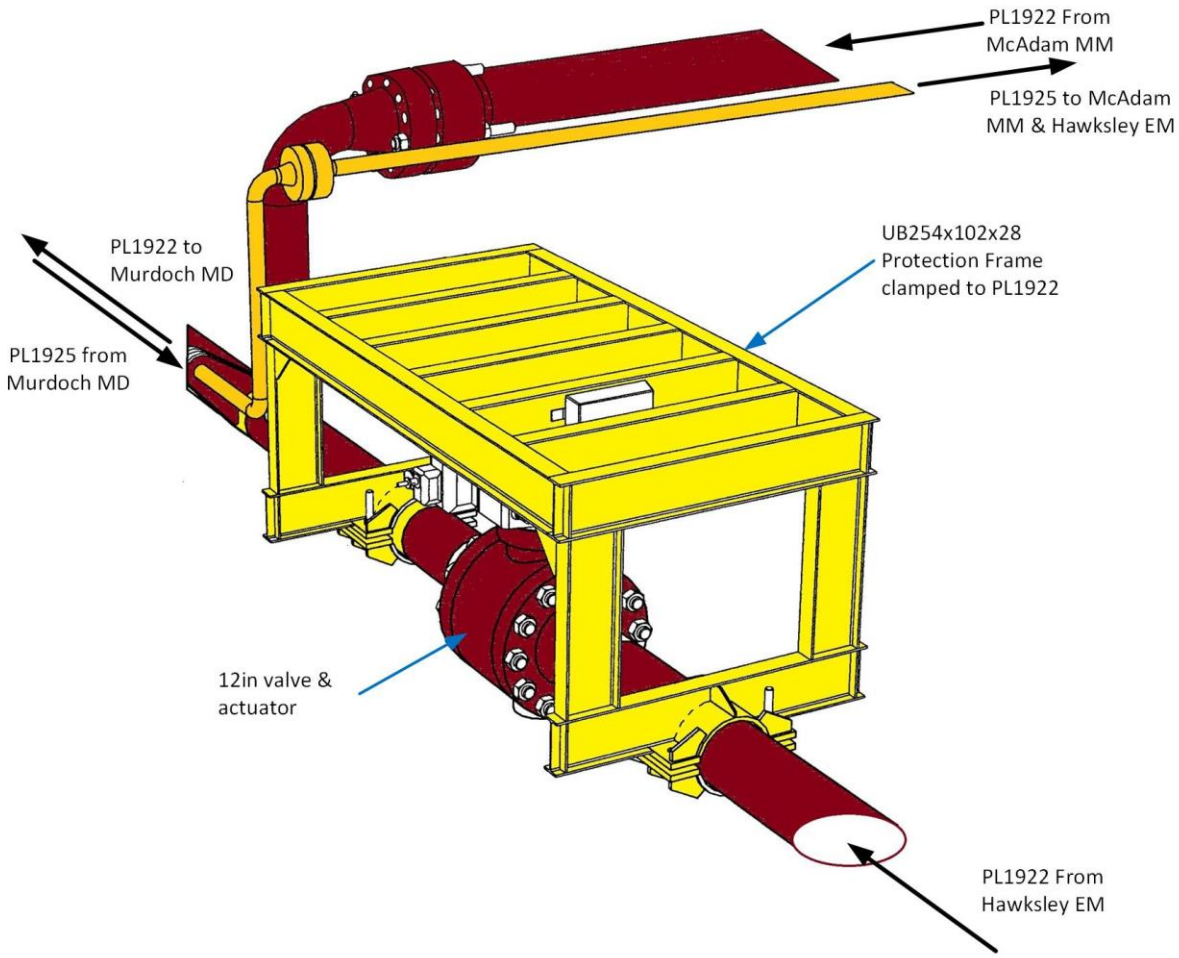


Figure 2.3.5: Perspective of the McAdam Tee protection structure

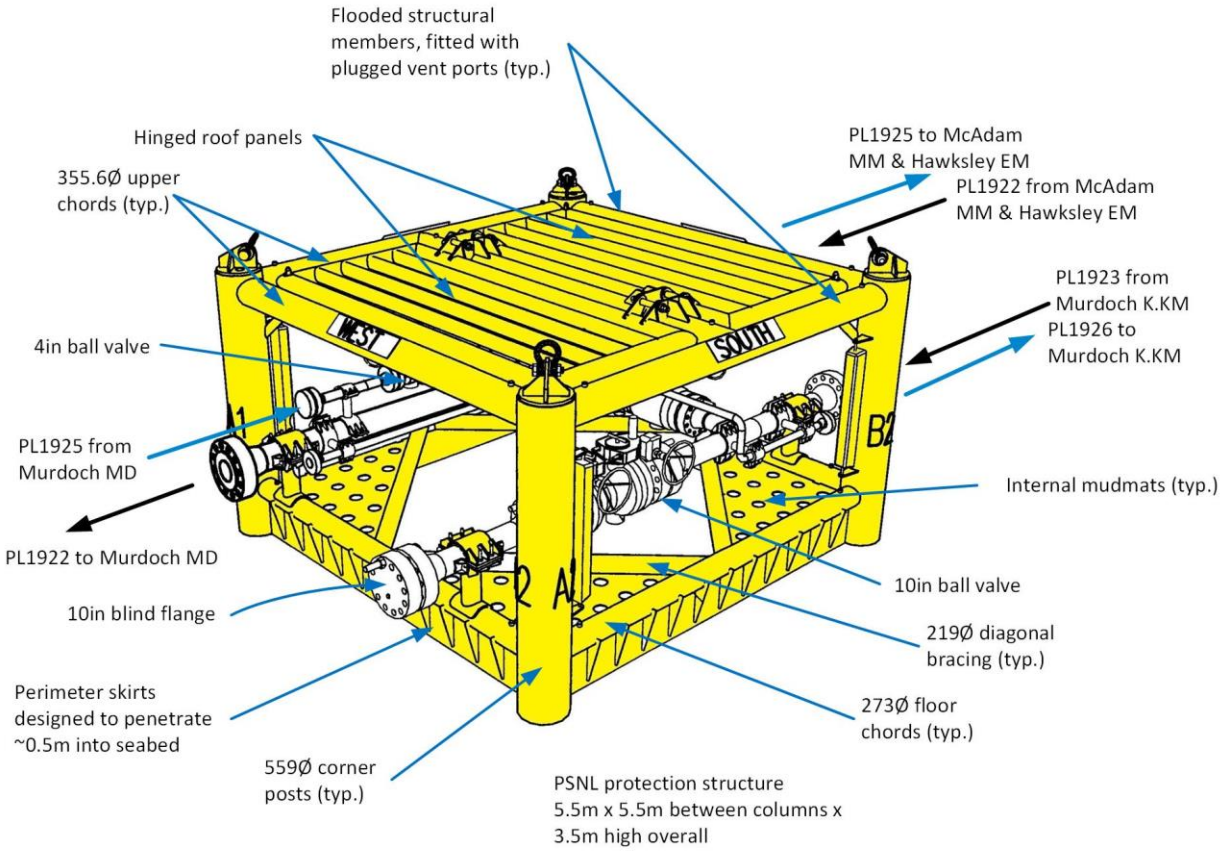


Figure 2.3.6: Perspective of the PSNL protection structure

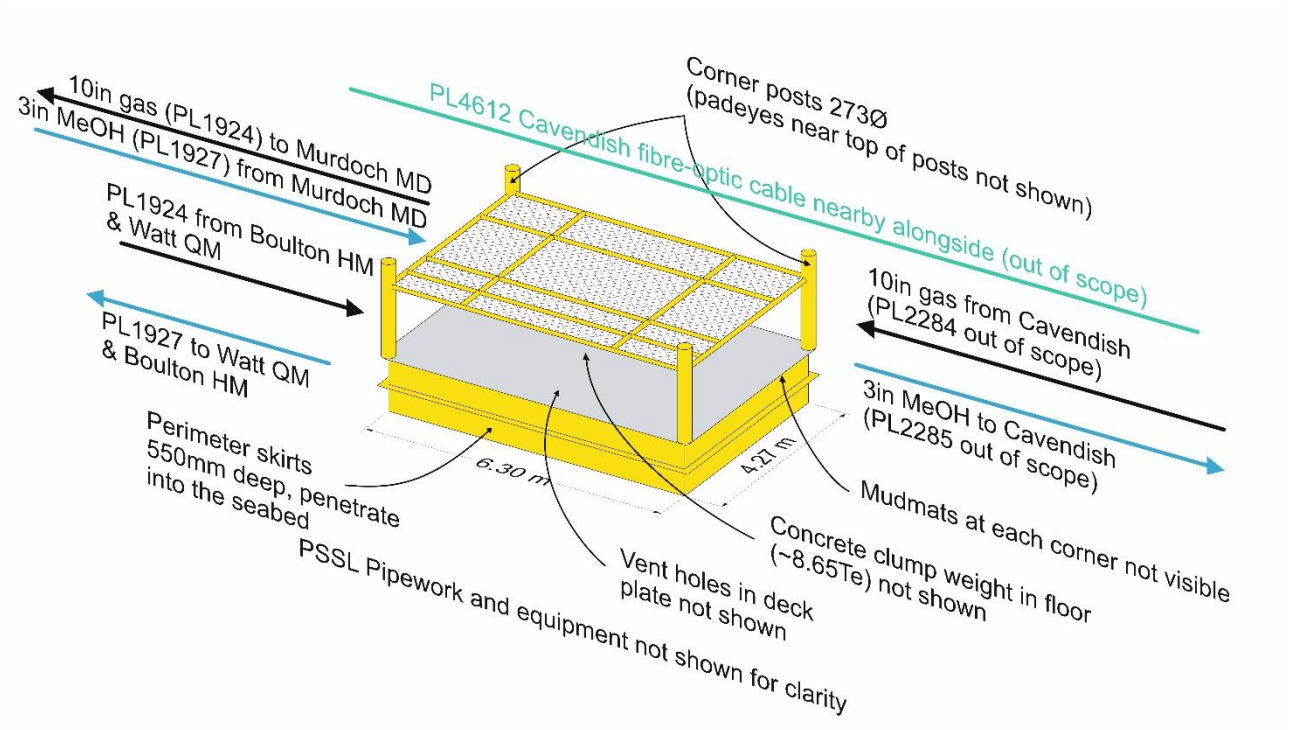


Figure 2.3.7: Perspective of the PSSL protection structure

2.3.4 Pipeline stablisation features

The following summary tables are presented by pipeline in numerical order. Schematics for each 500m safety zone, pipeline crossing locations and deposited rock may be found in Appendix 1, Appendix 2 and Appendix 3 respectively. Please note:

- There is no record of protection and stabilisation features other than those listed in the respective tables;
- Notional quantities quoted for grout bags (25kg) estimated and based on expectation;
- Mass of deposited rock is estimated, based on the estimated volume and profile.

Their burial status will be determined at the time of decommissioning, but as explained in the CMS Comparative Assessment [5] the recommendation is that the mattresses be removed.

Table 2.3.13: Pipeline stabilisation features (PL1436 & PL1437)

No.	Stabilisation feature	Total number	Total mass (Te)	Location(s)	Exposed / buried / condition
INSIDE BOULTON BM 500M ZONE					
1.	Concrete fronded mattresses	22	200.1	Boulton BM approach (PL1436 & PL1437). Refer Figure A1.2.1.	Expected to be mostly buried but to be confirmed.
2.	Grout bags (25kg)	200	5.0	Underneath pipelines near risers at Boulton BM. Refer Figure A1.2.1.	Expected to be exposed but to be confirmed.
3.	Deposited rock	150m	2,385	On approach to Boulton BM. Refer Figure A1.2.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN BOULTON BM & MURDOCH MD					
4.	Deposited rock	174m	2,767	Infield, dispersed between the 500m zones.	Likely exposed with dusting of sediment but to be confirmed.
INSIDE MURDOCH MD 500M ZONE					
5.	Concrete mattresses	12	97.4	Murdoch MD approach 6m x 6m x 0.3m concrete mattresses. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
6.	Grout bags (25kg)	200	5.0	Underneath pipelines near risers at Murdoch MD. Figure A1.1.1.	Expected to be exposed but to be confirmed.
7.	Deposited rock	184m	2,926	On approach to Murdoch MD between KP0.022 and KP0.206	Likely exposed with dusting of sediment.

NOTES:

1. Origin of pipeline KP taken at base of PL1436 riser at Murdoch MD.

Table 2.3.14: Pipeline stabilisation features (PL1922 & PL1925)

No.	Stabilisation feature	Total number	Total mass (Te)	Location(s)	Exposed / buried / condition
INSIDE HAWKSLEY EM 500M ZONE (PL1922)					
8.	Anchored fronded mattresses	7	0.55	Hawksley approach (PL1922). Refer Figure A1.4.1.	Expected to be mostly buried but to be confirmed.
9.	Concrete fronded mattresses	22	220.0	Hawksley approach (PL1922). Refer Figure A1.4.1.	Expected to be mostly buried but to be confirmed.
10.	Concrete mattresses	5	50.0	Hawksley approach (PL1922). Refer Figure A1.4.1.	Expected to be at least partly buried but to be confirmed.
11.	Grout bags (25kg)	150	3.8	Hawksley approach (PL1922). Refer Figure A1.4.1.	Expected to be at least partly buried but to be confirmed.

Table 2.3.14: Pipeline stabilisation features (PL1922 & PL1925)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
12.	Deposited rock	126m	2,003	On approach to Hawksley EM. Refer Figure A1.4.1.	Likely exposed with dusting of sediment.
INSIDE HAWKSLEY EM 500M ZONE (PL1925)					
13.	Anchored fronded mattresses	3	0.55	Hawksley approach (PL1925). Refer Figure A1.4.1.	Expected to be mostly buried but to be confirmed.
14.	Concrete fronded mattresses	24	220.0	Hawksley approach (PL1925). Refer Figure A1.4.1.	Expected to be mostly buried but to be confirmed.
15.	Grout bags (25kg)	200	5.0	Hawksley approach (PL1925). Refer Figure A1.4.1.	Expected to be at least partly buried but to be confirmed.
16.	Deposited rock	112m	1,781	On approach to Hawksley. Refer Figure A1.4.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM 500M ZONE (PL1922)					
17.	Deposited rock	644m	10,240	Used for UHB and depth of cover mitigation on PL1922, dispersed infield between Hawksley EM and McAdam MM.	Likely exposed with dusting of sediment.
18.	Concrete mattresses	5	40.6	PL1922, at Tyne-Trent PL1220 & PL1221 pipeline crossing.	Buried under deposited rock
19.	Deposited rock	349m	5,549	PL1922, at Tyne-Trent PL1220 & PL1221 pipeline crossing.	Likely exposed with dusting of sediment.
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM (PL1925 & PLU4685)					
20.	Deposited rock	Shared with PLU4685. Refer Table 2.3.20.			
21.	Concrete mattresses	Shared with PLU4685. Refer Table 2.3.20.			
INSIDE MCADAM MM 500M ZONE (PL1922)					
22.	Anchored fronded mattresses	3	0.2	On approach to McAdam MM WHPS. Refer Figure A1.5.1.	Expected to be mostly buried but to be confirmed.
23.	Concrete fronded mattresses	12	109.2	On approach to McAdam MM WHPS. Refer Figure A1.5.1.	Expected to be mostly buried but to be confirmed.
24.	Concrete mattresses	4	32.5	On approach to McAdam MM WHPS. Refer Figure A1.5.1.	Expected to be at least partly buried but to be confirmed.
25.	Grout bags (25kg)	100	2.5	On approach to McAdam MM WHPS. Refer Figure A1.5.1.	Expected to be partly buried but to be confirmed.
26.	Deposited rock	60.5m	962	On northern approach to McAdam Tee. Total length 121m. Refer Figure A1.5.1.	Likely exposed with dusting of sediment.
INSIDE MCADAM MM 500M ZONE (PL1925)					
27.	Anchored fronded mattresses	3	0.2	On approach to McAdam MM WHPS. Refer Figure A1.5.1	Expected to be mostly buried but to be confirmed.
28.	Concrete fronded mattresses	19	172.8	On approach to McAdam MM WHPS. Refer Figure A1.5.1	Expected to be mostly buried but to be confirmed.
29.	Concrete mattresses	2	16.2	On approach to McAdam MM WHPS. Refer Figure A1.5.1	Expected to be at least partly buried but to be confirmed.
30.	Grout bags (25kg)	100	2.5	On approach to McAdam MM WHPS. Refer Figure A1.5.1	Expected to be partly buried but to be confirmed.
31.	Deposited rock	Shared with PLU4685. Refer Table 2.3.20, item		On approach to McAdam MM WHPS. Refer Figure A1.5.1	Likely exposed with dusting of sediment.

Table 2.3.14: Pipeline stabilisation features (PL1922 & PL1925)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
		no. 94.			
INSIDE MCADAM MM 500M ZONE (PL1922 & PL1925)					
32.	Deposited rock	60.5m	962	On southern approach to McAdam Tee. Total length 121m. Refer Figure A1.5.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN MCADAM MM & MURDOCH MD (PL1922 & PL1925)					
33.	Deposited rock	364m	5,788	PL1922 & PL1925, used for UHB and depth of cover mitigation, dispersed infield between McAdam MM and Murdoch MD.	Likely exposed with dusting of sediment.
INSIDE MURDOCH MD 500M ZONE (PL1922 & PL1925)					
34.	Anchored fronded mattresses	16	1.2	On approach to Murdoch from north. Refer Figure A1.1.1.	Expected to be mostly buried but to be confirmed.
35.	Concrete fronded mattresses	43	430.0	On approach to Murdoch from north. Refer Figure A1.1.1.	Expected to be mostly buried but to be confirmed.
36.	Concrete mattresses	24	240.0	On approach to Murdoch from north. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
37.	Deposited rock	372m	5,915	On approach to Murdoch from north. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.

Table 2.3.15: Pipeline stabilisation features (PL1923 & PL1926)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MURDOCH K.KM 500M SAFETY ZONE (PL1923 & PL1926)					
38.	Anchored fronded mattresses	3	0.2	On approach to Murdoch K.KM. Refer Figure A1.7.1.	Expected to be mostly buried but to be confirmed.
39.	Concrete fronded mattresses	16	145.5	On approach to Murdoch K.KM. Refer Figure A1.7.1.	Expected to be mostly buried but to be confirmed.
40.	Concrete mattresses	6	48.7	On approach to Murdoch K.KM. Refer Figure A1.7.1.	Expected to be at least partly buried but to be confirmed.
41.	Grout bags (25kg)	300	7.5	On approach to Murdoch K.KM. Refer Figure A1.7.1.	Expected to be partly buried but to be confirmed.
42.	Deposited rock	155m	1,725	On approach to Murdoch K.KM. Refer Figure A1.7.1.	Likely exposed with dusting of sediment.
INSIDE MURDOCH MD 500M ZONE (PL1923 & PL1926)					
43.	Concrete mattresses & deposited rock	PLU4890, Table 2.3.24, item no. 131		On approach to Murdoch MD. Refer Figure A1.1.1.	Refer Table 2.3.24, item no. 131.
44.	Concrete fronded mattresses	12	120.0	On approach to Murdoch MD. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
45.	Deposited rock	494m	5,498	On approach to Murdoch MD. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.

Table 2.3.16: Pipeline stabilisation features (PL1924 & PL1927)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE BOULTON HM 500M SAFETY ZONE (PL1924 & PL1927)					
46.	Anchored fronded mattresses	8	0.2	On approach to Boulton HM. Refer Figure A1.3.1.	Expected to be mostly buried but to be confirmed.
47.	Concrete fronded mattresses	11	145.5	On approach to Boulton HM. Refer Figure A1.3.1.	Expected to be mostly buried but to be confirmed.
48.	Concrete mattresses	6	48.7	On approach to Boulton HM. Refer Figure A1.3.1.	Expected to be at least partly buried but to be confirmed.
49.	Grout bags (25kg)	100	7.5	On approach to Boulton HM and at WHPS. Refer Figure A1.3.1.	Expected to be partly buried but to be confirmed.
50.	Deposited rock	185m	1,725	On approach to Boulton HM. Refer Figure A1.3.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN BOULTON BM & WATT QM (PL1924 & PL1927)					
51.	Deposited rock	546m	7,417	PL1922 & PL1925, used for UHB and depth of cover mitigation, dispersed infield between Boulton HM and Watt QM, excluding pipeline crossings.	Likely exposed with dusting of sediment.
52.	Deposited rock	254m	2,500	On approach to and incl. Schooner pipeline crossing (PL1222 & PL1223). Refer Figure A2.1.1.	Likely exposed with dusting of sediment.
INSIDE WATT QM 500M ZONE (PL1924 & PL1927)					
53.	Anchored fronded mattresses	14	1.0	On approach to Watt QM. Refer Figure A1.10.1.	Expected to be mostly buried but to be confirmed.
54.	Concrete fronded mattresses	38	345.7	On approach to Watt QM. Refer Figure A1.10.1.	Expected to be mostly buried but to be confirmed.
55.	Concrete mattresses	12	97.4	On approach to Watt QM. Refer Figure A1.10.1.	Expected to be at least partly buried but to be confirmed.
56.	Grout bags (25kg)	200	5.0	On approach to Watt QM and at WHPS. Refer Figure A1.10.1.	Expected to be partly buried but to be confirmed.
57.	Deposited rock	580m	8,743	On approach to Watt QM crossing. Refer Figure A1.10.1.	Likely exposed with dusting of sediment.
58.	Deposited rock	138m	1,536	On approach to Watt QM. Refer Figure A1.10.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN WATT QM & MURDOCH MD (PL1924 & PL1927)					
59.	Deposited rock	1,289m	17,107	Used for UHB and depth of cover mitigation, dispersed infield between Watt QM and Murdoch MD. Refer Figure A2.1.1.	Likely exposed with dusting of sediment.
60.	Concrete mattresses	29	235.4	At Ketch PL1612 & PL1613 Pipeline crossing. 6m x 3m x 0.3m. Refer Figure A2.1.1.	Buried under deposited rock.
61.	Deposited rock	506m	8,045	On approach to and at Ketch PL1612 & PL1613 Pipeline crossing. Refer Figure A2.1.1	Likely exposed with dusting of sediment.

Table 2.3.16: Pipeline stabilisation features (PL1924 & PL1927)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
MURDOCH MD 500M ZONE (PL1924 & PL1927)					
62.	Fronded concrete mattresses	35	350.0	On approach to Murdoch MD. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
63.	Deposited rock	29m	461.0	Between KP16.857 and KP16.886 on Caister pipeline PL935 & PL936 crossing. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.
64.	Deposited rock	467m	7,425	On approach to Murdoch MD. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.
NOTES: 1. Origin of KP for PL1924 taken at Boulton HM WHPS.					

Table 2.3.17: Pipeline stabilisation features (PL2109 & PL2110)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MUNRO MH 500M ZONE (PL2109 & PL2110)					
65.	Concrete mattresses	21	170.5	Munro MH approach (PL2109 & PL2110). Refer Figure A1.6.1.	Expected to be at least partly buried but to be confirmed.
66.	Grout bags (25kg)	100	2.5	Underneath pipelines near risers at Munro MH. Refer Figure A1.6.1.	Expected to be exposed but to be confirmed.
INSIDE HAWKSLEY EM 500M ZONE (PL2109 & PL2110)					
67.	Concrete fronded mattresses	29	237.8	Hawksley EM approach. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
68.	Grout bags (25kg)	100	5.0	Underneath pipelines adjacent to WHPS. Refer Figure A1.1.1.	Expected to be exposed but to be confirmed.
69.	Deposited rock	32m	509	Around WHPS. Quantified as additional to deposited rock described in Table 2.2.1.	Likely exposed with dusting of sediment.

Table 2.3.18: Pipeline stabilisation features (PL2430 & PLU2431)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE KELVIN TM 500M ZONE (PL2430 & PLU2431)					
70.	Concrete mattresses	15	58.5	Kelvin TM approach (PL2430 & PL2110). Refer Figure A1.8.1.	Some wet stored adjacent to the Kelvin Tee. Expected to be at least partly buried but to be confirmed.
71.	Grout bags (25kg)	200	5.0	Underneath pipelines near risers at Kelvin TM. Refer Figure A1.8.1.	Expected to be exposed but to be confirmed.
72.	Deposited rock	255m	4,054	On approach and adjacent to Kelvin TM. Refer Figure A1.8.1.	Likely exposed with dusting of sediment.

Table 2.3.18: Pipeline stabilisation features (PL2430 & PLU2431)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INFIELD BETWEEN KELVIN TM & MURDOCH MD (PL2430 & PLU2431)					
73.	Deposited rock	98m	1,558	Used for UHB and depth of cover mitigation, dispersed infield between Kelvin TM and Murdoch MD.	Likely exposed with dusting of sediment.
INSIDE MURDOCH MD 500M ZONE (PL2430 & PLU2431)					
74.	Concrete fronded mattresses	32	173.3	Between end of deposited rock (100m) and PSSL. Refer Figure A1.1.1. Note presence of 'initiation pile' noted on Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
75.	Concrete mattresses	5	40.6	At PL1922 & PL1925 crossing. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
76.	Concrete mattresses	3	30.0	On final approach to Murdoch near Cavendish CM pipeline. Refer Figure A1.1.1.	Expected to be at least partly buried but to be confirmed.
77.	Deposited rock	110m	1,749	On approach to Murdoch MD. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.

Table 2.3.19: Pipeline Stabilisation Features (PL2894 & PL2895)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE KATY KT 500M ZONE (PL2894 & PL2895)					
78.	Concrete mattresses	11	100.1	Kelvin TM approach (PL2894 & PL2895). Refer Figure A1.9.1.	Expected to be at least partly buried but to be confirmed.
79.	Grout bags (25kg)	200	5.0	Underneath pipelines near risers at Katy KT. Refer Figure A1.9.1.	Expected to be exposed but to be confirmed.
80.	Deposited rock	97m	1,542	On approach and adjacent to Katy KT. Refer Figure A1.9.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN KATY KT & KELVIN TM (PL2894 & PL2895)					
81.	Deposited rock	240m	3,816	Used for UHB and depth of cover mitigation, dispersed infield between Katy KT and Kelvin TM.	Likely exposed with dusting of sediment.
INSIDE KELVIN TM 500M ZONE (PL2894 & PL2895)					
82.	Concrete mattresses	13	60.3	On approach to Kelvin PMA and Kelvin STA. Refer Figure A1.8.1.	Expected to be at least partly buried but to be confirmed.
83.	Grout bags (25kg)	400	10.0	At Kelvin PMA and Kelvin STA. Refer Figure A1.8.1.	Expected to be at partly buried but to be confirmed.
84.	Deposited rock	102m	1,622	On approach to Murdoch MD. Refer Figure A1.8.1.	Likely exposed with dusting of sediment.

Table 2.3.20: Pipeline stabilisation features (PLU4685)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE HAWKSLEY EM 500M ZONE (PLU4685)					
85.	Concrete fronded mattresses	3	37.2	Hawksley EM approach (PLU4685). Refer Figure A1.4.1.	Expected to be at least partly buried but to be confirmed.
86.	Grout bags (25kg)	200	5.0	Underneath umbilical on approach to WHPS. Refer Figure A1.4.1.	Expected to be partly buried but to be confirmed.
87.	Deposited rock	468m	5,209	On approach and adjacent to Hawksley EM. Refer Figure A1.4.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM (PLU4685 & PL1925)					
88.	Deposited rock	2,859m	35,035	Used for UHB and depth of cover mitigation, dispersed infield between Hawksley EM and McAdam MM. Refer Figure A3.1.1.	Likely exposed with dusting of sediment but to be confirmed.
89.	Concrete mattresses	1	8.1	Tyne-Trent pipeline (PL1220 & PL1221) crossing. Refer Figure A2.1.1.	Buried under deposited rock.
90.	Deposited rock	168m	1,874	Tyne-Trent pipeline (PL1220 & PL1221) crossing. Refer Figure A2.1.1.	Likely exposed with dusting of sediment.
INSIDE MCADAM MM 500M ZONE (PLU4685)					
91.	Anchored fronded mattresses	1	0.1	On approach to McAdam MM. Refer Figure A1.5.1.	Expected to be mostly buried but to be confirmed.
92.	Concrete fronded mattresses	14	145.6	On approach to Kelvin PMA and Kelvin STA. Refer Figure A1.5.1..	Expected to be at least partly buried but to be confirmed.
93.	Grout bags (25kg)	100	2.5	At Kelvin PMA and Kelvin STA. Refer Figure A1.5.1..	Expected to be at partly buried but to be confirmed.
94.	Deposited rock	48m	529	On approach to McAdam MM. Refer Figure A1.5.1. Shared with PL1925.	Likely exposed with dusting of sediment.

Table 2.3.21: Pipeline stabilisation features (PLU4686)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MCADAM MM 500M ZONE (PLU4686)					
95.	Concrete fronded mattresses	8	83.2	McAdam MM southern approach (PLU4686). Refer Figure A1.5.1.	Expected to be at least partly buried but to be confirmed.
96.	Grout bags (25kg)	100	2.5	Underneath umbilical on approach to WHPS. Refer Figure A1.5.1.Figure A1.4.1	Expected to be partly buried but to be confirmed.
INFIELD BETWEEN MCADAM MM & MURDOCH MA (PLU4686)					
97.	Deposited rock	19m	208	Used for UHB and depth of cover mitigation, dispersed infield between McAdam MM	Likely exposed with dusting of sediment.

Table 2.3.21: Pipeline stabilisation features (PLU4686)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
				and Murdoch MA. Refer Figure A3.1.1.	
INSIDE MURDOCH MA 500M ZONE (PLU4686)					
98.	Concrete fronded mattresses	48	595.2	On northern approach to Murdoch MA. Includes: PL2430 & PLU2431 crossing, Tampnet cable crossing, PL1922 & PL1925 crossing, PL1923 & PL1926 crossing, PL1924 & PL1927 crossing. Refer Figure A1.1.1.	Expected to be mostly buried but to be confirmed.
99.	Concrete mattresses	2	16.2	On Tampnet cable crossing. On northern approach to Murdoch MA, western branch of deposited rock joining PL1922 & PL1925. Refer Figure A1.1.1.	Buried under deposited rock.
100.	Concrete mattresses	3	24.4	On Tampnet cable crossing. On northern approach to Murdoch MA, shared with PL1922 & PL1925. Refer Figure A1.1.1.	Buried under deposited rock.
101.	Deposited rock	72m	801	On northern approach to Murdoch MA joining PL1922 & PL1925. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.
102.	Deposited rock	306m	3,406	On northern approach to Murdoch MA combined with PL1922 & PL1925. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.
103.	Concrete mattresses	2	16.2	Caister pipeline (PL935 & PL936) crossing. Refer Figure A1.1.1.	Overlain by Concrete fronded mattresses.
104.	Concrete mattresses	2	16.2	Ketch pipeline (PL1612 & PL1613) crossing. Refer Figure A1.1.1.	Overlain by Concrete fronded mattresses.
105.	Concrete mattresses	2	16.2	Schooner pipeline (PL1222 & PL1223) crossing. Refer Figure A1.1.1.	Overlain by Concrete fronded mattresses.
106.	Concrete mattresses	2	16.2	TGT pipeline (PL929 & PL930) crossing. Refer Figure A1.1.1.	Overlain by Concrete fronded mattresses.
107.	Concrete mattresses	2	16.2	Boulton BM pipeline (PL1436 & PL1437) crossing. Refer Figure A1.1.1.	Overlain by Concrete fronded mattresses.

Table 2.3.22: Pipeline stabilisation features (PLU4888)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE BOULTON HM 500M ZONE (PLU4888)					
108.	Concrete fronded mattresses	4	41.6	Boulton HM approach (PLU4888). Refer Figure A1.3.1.	Expected to be at least partly buried but to be confirmed.

Table 2.3.22: Pipeline stabilisation features (PLU4888)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
109.	Grout bags (25kg)	150	3.8	Underneath umbilical on approach to WHPS. Refer Figure A1.3.1.	Expected to be partly buried but to be confirmed.
110.	Deposited rock	24m	539	Between KP0.116 and KP0.140 and used for UHB and depth of cover mitigation on approach to Boulton HM. Refer Figure A1.3.1.	Likely exposed with dusting of sediment.
INFIELD BETWEEN BOULTON HM & WATT QM (PLU4888)					
111.	Deposited rock	775m	2,853	Used for UHB and depth of cover mitigation, dispersed infield between Boulton HM and Watt QM. Refer Figure A3.1.1.	Likely exposed with dusting of sediment.
112.	Concrete mattresses	3	24.4	Schooner pipeline (PL1222 & PL1223) crossing shared with PL1924 & PL1927. Figure A2.1.1.	Buried under deposited rock.
113.	Deposited rock	180m	1,212	Schooner pipeline (PL1222 & PL1223) crossing shared with PL1924 & PL1927. Figure A2.1.1.	Likely exposed with dusting of sediment.
114.	Concrete mattresses	3	24.4	Tampnet cable crossing, shared with PL1924 & PL1927. Figure A2.1.1.	Buried under deposited rock.
115.	Deposited rock	156m	1,268	Tampnet cable crossing, shared with PL1924 & PL1927. Figure A2.1.1.	Likely exposed with dusting of sediment.
INSIDE WATT QM 500M ZONE (PLU4888)					
116.	Concrete fronded mattresses	3	27.3	On approach to Watt QM. Refer Figure A1.10.1.	Expected to be mostly buried but to be confirmed.
117.	Concrete fronded mattresses	16	166.4	On approach to Watt QM. Refer Figure A1.10.1.	Expected to be mostly buried but to be confirmed.
118.	Grout bags (25kg)	150	3.8	On approach to Watt QM. Figure A1.10.1.	Expected to be at partly buried but to be confirmed.

Table 2.3.23: Pipeline stabilisation features (PLU4889)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE WATT QM 500M ZONE (PLU4889)					
119.	Concrete fronded mattresses	15	156.0	On approach to Watt QM (PLU4889). Refer Figure A1.10.1.	Expected to be mostly buried but to be confirmed.
120.	Grout bags (25kg)	150	3.8	Underneath umbilical on approach to WHPS. Refer Figure A1.10.1.	Expected to be partly buried but to be confirmed.
INFIELD BETWEEN WATT QM & MURDOCH MA (PLU4889)					
121.	Deposited rock	531m	5,910	Used for UHB and depth of cover mitigation, dispersed	Likely exposed with dusting of sediment but to be confirmed.

Table 2.3.23: Pipeline stabilisation features (PLU4889)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
				infield between Watt Boulton HM and Watt QM. Refer Figure A3.1.1.	
122.	Concrete mattresses	3	24.4	Ketch pipeline (PL1612 & PL1613) crossing. Figure A2.1.1.	Buried under deposited rock.
123.	Deposited rock	87m	968	Ketch pipeline (PL1612 & PL1613) crossing. Figure A2.1.1.	Likely exposed with dusting of sediment.
INSIDE MURDOCH MA 500M ZONE (PLU4889)					
124.	Concrete mattresses	2	16.2	Tampnet cable, PL1924 & PL1927 crossing. Refer Figure A1.1.1.	Buried under deposited rock 402m)
125.	Concrete mattresses	2	16.2	Ketch pipeline (PL1612 & PL1613) crossing. Refer Figure A1.1.1.	Buried under deposited rock (402m)
126.	Concrete mattresses	2	16.2	Schooner pipeline (PL1222 & PL1223) crossing shared with PLU4890. Refer Figure A1.1.1.	Buried under deposited rock (402m)
127.	Concrete fronded mattresses	5	62.0	At the end of the deposited rock on approach to Murdoch MA. Refer Figure A1.1.1.	Expected to be mostly buried but to be confirmed.
128.	Deposited rock	402m	4,474	On approach to Murdoch MA. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.

Table 2.3.24: Pipeline stabilisation features (PLU4890)					
No.	**Stabilisation feature**	**Total number**	**Total mass (Te)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MURDOCH K.KM 500M ZONE (PLU4890)					
129.	Concrete fronded mattresses	16	166.4	Murdoch K.KM approach (PLU4890). Refer Figure A1.7.1.	Expected to be mostly buried but to be confirmed.
130.	Grout bags (25kg)	100	2.5	Underneath umbilical on approach to WHPS. Refer Figure A1.7.1.	Expected to be mostly buried but to be confirmed.
INSIDE MURDOCH MA 500M ZONE (PLU4890)					
131.	Concrete mattresses	3	24.4	Tampnet cable crossing. Refer Figure A1.1.1.	Buried under deposited rock (393m).
132.	Concrete mattresses	2	16.2	Caister pipeline (PL935 & PL936) crossing. Refer Figure A1.1.1.	Buried under deposited rock (393m).
133.	Concrete mattresses	2	16.2	Ketch pipeline (PL1612 & PL1613) crossing. Refer Figure A1.1.1.	Buried under deposited rock (393m).
134.	Concrete mattresses	Refer PLU4889		Schooner pipeline (PL1222 & PL1223) crossing shared with PLU4889. Refer Figure A1.1.1	Buried under deposited rock (393m).
135.	Concrete mattresses	2	16.2	Boulton HM pipeline (PL1924 & PL1927)and umbilical PLU4889 crossing. Refer Figure A1.1.1.	Buried under deposited rock (393m).
136.	Deposited rock	393m	5,346	On approach to Murdoch MA. Refer Figure A1.1.1.	Likely exposed with dusting of sediment.

2.4 Wells

Table 2.4.1: Well information			
Murdoch MD platform wells	**Designation**	**Status**	**Category of well**
BOULTON BM			
44/21a-B1Z	Gas Production	Completed (Shut in)	PL-4-0-3
44/21a-B2Y	Gas Production	Completed (Shut in)	PL-4-0-3
44/21a-B3	Gas Production	Plugged	PL-3-0-3
44/21a-B4	Gas Production	Plugged	PL-3-0-3
BOULTON HM			
44/22b-H1	Gas Production	Completed (Shut in)	SS-4-0-3
KATY KT			
44/19-K1	Gas Production	Plugged	PL-3-0-3
KELVIN TM			
44/18b-K1	Gas Production	Plugged	PL-3-0-3
HAWKSLEY EM			
44/17a-6Y (Hawksley)	Gas Production	Decommissioned, AB2	SS-3-3-3
McADAM MM			
44/17C-M1Z	Gas Production	Decommissioned, AB2	SS-4-0-3
44/17C-M2	Gas Production	Decommissioned, AB2	SS-3-0-3
MUNRO MH			
44/17b-H1Z	Gas Production	Plugged	PL-3-0-3
MURDOCH K.KM			
44/22a-10y	Gas Production	Completed (Shut-in)	SS-3-0-3
WATT QM			
44/22b-11 (Watt)	Gas Production	Decommissioned, AB3	SS-3-3-3
NOTES 1. Wells with “Suspended” status have meantime been temporarily plugged using a mechanical plug.			

For details of well categorisation see the latest version of the Oil & Gas UK Guidelines for the Decommissioning of Wells.

2.5 Inventory estimates

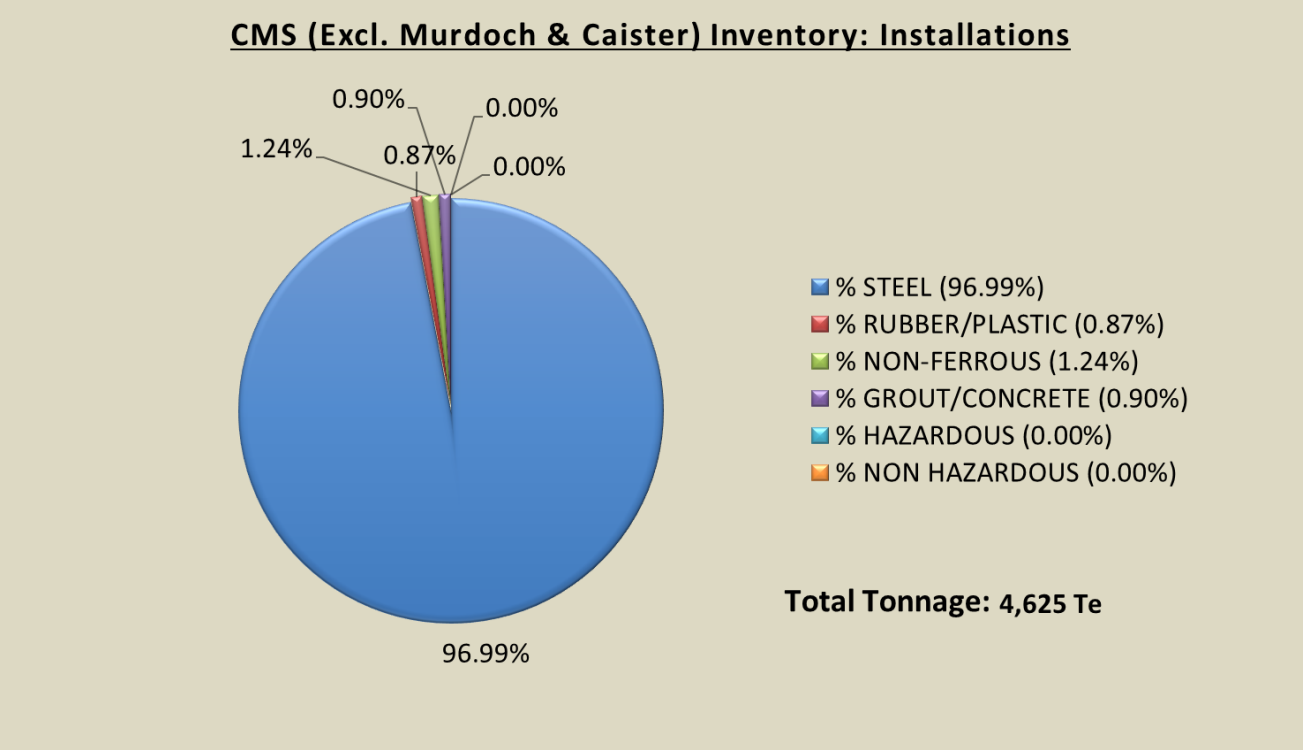


Figure 2.5.1: Pie-chart of estimated installation inventory

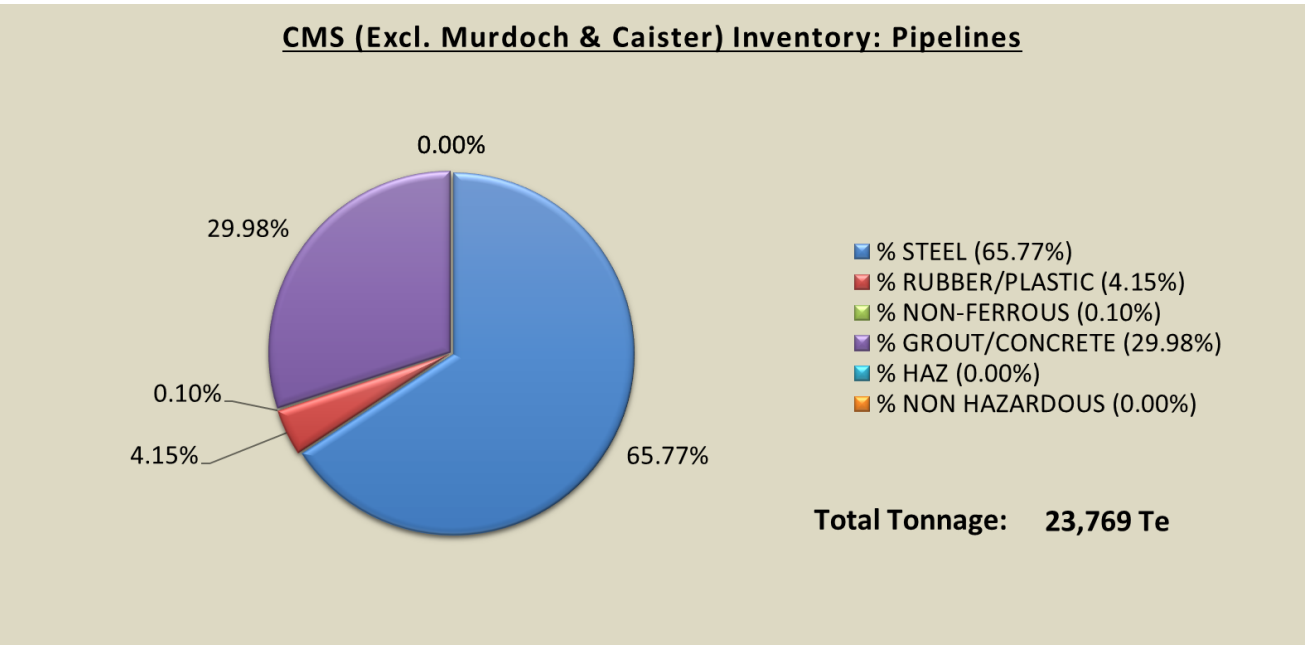


Figure 2.5.2: Pie-chart of estimated pipeline inventory, excluding deposited rock

3 Removal and disposal methods

Waste will be dealt with in accordance with the Waste Framework Directive [9]. The reuse of an installation or pipelines (or parts thereof) is first in the order of preferred decommissioning options. However, given the age of the installations and infrastructure it is unlikely that reuse opportunities will be realised. Waste generated during decommissioning will be segregated by type and periodically transported to shore in an auditable manner through licensed waste contractors. Transfrontier shipment of waste will not be required. Steel and other recyclable metal are estimated to account for the greatest proportion of the materials inventory. Refer to section 5.4 of the Environmental Appraisal [4] for further details concerning disposal of waste.

3.1 Topsides decommissioning

3.1.1 Boulton BM

Topsides description: the Boulton BM platform is a Normally Unattended Installation. The overall topsides dimension is ~34m x 18m and the overall height between LAT and the helideck is ~30.4m. The overall mass of the topsides is ~351.0Te. Shown in Figure 3.1.1, the topsides is supported from a four leg Vierendeel type structure using four spider braces that prop the four deck support points at a spacing of 12.75m x 16m at EL. +19.8m. There are no processing or treatment facilities on the Boulton BM platform.

Removal methods: the topsides will be completely removed and returned to shore. Possible methods are described in Table 3.1.2.

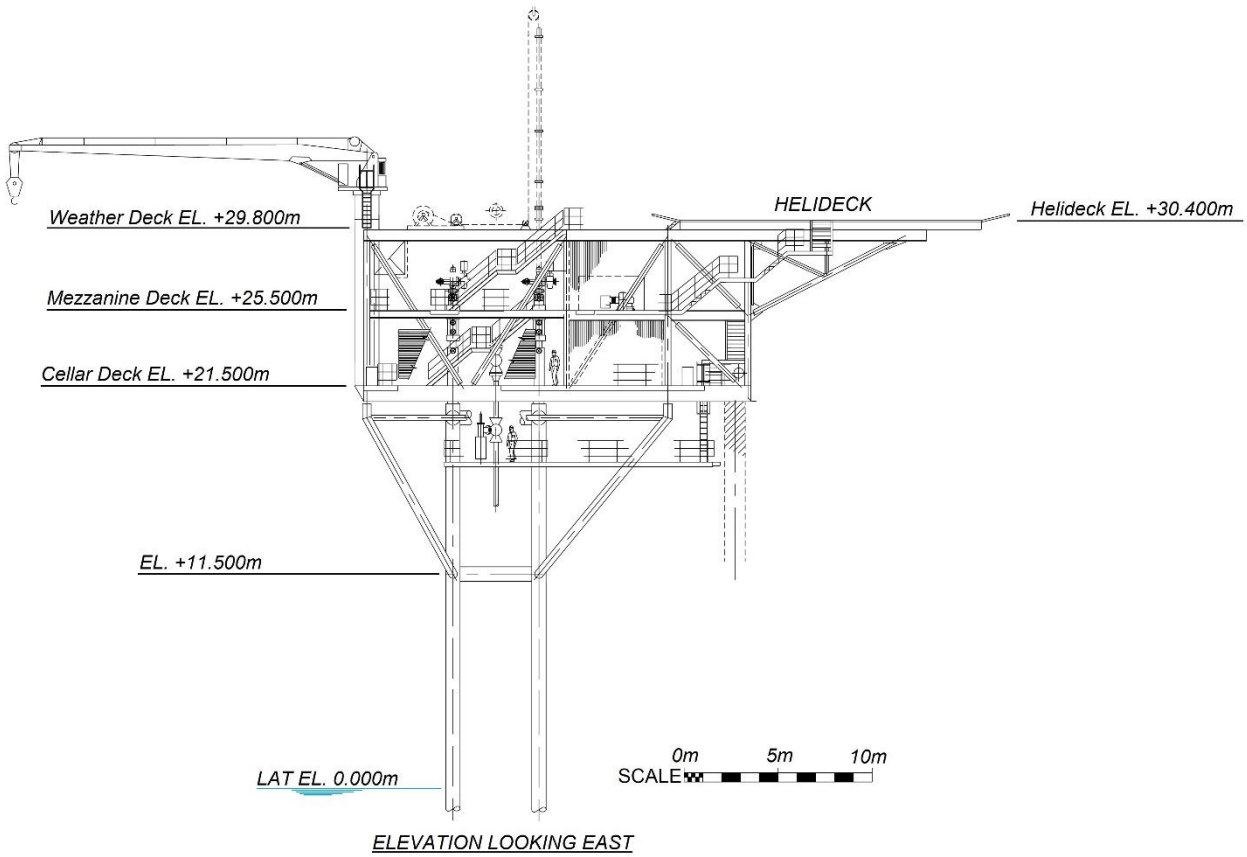


Figure 3.1.1: View on Boulton BM topsides looking east

3.1.2 Katy KT

Topsides description: the Katy KT platform is a Normally Unattended Installation, and the main structure is virtually identical to the Kelvin TM. The overall topsides dimension is ~29.5m x 19.4m and the overall height between LAT and the helideck is ~32.9m. The overall mass of the topsides is ~353.4Te. Shown in Figure

3.1.2, the rectangular topsides is supported from a three-leg substructure using four deck support points at a spacing of 12.75m x 13.4m at EL.+23.3m. There are no processing or treatment facilities on the Katy KT platform.

Removal methods: the topsides will be completely removed and returned to shore. Possible methods are described in Table 3.1.2.

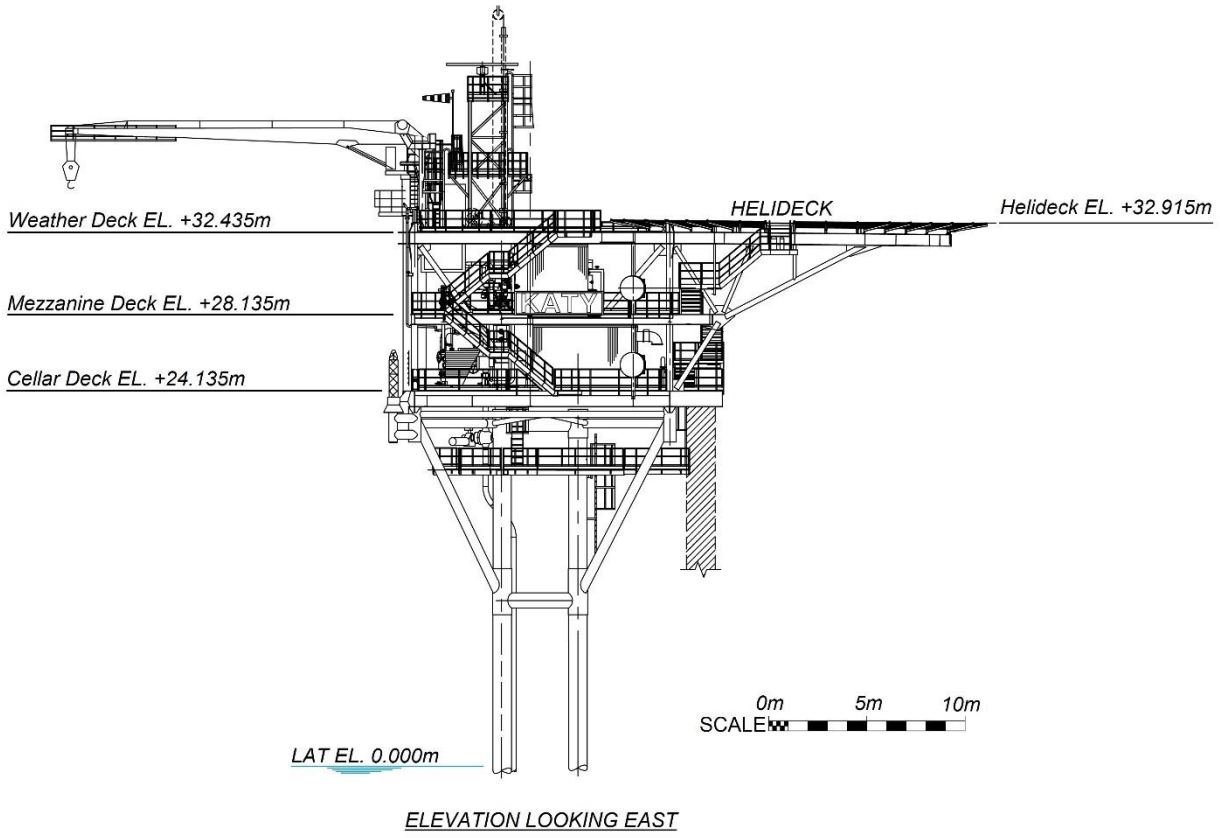


Figure 3.1.2: View on Katy KT topsides looking east

3.1.3 Kelvin TM

Topsides description: the Kelvin TM platform is a Normally Unattended Installation, and the main structure is virtually identical to the Katy KT. The overall topsides dimension is ~29.5m x 19.4m and the overall height between LAT and the helideck is ~32.9m. The overall mass of the topsides is ~288.6Te. Shown in Figure 3.1.3, the rectangular topsides is supported from a three-leg substructure using four deck support points at a spacing of 12.75m x 13.4m at EL.+23.2m. There are no processing or treatment facilities on the Kelvin TM platform.

Removal methods: the topsides will be completely removed and returned to shore. Possible methods are described in Table 3.1.2.

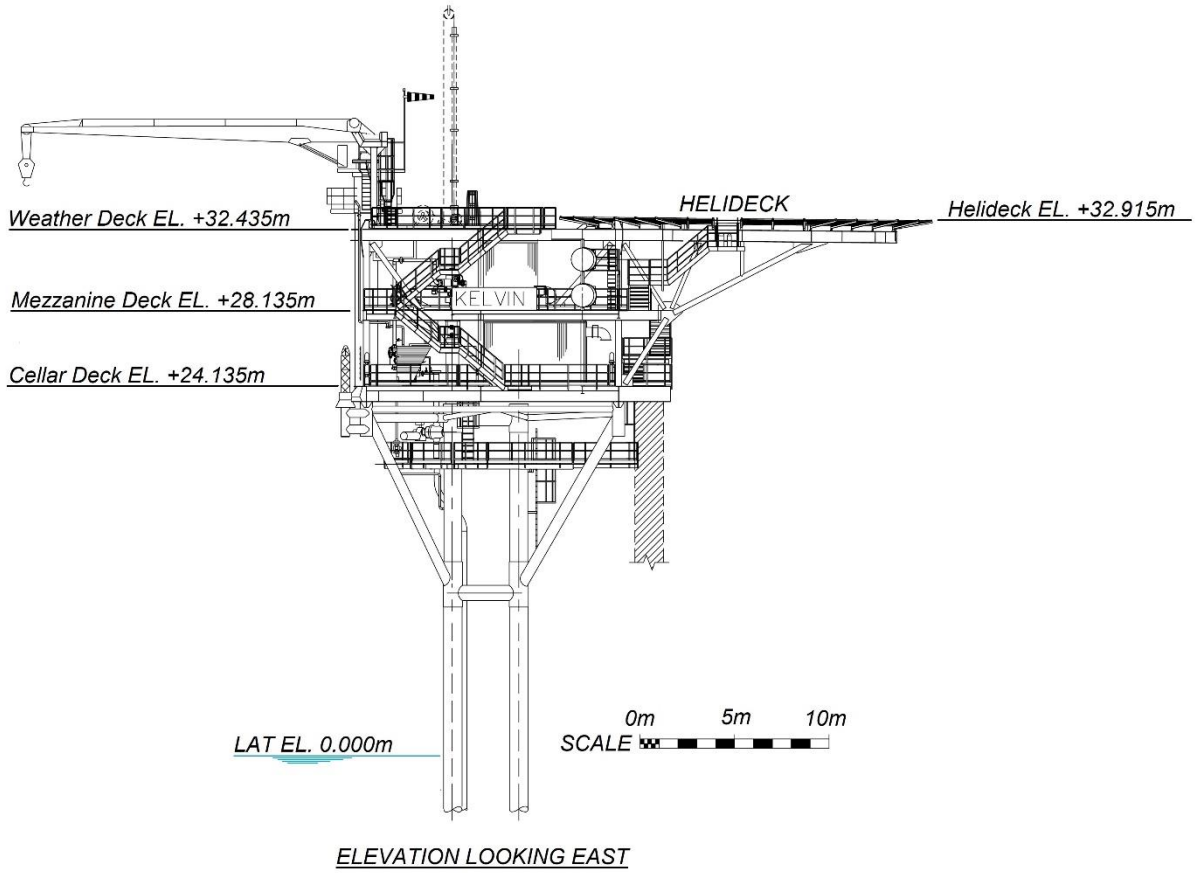


Figure 3.1.3: View on Kelvin TM topsides looking east

3.1.4 Munro MH

Topsides description: the Munro MH platform is a Normally Unattended Installation. The overall topsides dimension is ~26.9m x 17.8m and the overall height between LAT and the helideck is ~28.4m. The overall mass of the topsides is ~210.9Te. Shown in Figure 3.1.4, the rectangular topsides is supported from a three-leg substructure using four deck support points at a spacing of 10.5m x 7.5m at EL.+21.3m. There are no processing or treatment facilities on the Munro MH platform.

Removal methods: the topsides will be completely removed and returned to shore. Possible methods are described in Table 3.1.2.

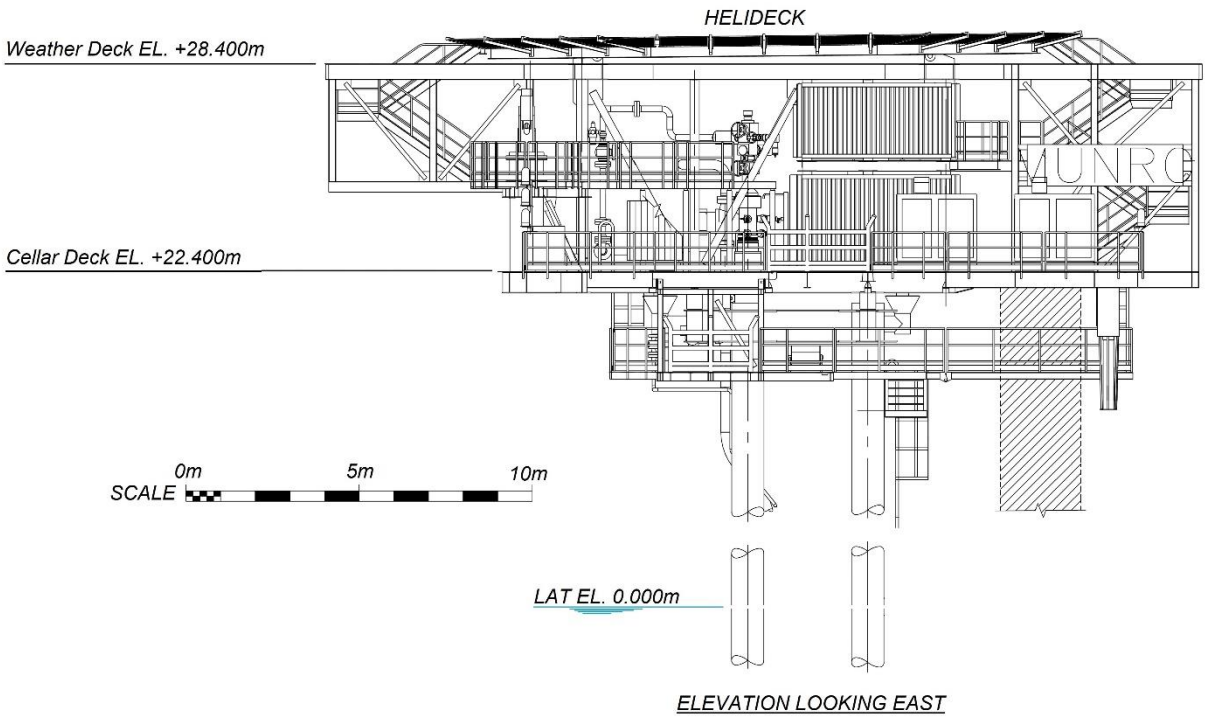


Figure 3.1.4: View on Munro MH topsides looking east

Preparation / Cleaning: The methods that will be used to flush, purge, and clean the topsides prior to removal to shore are summarised in Table 3.1.1.

Table 3.1.1: Cleaning of topsides for removal

Waste type	Composition of waste	Disposal route
Hydrocarbons	Process fluids	Vessels and pipework have already been flushed, nitrogen purged vented and made liquid free.
Produced solids	Sand, NORM	Any pipeline debris captured in filter packages, has been returned onshore for disposal. Any solids remaining in vessels has already been removed and disposed of during the dismantlement of the Topsides onshore.
Diesel	Bunkered Diesel fuel	Bunkered diesel has already been drained and returned onshore for reuse or disposal.
Lubricating oils	Lubricants for equipment e.g., gearboxes, pumps, pedestal crane compressor skid	Lubricating oils have already been drained and returned onshore for reuse or disposal.

3.1.5 Topsides removal methods

Table 3.1.2: Topsides removal methods	
1) Semi-Submersible Crane Vessel ☑; 2) Monohulled Crane Vessel ☑; 3) Shear Leg Vessel ☑; 4) Jack up Work barge ☑; 5) Piece small or large ☑; 6) Complete with jacket ☑.	
Methods considered	**Description**
Single lift removal by SSCV / MCV / SLV	Removal of topsides and jacket as a complete unit followed by recovery to shore for reuse, recycling, and disposal as appropriate
Single lift removal by SSCV / MCV / SLV	Removal of topsides as a single unit followed by recovery to shore for reuse, recycling, disposal as appropriate
Piece-small or piece large removal using attendant support vessel such as a JUWB	Removal of topsides in a series of smaller sub-units making use of the JUWB used for the well decommissioning activities, followed by recovery to shore for a programme of reuse, recycling or disposal as appropriate
Proposed removal method and disposal route	**Removal of topsides individually followed by recovery to shore for reuse, recycling, and final disposal to landfill as appropriate. A final decision on the decommissioning method was made following a commercial tendering process and the removal contract has now been awarded. Removal will likely be carried out using an JUWB, but this may be changed for a MCV to suit contractual arrangements.**

3.2 Jacket decommissioning

3.2.1 Boulton BM

Jacket description: the Boulton BM jacket is an unconventional shape and is a four-leg Vierendeel tower type structure. It is pinned to the seabed by four piles driven through four external pile sleeves, one at each corner. The main jacket frame is square, measuring 4.572m x 4.572m in plan with horizontal braces at EL +11.5m, EL. 3.5m, and EL. -5.0m. It is supported by four 800mm diameter braces extending diagonally down to a square space structure measuring 20.5m x 20.5m x 12.9m high between main braces. (Figure 3.2.1).

The mass of the jacket is ~601.5Te excluding the piles and excluding any rigging that would be used for lifting operations. The legs will be cut at an appropriate elevation to allow the lifting aids to be installed, and the jackets will ideally each be removed in a single lift[3]. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut. The jacket will be returned to shore for recycling.

Removal methods: the jacket along with mud mats will be completely removed and returned to shore. Possible methods are described in Table 3.2.1.

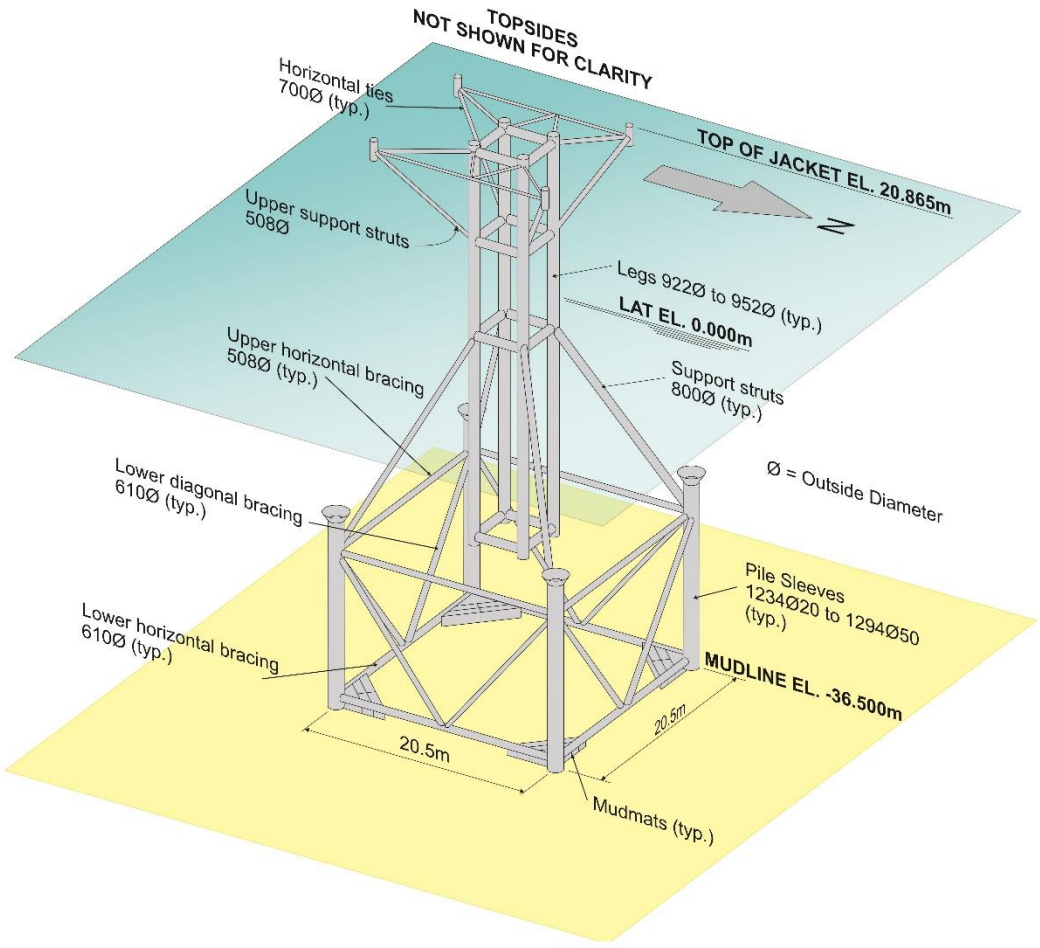


Figure 3.2.1: Boulton BM jacket 3D view

[3] The technique adopted for removal of the jacket will be subject to engineering feasibility and any commercial agreements; they are also subject to regulatory requirements.

3.2.2 Katy KT

Jacket description: the Katy KT jacket is an unconventional shape pinned to the seabed by three piles driven through threes external pile sleeves, one at each of the three corners. The main jacket frame is triangular, measuring 4.0m x 4.0m x 4.0m in plan with horizontal braces at EL +13.0m, EL. 3.5m, EL. -5.0m and EL. -14.0m. This part of the jacket is supported by three 800mm diameter braces extending diagonally down to a triangular space structure measuring 20.0m x 19.053m x 19.053m x 6.5m high between main braces (Figure 3.2.2).

The mass of the jacket is ~580.6Te, excluding the piles and excluding any rigging that would be used for lifting operations. The legs will be cut at an appropriate elevation to allow the lifting aids to be installed, and the jackets will ideally each be removed in a single lift[4]. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut. The jacket will be returned to shore for recycling.

Removal methods: the jacket along with mud mats will be completely removed and returned to shore. Possible methods are described in Table 3.2.1.

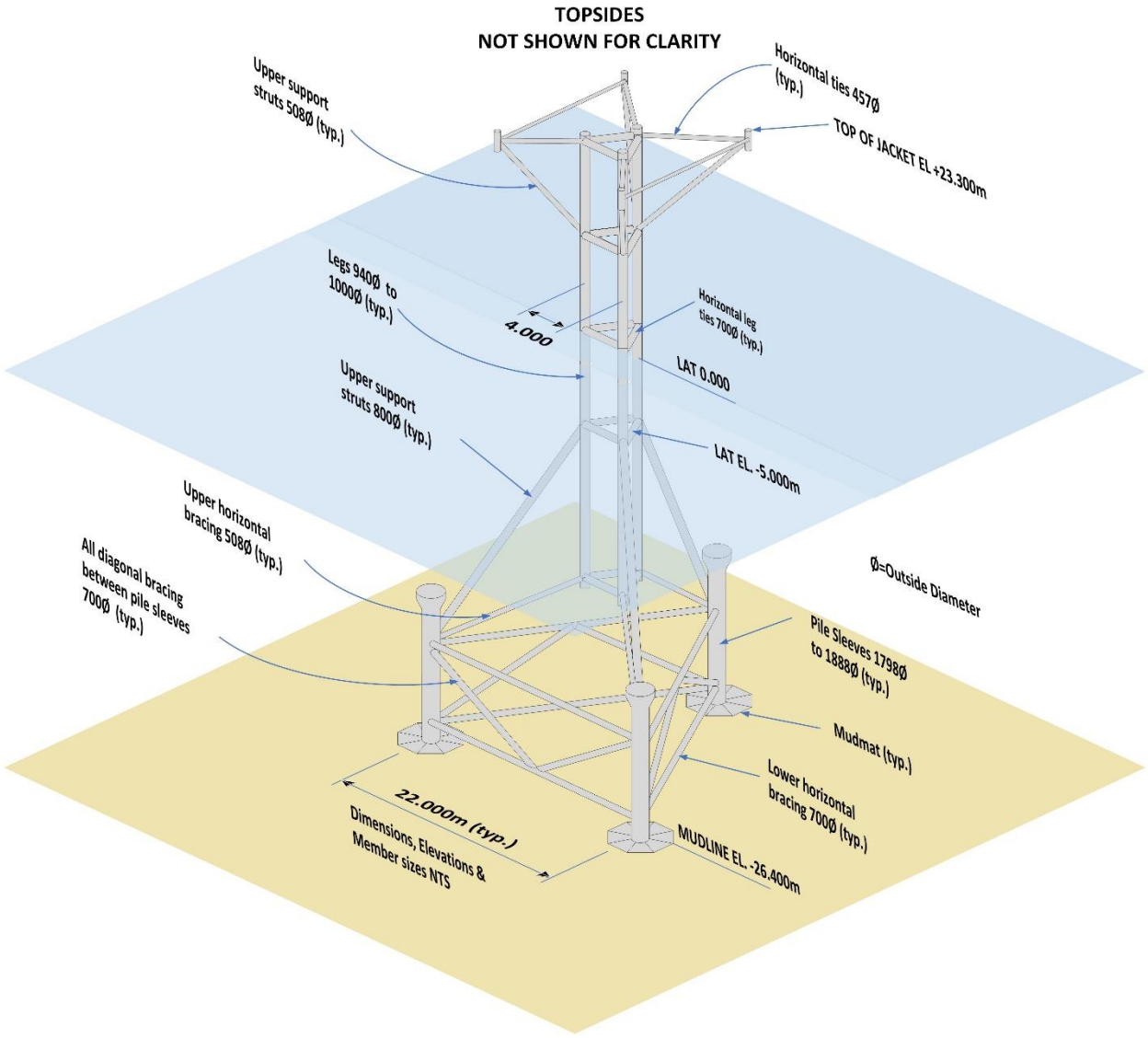


Figure 3.2.2: Katy KT Jacket 3D View

[4] The technique adopted for removal of the jacket will be subject to engineering feasibility and any commercial agreements; they are also subject to regulatory requirements.

3.2.3 Kelvin TM

Jacket description: the Kelvin TM jacket is an unconventional shape pinned to the seabed by three piles driven through threes external pile sleeves, one at each of the three corners. The main jacket frame is triangular, measuring 4.0m x 4.0m x 4.0m in plan with horizontal braces at EL +13.0m, EL. 4.0m, EL. -5.0m and EL. -15.0m). This part of the jacket is supported by three 800mm diameter braces extending diagonally down to a triangular space structure measuring 24.0m x 20.785m x 20.785m x 7.9m high between main braces (Figure 3.2.3).

The mass of the jacket is 483.6Te, excluding the piles and excluding any rigging that would be used for lifting operations. The legs will be cut at an appropriate elevation to allow the lifting aids to be installed, and the jackets will ideally each be removed in a single lift[5]. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut. The jacket will be returned to shore for recycling.

Removal methods: the jacket along with mud mats will be completely removed and returned to shore. Possible methods are described in Table 3.2.1.

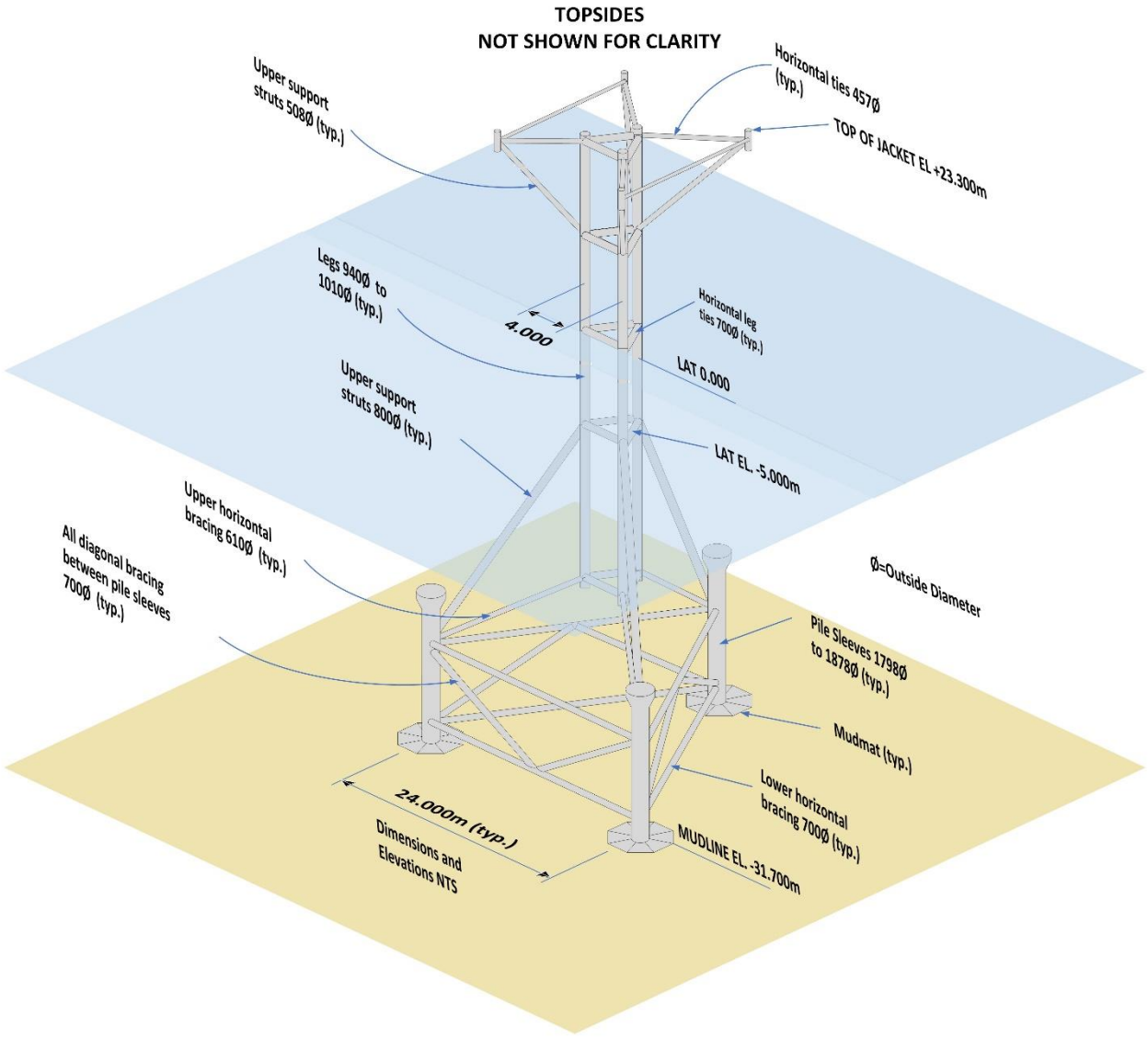


Figure 3.2.3: Kelvin TM Jacket 3D View

[5] The technique adopted for removal of the jacket will be subject to engineering feasibility and any commercial agreements; they are also subject to regulatory requirements.

3.2.4 Munro MH

Jacket description: the Munro MH jacket is an unconventional shape pinned to the seabed by three piles driven through threes external pile sleeves, one at each of the three corners. The main jacket frame is triangular, measuring 4.0m x 4.0m x 4.0m in plan with horizontal braces at EL +12.0m, EL. 3.5m, EL. -5.0m and EL. -20.0m). This part of the jacket is supported by two sets of three 950mm and 508mm diameter braces extending diagonally down from EL -15.0m and EL-20.0m respectively to three pile guides (Figure 3.2.4).

The mass of the jacket is ~384.9Te excluding the piles and excluding any rigging that would be used for lifting operations. The legs will be cut at an appropriate elevation to allow the lifting aids to be installed, and the jacket will ideally be removed in a single lift[6]. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut. The jacket will be returned to shore for recycling.

Removal methods: the jacket along with mud mats and all the risers will be completely removed and returned to shore. Possible methods are described in Table 3.2.1.

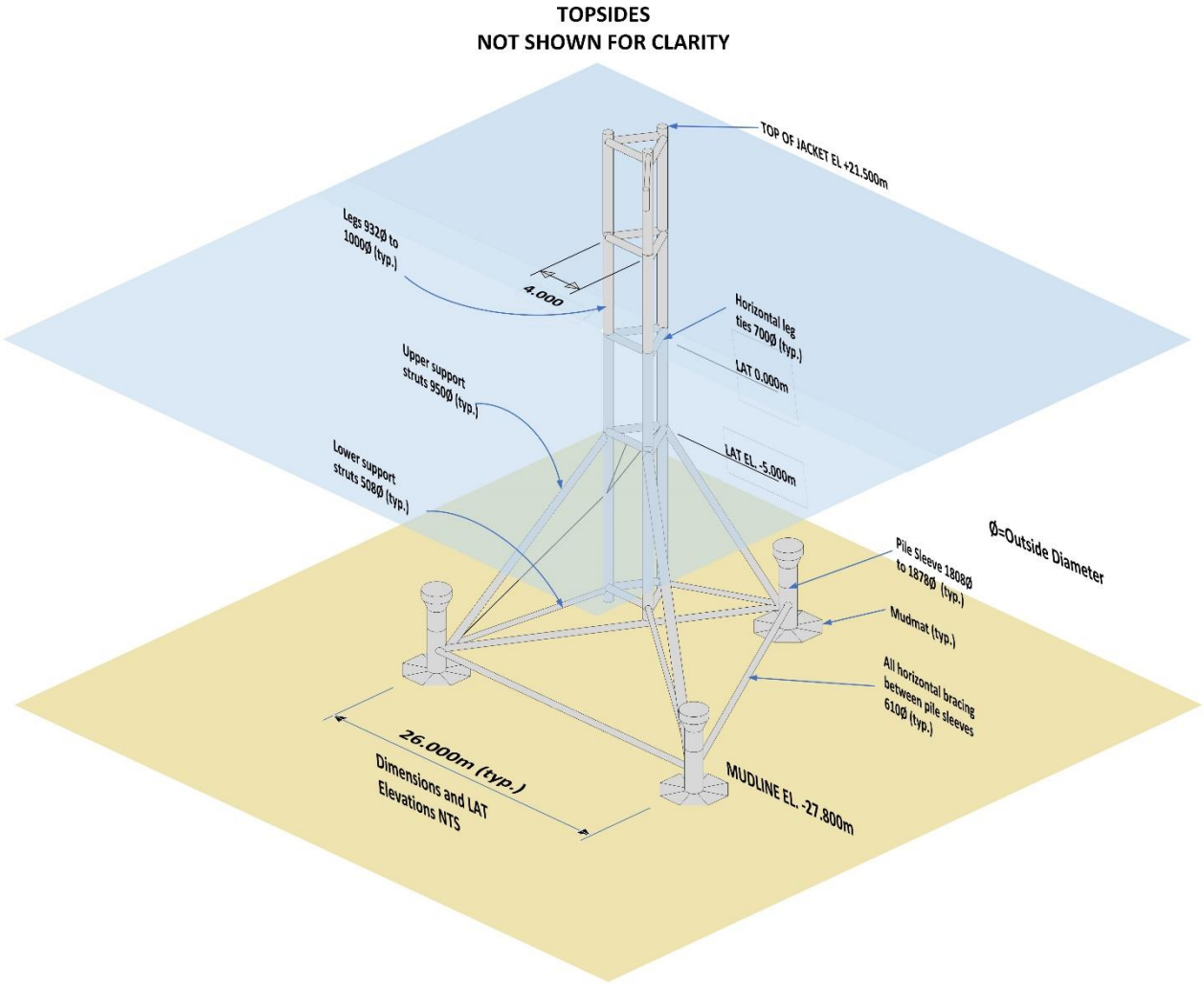


Figure 3.2.4: Munro MH Jacket Typical 3D View

[6] The technique adopted for removal of the jacket will be subject to engineering feasibility and any commercial agreements; they are also subject to regulatory requirements.

3.2.5 Jacket removal methods

Table 3.2.1: Jacket Removal Methods	
1) Semi-Submersible Crane Vessel ☑; 2) Monohulled Crane Vessel ☑; 3) Shear Leg Vessel ☑; 4) Jack up Work barge ☑; 5) Piece small or large ☑; 6) Complete with topsides ☑.	
Methods Considered	**Description**
Single lift removal along with topsides using SSCV.	Removal of the topsides and jacket as a complete unit followed by recovery to shore for reuse, recycling, and disposal as appropriate.
Single lift removal using SSCV.	Removal of the jacket as a single unit followed by recovery to shore for reuse, recycling, disposal as appropriate.
Offshore removal 'piece-small' for onshore disposal	Removal of jacket and dismantlement offshore followed by transportation to shore for disposal and recycling.
Proposed removal method and disposal route	**Removal of jacket individually followed by recovery to shore for reuse, recycling, and final disposal to landfill as appropriate. A final decision on the decommissioning method was made following a commercial tendering process and the removal contract has now been awarded. Removal will likely be carried out using an JUWB, but this may be changed for a MCV to suit contractual arrangements.**

3.3 Subsea installations and stabilisation features

Table 3.3.1: Subsea installations and stabilisation features			
Subsea Installations and stabilisation features	**Number**	**Option**	**Comments / status**
Boulton HM	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Anchored fronded mattresses	11	Complete removal	Remove to shore for reuse or recycling.
Hawksley EM	1	Complete removal	Remove to shore for reuse or recycling.
Concrete fronded Mattresses	4	Complete removal	Remove to shore for reuse or recycling.
Deposited rock	1	Leave *in situ*	
McAdam MM	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Anchored fronded mattresses	11	Complete removal	Remove to shore for reuse or recycling.
Murdoch K.KM	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Anchored fronded mattresses	8	Complete removal	Recovery to shore, recycle steel anchors and recycle synthetic materials as energy.
Watt QM	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Anchored Fronded mattresses	6	Complete removal	Remove to shore for reuse or recycling.
NOTE 1. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut; 2. Any grout bags not listed but that are found exposed will be removed; 3. Recycling synthetic materials as energy is an aspiration.			

3.4 Pipelines and stabilisation features

3.4.1 Decommissioning options

Although there may remain commercial opportunities for individual pipelines, there is an implicit assumption that options for reusing the pipelines have been exhausted prior to the facilities and infrastructure moving into the decommissioning phase and associated comparative assessment. Therefore, this option has been excluded. The three decommissioning options considered for the pipelines or umbilicals in Table 3.4.1 are:

1) **Complete removal** – This would involve the complete removal of the pipelines by whatever means most practicable and acceptable from a technical perspective;
2) **Partial removal or remediation** – This would involve removing exposed or potentially unstable sections of pipelines. Remedial work may need to be carried out to make the remaining pipeline safe for leaving in situ. This option is relevant for those pipelines that have known exposures or spans. There will likely be a need to verify their status via future surveys;
3) **Leave *in situ*** – This would involve leaving the pipeline(s) *in situ* with no remedial works but possibly verifying their status via future surveys.

Note that for the purposes of the comparative assessment remediation in this context refers to any exposures or spans that may be found along the pipelines, not the pipeline ends.

The pipelines ends, that is, the mattresses and the underlying pipelines on the approaches were also subject to a comparative assessment. All exposed pipelines or pipespools on approach to the various installations associated with the scope in this Decommissioning Programme will be completely removed up to the point of burial as described in Table 3.4.2.

Table 3.4.1: Pipeline or pipeline groups / decommissioning options

Pipelines Group	Condition of line / group (surface laid/trenched/buried/spanning)	Whole or part of pipeline/group	Decommissioning options considered
PIPELINES GROUP 2			
PL1436 & PL1437 (Pipelines between Boulton BM & Murdoch MD)			
PL1436 & PL1437	Piggybacked. Trenched and buried in the seabed throughout their length except on approach to Boulton BM and Murdoch MD where the pipelines are buried under deposited rock and mattresses. At Murdoch MD, PL1436 and PL1437 are connected to PL1311 and PL1312 at their respective riser tie-in flanges. The risers are dealt with in the CDP3 DP [3]. Pipeline crossings inside Murdoch MD 500m zone are as described in Table 2.3.2.	Whole of 10in and 3in pipelines, between Boulton BM and Murdoch MD. Refer Table 2.3.1.	1, 3
PL1922 & PL1925 (Pipelines between Hawksley EM, McAdam MM & Murdoch MD via PSNL)			
PL1922 & PL1925	The pipeline routes are split into two segments being split at the McAdam Tee. Between Hawksley EM and McAdam MM the pipelines are buried in separate trenches with PL1925 being buried in the same trenched as PLU4685, whereas between McAdam MM and Murdoch MD PL1922 is piggybacked by PL1925 and therefore buried in the same trench. On approach to Hawksley EM, McAdam MM and Murdoch MD the pipelines are buried under deposited rock and concrete mattresses. Pipeline crossings are as described in Table 2.3.3.	Whole of 10in and 3in pipelines between Hawksley EM, McAdam MM, PSNL and Murdoch MD Table 2.3.1.	1, 3
PL1923 & PL1926 (Pipelines between Murdoch K.KM & Murdoch MD via PSNL)			

Table 3.4.1: Pipeline or pipeline groups / decommissioning options			
Pipelines Group	**Condition of line / group (surface laid/trenched/buried/spanning)**	**Whole or part of pipeline/group**	**Decommissioning options considered**
PL1923 & PL1926	Piggybacked. Trenched and buried in the seabed throughout their length except on approach to Murdoch K.KM and Murdoch MD where the pipelines are buried under deposited rock and mattresses. Pipeline crossings are as described in Table 2.3.4.	Whole of 10in and 3in pipelines between Murdoch K.KM, PSNL and Murdoch MD. Refer Table 2.3.1.	1, 3
PL1924 & PL1927 (Pipelines between Boulton HM, Watt QM & Murdoch MD via PSSL)			
PL1924 & PL1927	Piggybacked. Trenched and buried in the seabed throughout their length except on approach to Boulton HM, Watt QM and Murdoch MD where the pipelines are buried under deposited rock and mattresses. Pipeline crossings are as described in Table 2.3.5.	Whole of 10in and 3in pipelines between Boulton HM, Watt QM, PSSL and Murdoch MD. Refer Table 2.3.1.	1, 3
PL2109 & PL2110 (Pipelines between Munro MH & Hawksley EM)			
PL2109 & PL2110	Piggybacked. Trenched and buried in the seabed throughout their length except for the first 1.5km of pipeline measured from Munro that experiences intermittent exposures and on approach to Munro MH and Hawksley EM the pipelines are overlain by concrete mattresses.	Whole of 10in and 3in pipelines between Munro MH and Hawksley EM. Refer Table 2.3.1.	1, 2, 3
PL2430 & PLU2431 (Pipelines between Kelvin TM & Murdoch MD via Kelvin SPS & PSSL)			
PL2430 & PLU2431	Piggybacked. Trenched and buried in the seabed throughout their length except on approach to Kelvin TM, Kelvin STA, PSSL and Murdoch MD where the pipelines are buried under deposited rock and mattresses. Pipeline crossings are as described in Table 2.3.6	Whole of 12in and 3in pipelines between Kelvin TM, Kelvin STA, PSSL and Murdoch MD. Refer Table 2.3.1.	1, 3
PL2894 & PL2895 (Pipelines between Katy KT & Kelvin TM)			
PL2894 & PL2895	Piggybacked. Trenched and buried in the seabed throughout their length except on approach to Katy KT, Katy Tee, Kelvin PMA, and Kelvin STA where the pipelines are buried under deposited rock and mattresses.	Whole of 10in and 2in pipelines between Katy KT, Katy Tee, Kelvin PMA and Kelvin STA. Refer Table 2.3.1.	1, 3
PIPELINES GROUP 3 (UMBILICALS)			
PLU4685 (Umbilical between McAdam MM & Hawksley EM)			
PLU4685	Trenched and buried in seabed between McAdam MM and Hawksley EM where it is buried under deposited rock and concrete mattresses. In 2011, 1x exposure ~7m long was found at KP0.028, and 3x freespans (3m, 4.5m, and 11.4m long) and 1x exposure (33m long) were observed between KP0.222 and ~KP0.280 near Hawksley. Otherwise shares same trench as PL1925. Pipeline crossings are as described in Table 2.3.7.	Whole of umbilical between McAdam MM and Hawksley EM. Refer Table 2.3.1.	1, 2, 3
PLU4686 (Umbilical between McAdam & Murdoch MA)			
PLU4686	Trenched and buried in seabed between McAdam MM and Murdoch MA where it is buried under deposited rock and concrete mattresses. Shares same route as PL1922 &	Whole of umbilical between McAdam MM and Murdoch	1, 3

Table 3.4.1: Pipeline or pipeline groups / decommissioning options			
Pipelines Group	**Condition of line / group (surface laid/trenched/buried/spanning)**	**Whole or part of pipeline/group**	**Decommissioning options considered**
	PL1925 on approach to Murdoch MA and MD but diverges where PL1922, PL1925 and PLU4686 cross PL2430 and PLU2431. Fronded mattresses on final approach to Murdoch MA shared with PLU4889 and PLU4890. Pipeline crossings are as described in Table 2.3.8.	MA. Refer Table 2.3.1.	
PLU4888 (Umbilical between Watt QM & Boulton HM)			
PLU4888	Trenched and buried in seabed between Watt QM and Boulton HM where it is buried under Concrete fronded mattresses. Buried under a short section of deposited rock on approach to Boulton HM. Pipeline crossings are as described in Table 2.3.9	Whole of umbilical between Watt QM and Boulton HM. Refer Table 2.3.1.	1, 3
PLU4889 (Umbilical between Murdoch MA & Watt QM)			
PLU4889	Trenched and buried in seabed between Murdoch MA and Watt QM except on the approaches. Buried under fronded mattresses and deposited rock on approach Murdoch MA, Buried under Concrete fronded mattresses on approach to Watt QM. Mattresses shared with PLU4686 and PLU4890 on approach to Murdoch MA. Pipeline crossings are as described in Table 2.3.10.	Whole of umbilical between Murdoch MA and Watt QM. Refer Table 2.3.1.	1, 3
PLU4890 (Umbilical between Murdoch MA & Murdoch K.KM)			
PLU4890	Trenched and buried in seabed between Murdoch MA and Murdoch K.KM except on the approaches. Buried under fronded mattresses and deposited rock on approach Murdoch MA, Buried under Concrete fronded mattresses on approach to Murdoch K.KM. Mattresses shared with PLU4686 and PLU4889 on approach to Murdoch MA. Pipeline crossings are as described in Table 2.3.11	Whole of umbilical between Murdoch MA and Murdoch K.KM. Refer Table 2.3.1.	1, 3

3.4.2 Outcomes of comparative assessment

A comparative assessment of the decommissioning options was carried out in accordance with the OPRED decommissioning guidance notes [13]. Each decommissioning option was qualitatively assessed against Safety, Environment, Technical and Societal and Cost. Refer [5] for details. Pipeline burial profiles can be found in section 3.0 of the Comparative Assessment report.

The chosen option for all but PL2109 & PL2110 and PLU4685 is to 'leave *in situ* but remove the pipeline ends on the approaches. Due to the presence of exposures PL2109 & PL2110 and PLU4685 will be partially removed, this being on the basis that once the exposures have been removed the uncertainty with regards burial status for the pipelines and umbilical would be likely removed. For the partial removal options, removal of the first 1.5km of PL2109 and PL2110 would minimise any potential increase in snagging hazards, for example, by removing intermediate exposures or spans and would potentially minimise the requirement for additional rock to remediate cut pipeline ends. The means that the pipelines would meantime remain as they are, and no exposures or spans would likely need to be dealt with in future.

Please also refer the general notes at the bottom of Table 3.4.2. These have been included to avoid repetition for each pipeline.

Table 3.4.2: Outcomes of comparative assessment		
Pipeline or Group	**Recommended option**	**Justification**
PIPELINE GROUP 2		
PL1436 & PL1437 (between Boulton BM & Murdoch MD)	Leave *in situ*. Remove surface laid pipeline ends and overlying mattresses at Boulton BM and Murdoch MD. At Boulton BM remove surface laid section of pipelines each ~113m long up to point of burial in rock and remove overlying mattresses. At Murdoch MD remove the surface laid section of pipeline ~77m long up to point of burial in rock and remove overlying mattresses.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL1922 & PL1925 (between Hawksley EM & McAdam MM)	Leave *in situ*. Remove surface laid pipeline ends and overlying mattresses at Hawksley EM, McAdam MM and Murdoch MD. At Hawksley EM remove surface laid section of PL1922 ~106m long up to the point of burial in rock and remove overlying mattresses. At Hawksley EM remove surface laid section of PL1925 ~92m long up to the point of burial in rock and remove overlying mattresses. PL1922 routed from the north to the McAdam Tee and buried in rock will not be touched. At McAdam MM remove surface laid section of PL1925 ~74m long between rock near the McAdam Tee and the point of burial in rock to the north and remove overlying mattresses.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL1922 & PL1925 (between McAdam MM & Murdoch MD)	Leave *in situ*. Remove surface laid pipeline ends and overlying mattresses at McAdam MM and Murdoch MD. At McAdam MM remove surface laid sections of PL1922 ~58m long between WHPS and the deposited rock downstream of the McAdam Tee and remove overlying mattresses. At Murdoch MD remove surface laid sections of PL1922 ~248m from where it emerges from burial in rock to where it terminates at the riser at Murdoch MD and remove overlying mattresses. At McAdam MM remove surface laid sections of PL1925 ~45m long between WHPS and the deposited rock near the McAdam Tee and remove overlying mattresses. At Murdoch MD remove surface laid sections of PL1925 ~232m from where it emerges from burial in rock to where it terminates at the riser at Murdoch MD and remove overlying mattresses. The PSNL and associated mattresses will be fully recovered to shore for reuse, recycling, or disposal.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL1923 & PL1926 (between Murdoch K.KM & PSNL near Murdoch MD	Leave *in situ*. Piggybacked. Remove surface laid pipeline ends and overlying mattresses at Murdoch K.KM and at PSNL near Murdoch MD. At Murdoch K.KM remove surface laid sections of PL1923 & PL1926 ~66m and ~64m long respectively up to the point of burial in rock and remove overlying mattresses. At Murdoch MD remove surface laid sections of PL1923 & PL1926 each ~45m long from the point of burial in rock to where they terminate at PSNL and remove overlying mattresses. The PSNL and associated mattresses will be fully recovered to shore for reuse, recycling, or disposal.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL1924 & PL1927 (between Boulton HM & Watt QM)	Leave *in situ*. Piggybacked. Remove surface laid pipeline ends and overlying mattresses at Boulton HM and Watt QM. At Boulton HM remove surface laid sections of PL1924 & PL1927 ~82m and ~68m long respectively up to the point of burial in rock and remove overlying mattresses.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).

Table 3.4.2: Outcomes of comparative assessment		
Pipeline or Group	**Recommended option**	**Justification**
	At Watt QM remove surface laid sections of PL1924 & PL1927 each ~89m long from the point of burial in rock to where they terminate at Watt QM and remove overlying mattresses.	
PL1924 & PL1927 (between Watt QM & Murdoch MD)	Leave *in situ.* Remove surface laid pipeline ends and overlying mattresses at Watt QM and at Murdoch MD. At Watt QM remove surface laid sections of PL1924 & PL1927 ~66m and 64m long respectively up to the point of burial in rock and remove overlying mattresses. At Murdoch MD remove surface laid sections of PL1924 & PL1927 ~157m and ~194m long respectively from the point of burial in rock to where they terminate at Murdoch MD via PSSL and remove overlying mattresses. The PSSL and associated mattresses will be fully recovered to shore for reuse, recycling, or disposal.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL2109 & PL2110 (between Munro MH and Hawksley EM)	Partial removal. Piggybacked. Remove surface laid pipeline ends and overlying mattresses at Watt QM and at Murdoch MD. Remove part of pipelines between KP0 and ~KP1.5. At Munro MH remove surface laid sections of PL2109 & PL2110 ~21m and ~38m long respectively up to the pipeline flange connection and remove overlying mattresses. Expose the pipelines between KP0 and ~KP1.5 and recover both pipelines. Ensure that the cut pipeline ends remain buried, and mechanically backfill the excavation near the cut pipeline ends. Mechanically backfill the excavated trench. At Hawksley EM remove surface laid sections of PL2109 & PL2110 ~207m and ~244m long respectively - includes 50m allowance for transition distance to trench depth, from trench depth in the seabed to where they terminate at Hawksley EM and remove overlying mattresses.	Removes exposed sections of pipelines, thereby removing potential snagging hazards. Minimises deposition of new rock. Removes exposed sections of plastic spoiler[7] reducing bioavailability of microplastics to the local marine environment. The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PL2430 & PLU2431 (between Kelvin TM & PSSL near Murdoch MD)	Leave *in situ*. Piggybacked. Remove surface laid pipeline ends and overlying mattresses at Kelvin TM, Kelvin TM subsea tee assembly and at PSSL near Murdoch MD. At Kelvin TM remove sections of PL2430 & PLU2431 between Kelvin TM and Kelvin TM subsea tee assembly ~43m and ~31m long respectively between the cut point near the base of the riser and the pipeline flange connection at the Kelvin subsea tee assembly. Remove overlying mattresses. Locally disperse short-length of overlying rock (~27m long) near the Kelvin TM jacket to expose the pipelines if necessary. Remove surface laid section of PL2430 & PLU2431 pipelines each ~20m long between the Kelvin TM subsea tee assembly and the deposited rock downstream and remove overlying mattresses. At Murdoch MD remove surface laid sections of PL2430 & PLU2431 each ~141m long from the point of burial in rock to where they terminate at PSSL near Murdoch MD and remove overlying mattresses. The Kelvin STA and PMA and associated mattresses will be fully	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).

[7] PL2109 (& PL2110) was furnished with a plastic spoiler with a view to aiding the pipeline to bury itself.

Table 3.4.2: Outcomes of comparative assessment		
Pipeline or Group	**Recommended option**	**Justification**
	recovered to shore for reuse, recycling, or disposal.	
PL2894 & PL2895 (between Katy KT & Kelvin TM)	Leave *in situ*. Piggybacked. Remove surface laid pipeline ends and overlying mattresses near Katy KT and Katy Tee, and the overlying mattresses near Kelvin PMA and Kelvin STA. At Katy KT remove sections of PL2894 & PL2895 between Katy KT and Katy Tee ~19m and ~22m long respectively between the cut point near the base of the riser and the pipeline flange connection at the Katy tee and remove overlying mattresses. Remove surface laid section of PL2894 & PL2895 pipelines each ~38m long between the Katy Tee and the deposited rock downstream and remove overlying mattresses. Near Kelvin TM remove sections of PL2894 & PL2895 between burial in the deposited rock and the Kelvin PMA ~47m and ~49m long respectively. Remove overlying mattresses. Near Kelvin TM remove sections of PL2894 & PL2895 between the Kelvin PMA and the Kelvin STA ~40m and ~41m long respectively. Remove overlying mattresses. The Katy Tee and associated mattresses will be fully recovered to shore for reuse, recycling, or disposal.	The remaining pipelines are buried and stable throughout its length. (refer Table 2.3.1).
PIPELINE GROUP 3 (UMBILICALS)		
PLU4685 (between McAdam MM & Hawksley EM)	Partial removal. Remove surface laid umbilical ends and overlying mattresses near McAdam MM and Hawksley EM. PLU4685 shares some mattresses with PL1925 near McAdam MM. At McAdam MM remove surface laid PLU4685 ~220m long between McAdam MM and the deposited rock upstream and remove overlying mattresses. The length being removed would include a potential short exposure identified in 2007 at KP12.926 (~2m long) but it has not been observed since. Note the umbilical appears to double back on itself near McAdam MM. The length quoted here accounts for this. At Hawksley EM remove surface laid sections of PLU4685 ~87m long between the SUTU at Hawksley EM and a point of burial from within the deposited rock and remove the overlying mattresses. This length includes a short exposure ~7m long that is assumed present at KP0.028. Further, according to historical records there could be a short ~52m length of umbilical between KP0.222 and KP0.280 that should have been buried in rock but suffers from 3x freespans (~19m long) and 1x exposure (~33m long). Cut the ends of the exposed or free spanning umbilical near to where it re-enters burial in the rock.	The remaining umbilical is buried and stable throughout its length. (refer Table 2.3.1).
PLU4686 (Between Murdoch MA & McAdam MM)	Leave *in situ*. Remove surface laid umbilical ends and overlying mattresses near Murdoch MA and McAdam MM. PLU4686 shares some mattresses with PL1922 & PL1925 on approach to Murdoch MA. PLU4686 also shares some mattresses with PLU4889 & PLU4890 on the final approach to Murdoch MA. At Murdoch MA remove the surface laid PLU4686 ~362m long from the bottom of the J-tube at Murdoch MA to where it enters burial in deposited rock north of Murdoch and remove overlying mattresses. The length quoted here excludes the length of section from bell mouth of J-tube to TUTU. At McAdam MM remove the surface laid PLU4686 ~70m long - includes 25m allowance for transition distance to trench depth, from trench depth in the seabed to where it terminates at the SUTU at McAdam MM and remove overlying mattresses.	The remaining umbilical is buried and stable throughout its length. (refer Table 2.3.1).

Table 3.4.2: Outcomes of comparative assessment		
Pipeline or Group	**Recommended option**	**Justification**
PLU4888 (between Watt QM & Boulton HM)	Leave *in situ*. Remove surface laid umbilical ends and overlying mattresses near Watt QM and Boulton HM. At Watt QM remove the surface laid PLU4888 ~121m long - includes 25m allowance for transition distance to trench depth, from the SUTU at Watt QM to trench depth in the seabed and remove overlying mattresses. At Boulton BM remove the surface laid PLU4888 ~75m long - includes 25m allowance for transition distance to trench depth, from trench depth in the seabed to where it terminates at the SUTU at Boulton BM and remove overlying mattresses.	The remaining umbilical is buried and stable throughout its length. (refer Table 2.3.1).
PLU4889 (between Murdoch MA & Watt QM)	Leave *in situ*. Remove surface laid umbilical ends and overlying mattresses near Murdoch MA and Watt QM. PLU4889 also shares some mattresses with PLU4686 & PLU4890 on the final approach to Murdoch MA. At Murdoch MA remove the surface laid PLU4686 ~200m long from the bottom of the J-tube at Murdoch MA to where it enters burial in deposited rock to the east of the Murdoch installation and remove overlying mattresses. The length quoted here excludes the length of section from bell mouth of J-tube to TUTU. At Watt QM remove the surface laid PLU4889 ~115m long - includes 25m allowance for transition distance to trench depth, from trench depth in the seabed to where it terminates at the SUTU at Watt QM and remove overlying mattresses.	The remaining umbilical is buried and stable throughout its length. (refer Table 2.3.1).
PLU4890 (between Murdoch MA & Murdoch K.KM)	Leave *in situ*. Remove surface laid umbilical ends and overlying mattresses near Murdoch MA and Murdoch K.KM. PLU4890 also shares some mattresses with PLU4686 & PLU4889 on the final approach to Murdoch MA. At Murdoch MA remove the surface laid PLU4890 ~200m long from the bottom of the J-tube at Murdoch MA to where it enters burial in deposited rock to the east of the Murdoch installation and remove overlying mattresses. The length quoted here excludes the length of section from bell mouth of J-tube to TUTU. At Murdoch K.KM remove the surface laid PLU4889 ~115m long - includes 25m allowance for transition distance to trench depth, from trench depth in the seabed to where it terminates at the SUTU at Murdoch K.KM and remove overlying mattresses.	The remaining umbilical is buried and stable throughout its length. (refer Table 2.3.1).

NOTES

1. All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate;
2. Each cut pipeline or umbilical end at point of burial at or within deposited rock will be dealt with by the deposition of a small quantity of rock on top of or adjacent to existing rock. The amount used will be kept to a practical minimum and will likely be up to ~25Te;
3. For those pipelines (PL2109 & PL2110 at Munro MH & Hawksley EM), PLU4888 (at Boulton BM & Watt QM), PLU4889 (at Watt QM), PLU4890 (at Murdoch K.KM) whose point of burial is the seabed, the pipeline end will be excavated locally with small quantities of rock potentially used to ensure that the remaining pipeline end(s) are buried;
4. The pigging manifolds, subsea tees associated with these pipelines will all be fully removed along with the associated mattresses;
5. The remaining pipelines will be subject to inspection and monitoring to a schedule agreed with OPRED.

3.4.3 Pipeline crossings

The fate of pipeline crossings is explained in section 3.4.5 and so shall not be repeated here.

3.4.4 Subsea structures & stabilisation features

Table 3.4.3: Subsea structures and stabilisation features			
Subsea structures	**Number**	**Option**	**Disposal route (if applicable)**
Katy Tee Protection Structure	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Concrete mattresses	5	Complete removal	Remove to shore for reuse or recycling.
Kelvin/Murdoch Subsea Pigging Skid	1	Complete removal	Remove to shore for reuse or recycling.
Mattresses	n/a	n/a	Refer PL2430 & PLU2431.
Kelvin PMA	1	Complete removal	Cut 4x piles at 3m below seabed, remove to shore for reuse or recycling.
Concrete mattresses (6m x 3m x 0.3m)	8	Complete removal	Remove to shore for reuse or recycling.
Kelvin STA	1	Complete removal	Remove to shore for reuse or recycling.
Concrete mattresses (6m x 3m x 0.3m)	2	Complete removal	Remove to shore for reuse or recycling.
McAdam Tee	1	Complete removal	Remove along with section of PL1922 to shore for reuse or recycling.
Anchored fronded mattresses	n/a	n/a	Refer PL1922 & PL1925.
PSNL	1	Complete removal	Remove to shore for reuse or recycling.
Anchored fronded mattresses (5m x 5m)	2	Complete removal	Remove to shore for reuse or recycling.
PSSL	1	Complete removal	Remove to shore for reuse or recycling.

NOTE

1. All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate;
2. Assuming there would be no technical issues, the piles will be internally cut 3.0m below the seabed. Should any difficulties be encountered in accessing the piles internally and an external excavation be required, OPRED will be consulted before the piles are cut;
3. Where identified it is intended that mattresses be fully recovered to shore. However, should practical difficulties ensue OPRED will be consulted;
4. Any grout bags not listed but that are found exposed will be removed;
5. Recycling synthetic materials as energy is an aspiration.

3.4.5 Pipeline protection & stabilisation features

As explained in Table 3.4.2 all the surface laid pipeline and umbilical ends are to be recovered to shore for reuse, recycling, or disposal. This includes the overlying mattresses. The exceptions to this are those mattresses that are buried under deposited rock at pipeline crossings. These will be left *in situ*. The tables in this section also explain the fate of materials at pipeline crossings which are noted in the left-hand column of the table.

The following general notes apply to all the tables in this section:

- There is no record of stabilisation features other than those listed in this table;
- Notional quantities of grout bags (25kg) estimated and based on expectation;
- Mass of deposited rock is estimated, based on the estimated volume and profile;
- Where identified it is intended that mattresses be fully recovered to shore. However, should practical difficulties ensue OPRED will be consulted;
- Grout bags that are exposed will be removed;
- All materials that are identified for removal will be recovered to shore for reuse, recycling, or disposal as appropriate.

Table 3.4.4: Pipeline Protection & Stabilisation Features (PL1436 & PL1437)			
Protection or stabilisation features	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE BOULTON BM 500M ZONE			
Concrete fronded mattresses	22	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	2,385Te	Leave *in situ*	n/a
INFIELD BETWEEN BOULTON BM & MURDOCH MD			
Deposited rock	2,767Te	Leave *in situ*	n/a
INSIDE MURDOCH 500M ZONE			
Concrete mattresses	12	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	2,926Te	Leave *in situ*	n/a

Table 3.4.5: Pipeline stabilisation features (PL1922 & PL1925)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE HAWKSLEY EM 500M ZONE (PL1922)			
Anchored fronded mattresses	7	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	22	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	5	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	150	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	2,003Te	Leave *in situ*	n/a
INSIDE HAWKSLEY EM 500M ZONE (PL1925)			
Anchored fronded mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	24	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,781	Leave *in situ*	n/a
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM 500M ZONE (PL1922)			
Deposited rock	10,240Te	Leave *in situ*	n/a
Concrete mattresses at Tyne-Trent PL1222 & PL1222 pipeline crossing	5	Leave *in situ*	n/a
Deposited rock including Tyne-Trent PL1222 & PL1222 pipeline crossing	5,549Te	Leave *in situ*	n/a
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM (PL1925 & PLU4685)			
Deposited rock	Refer PLU4685		
Concrete mattresses	Refer PLU4685		
INSIDE MCADAM MM 500M ZONE (PL1922)			
Anchored fronded mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	12	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	4	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	962Te	Leave *in situ*	n/a
INSIDE MCADAM MM 500M ZONE (PL1925)			
Anchored fronded mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	19	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	2	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	Refer PLU4685		

Table 3.4.5: Pipeline stabilisation features (PL1922 & PL1925)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE MCADAM MM 500M ZONE (PL1922 & PL1925)			
Deposited rock	962Te	Leave *in situ*	n/a
INFIELD BETWEEN MCADAM MM & MURDOCH MD (PL1922 & PL1925)			
Deposited rock	5,788Te	Leave *in situ*	n/a
INSIDE MURDOCH MD 500M ZONE (PL1922 & PL1925)			
Anchored fronded mattresses	16	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	43	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	24	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	5,915Te	Leave *in situ*	n/a

Table 3.4.6: Pipeline stabilisation features (PL1923 & PL1926)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE MURDOCH K.KM 500M SAFETY ZONE (PL1923 & PL1926)			
Anchored fronded mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	16	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	6	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	300	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,725Te	Leave *in situ*	n/a
INSIDE MURDOCH MD 500M ZONE (PL1923 & PL1926)			
Concrete mattresses & deposited rock	Refer PLU4890	Refer PLU4890	Refer PLU4890
Concrete fronded mattresses	12	Completely remove	Remove to shore for reuse, or recycling
Deposited rock	5,498Te	Leave *in situ*	n/a

Table 3.4.7: Pipeline stabilisation features (PL1924 & PL1927)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE BOULTON HM 500M SAFETY ZONE (PL1924 & PL1927)			
Anchored fronded mattresses	8	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	11	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	6	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,725Te	Leave *in situ*	n/a
INFIELD BETWEEN BOULTON BM & WATT QM (PL1924 & PL1927)			
Deposited rock	7,417Te	Leave *in situ*	n/a
Deposited rock	2,500Te	Leave *in situ*	n/a
INSIDE WATT QM 500M ZONE (PL1924 & PL1927)			
Anchored fronded mattresses	14	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	38	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	12	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	8,743Te	Leave *in situ*	n/a
Deposited rock incl. Schooner pipeline crossing (PL1222 & PL1223)	1,536Te	Leave *in situ*	n/a

Table 3.4.7: Pipeline stabilisation features (PL1924 & PL1927)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INFIELD BETWEEN WATT QM & MURDOCH MD (PL1924 & PL1927)			
Deposited rock	17,107Te	Leave *in situ*	n/a
Concrete mattresses at Ketch pipeline crossing (PL1612 & PL1613)	29	Leave *in situ*	n/a
Deposited rock incl. Ketch pipeline crossing (PL1612 & PL1613)	8,045Te	Leave *in situ*	n/a
MURDOCH MD 500M ZONE (PL1924 & PL1927)			
Concrete fronded mattresses	35	Completely remove	Remove to shore for reuse or recycling.
Deposited rock incl. Caister pipeline crossing (PL935 & PL936).	461Te	Leave *in situ*	n/a
Deposited rock	7,425Te	Leave *in situ*	n/a

Table 3.4.8: Pipeline stabilisation features (PL2109 & PL2110)			
Stabilisation feature	**Number (UNO)**	**Option**	**Disposal route (if applicable)**
INSIDE MUNRO MH 500M ZONE (PL2109 & PL2110)			
Concrete mattresses	21	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
INSIDE HAWKSLEY EM 500M ZONE (PL2109 & PL2110)			
Concrete fronded mattresses	29	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	509Te	Leave *in situ*	n/a

Table 3.4.9: Pipeline Stabilisation Features (PL2430 & PLU2431)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE KELVIN TM 500M ZONE (PL2430 & PLU2431)			
Concrete mattresses	15	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	4,054Te	Leave *in situ*	n/a
INFIELD BETWEEN KELVIN TM & MURDOCH MD (PL2430 & PLU2431)			
Deposited rock	1,558Te	Leave *in situ*	n/a
INSIDE MURDOCH MD 500M ZONE (PL2430 & PLU2431)			
Concrete fronded mattresses	32	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses at PL1922 & PL1925 pipeline crossing	5	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,749Te	Leave *in situ*	n/a

NOTES:

1. The details are not known but the 'initiation pile' noted on Figure A1.1.1 (also refer Figure 3.4.1 below) underneath the concrete fronded mattress at the pipeline bend will need to be fully removed or cut to 3m below seabed whichever involves the least disruption to the local seabed.

Figure 3.4.1: Residual pile stick-up prior to installation of mattress

Table 3.4.10: Pipeline stabilisation features (PL2894 & PL2895)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE KATY KT 500M ZONE (PL2894 & PL2895)			
Concrete mattresses	11	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,542	Leave *in situ*	n/a
INFIELD BETWEEN KATY KT & KELVIN TM (PL2894 & PL2895)			
Deposited rock	3,816	Leave *in situ*	n/a
INSIDE KELVIN TM 500M ZONE (PL2894 & PL2895)			
Concrete mattresses	13	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	400	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	1,622	Leave *in situ*	n/a

Table 3.4.11: Pipeline stabilisation features (PLU4685)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE HAWKSLEY EM 500M ZONE (PLU4685)			
Concrete fronded mattresses	3	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	200	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	5,209Te	Leave *in situ*	n/a
INFIELD BETWEEN HAWKSLEY EM & MCADAM MM (PLU4685 & PL1925)			
Deposited rock	35,035Te	Leave *in situ*	n/a
Concrete mattresses Tyne-Trent pipeline (PL1220 & PL1221) crossing	1	Leave *in situ*	n/a
Deposited rock Tyne-Trent pipeline (PL1220 & PL1221) crossing	1,874Te	Leave *in situ*	n/a
INSIDE MCADAM MM 500M ZONE (PLU4685)			
Anchored fronded mattresses	1	Completely remove	Remove to shore for reuse or recycling.
Concrete fronded mattresses	14	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	529Te	Leave *in situ*	n/a

Table 3.4.12: Pipeline stabilisation features (PLU4686)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MCADAM MM 500M ZONE (PLU4686)			
Concrete fronded mattresses	8	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
INFIELD BETWEEN MCADAM MM & MURDOCH MA (PLU4686)			
Deposited rock	208Te	Leave *in situ*	n/a
INSIDE MURDOCH MA 500M ZONE (PLU4686)			
Concrete fronded mattresses PL2430 & PLU2431 crossing, Tampnet cable crossing, PL1922 & PL1925 crossing, PL1923 & PL1926 crossing, PL1924 & PL1927 crossing	48	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses Tampnet cable crossing	2	Leave *in situ*	n/a
Concrete mattresses Tampnet cable crossing	3	Leave *in situ*	n/a
Deposited rock	801Te	Leave *in situ*	n/a
Deposited rock	3,406Te	Leave *in situ*	n/a
Concrete mattresses Caister pipeline (PL935 & PL936) crossing	2	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses Ketch pipeline (PL1612 & PL1613) crossing	2	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses Schooner pipeline (PL1222 & PL1223) crossing	2	Completely remove	Remove to shore for reuse or recycling.

Table 3.4.12: Pipeline stabilisation features (PLU4686)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
Concrete mattresses TGT pipeline (PL929 & PL930) crossing	2	Completely remove	Remove to shore for reuse or recycling.
Concrete mattresses Boulton BM pipeline (PL1436 & PL1437)	2	Completely remove	Remove to shore for reuse or recycling.

Table 3.4.13: Pipeline stabilisation features (PLU4888)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE BOULTON HM 500M ZONE (PLU4888)			
Concrete fronded mattresses	4	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	150	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	539Te	Leave *in situ*	n/a
INFIELD BETWEEN BOULTON HM & WATT QM (PLU4888)			
Deposited rock	2,853Te	Leave *in situ*	n/a
Concrete mattresses Schooner pipeline (PL1222 & PL1223) crossing shared with PL1924 & PL1927	3	Leave *in situ*	n/a
Deposited rock Schooner pipeline (PL1222 & PL1223) crossing shared with PL1924 & PL1927.	1,212Te	Leave *in situ*	n/a
Concrete mattresses Tampnet cable crossing, shared with PL1924 & PL1927.	3	Leave *in situ*	n/a
Deposited rock incl. Tampnet cable crossing, shared with PL1924 & PL1927.	1,268Te	Leave *in situ*	n/a
INSIDE WATT QM 500M ZONE (PLU4888)			
Concrete fronded mattresses	19	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	150	Completely remove	Remove to shore for reuse or recycling.

Table 3.4.14: Pipeline stabilisation features (PLU4889)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE WATT QM 500M ZONE (PLU4889)			
Concrete fronded mattresses	15	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	150	Completely remove	Remove to shore for reuse or recycling.
INFIELD BETWEEN WATT QM & MURDOCH MA (PLU4889)			
Deposited rock	5,910Te	Leave *in situ*	n/a
Concrete mattresses Ketch pipeline (PL1612 & PL1613) crossing	3	Leave *in situ*	n/a

Table 3.4.14: Pipeline stabilisation features (PLU4889)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
Deposited rock incl. Ketch pipeline (PL1612 & PL1613) crossing	968Te	Leave *in situ*	n/a
INSIDE MURDOCH MA 500M ZONE (PLU4889)			
Concrete mattresses Tampnet cable crossing	2	Leave *in situ*	n/a
Concrete mattresses Ketch pipeline (PL1612 & PL1613) crossing	2	Leave *in situ*	n/a
Concrete mattresses Schooner pipeline (PL1222 & PL1223) crossing shared with PLU4890.	2	Leave *in situ*	n/a
Concrete fronded mattresses	5	Completely remove	Remove to shore for reuse or recycling.
Deposited rock	4,474Te	Leave *in situ*	n/a

Table 3.4.15: Pipeline stabilisation features (PLU4890)			
Stabilisation feature	**Number (UNO)**	**Location(s)**	**Exposed / buried / condition**
INSIDE MURDOCH K.KM 500M ZONE (PLU4890)			
Concrete fronded mattresses	16	Completely remove	Remove to shore for reuse or recycling.
Grout bags (25kg)	100	Completely remove	Remove to shore for reuse or recycling.
INSIDE MURDOCH MA 500M ZONE (PLU4890)			
Concrete mattresses Tampnet cable crossing	3	Leave *in situ*	n/a
Concrete mattresses Caister pipeline (PL935 & PL936) crossing	2	Leave *in situ*	n/a
Concrete mattresses Ketch pipeline (PL1612 & PL1613) crossing	2	Leave *in situ*	n/a
Concrete mattresses Schooner pipeline (PL1222 & PL1223) crossing shared with PLU4889.	Refer PLU4889		
Concrete mattresses Boulton HM pipeline (PL1924 & PL1927) and umbilical PLU4889 crossing	2	Leave *in situ*	n/a
Deposited rock	5,346Te	Leave *in situ*	n/a

3.5 Wells

Table 3.5.1: Well decommissioning
The Caister-Murdoch System – excluding Caister and Murdoch MA, MC, and MD, hosts several wells as listed in Table 2.4.1. All wells will be decommissioned in accordance with latest version of the Oil & Gas UK Well Decommissioning Guidelines. A Master Application Template (MAT) and the supporting Subsidiary Application Template (SAT) will be submitted in support of works carried out. An application to decommission the wells will be made via the online Well Operations Notification System (WONS) on the OGA Energy Portal. Well decommissioning will be scheduled in accordance with the outline schedule presented in Section 6.3.

3.6 Waste Streams

The Able UK Seaton Port in Hartlepool is the decommissioning facility that has been selected and will manage all wastes. ABLE offers speciality services in the decommissioning and recycling of end of life vessels and marine structures. This is part due to the unique offer to undertake the work at the large scale, specialised ABLE Seaton Port Facility in Hartlepool, North East of England. Chrysaor have used the organisation for previous decommissioning activities including the LOGGS complex structures.

Table 3.6.1: Waste stream management method

Waste stream	Removal and disposal method
Bulk liquids	Residual hydrocarbons have already been removed from topsides. Further cleaning and decontamination will take place onshore prior to reuse or recycling.
Marine growth	Where necessary and practicable, to allow access some marine growth will be removed offshore. The remainder will be brought to shore and disposed of according to guidelines and company policies and under appropriate permit.
NORM	Tests for NORM have been undertaken offshore by the Radiation Protection Supervisor. and recorded. Any NORM encountered onshore will be dealt with and disposed of in accordance with guidelines and company policies and under appropriate permit.
Asbestos	Given the age of the installations asbestos can be expected and will be dealt with and disposed of in accordance with guidelines and company policies.
Chromium VI	Given the age of the platforms Chromium VI paints may have been used for corrosion protection. Checks will be done to confirm whether Chromium IV is present on the platform using the correct PPE taking account of COSHH Regulations 2002. The material will be disposed of according to guidelines and company policies and under appropriate permit.
Other hazardous wastes	Other hazardous waste will be recovered to shore and disposed of according to guidelines and company policies and under appropriate permit.
Onshore dismantling sites	Appropriate licensed sites will be selected. The dismantling site must demonstrate proven disposal track record and waste stream management throughout the deconstruction process and demonstrate their ability to deliver reuse and recycling options.

Table 3.6.2: Inventory disposition

Asset	Inventory	Total (Te)	Planned materials to shore (Te)	Planned materials decommissioned *in situ* (Te)
Boulton BM	Installations	1,159	956	203
	Pipelines	1,788	330	1,458
	Deposited rock	8,077	-	8,077
Boulton HM	Installations	118	118	-
	Pipelines	4,165	1,258	2,907
	Deposited rock	34,265	-	34,265
Hawksley EM	Installations	70	70	-
	Pipelines	6,488	1,810	4,678
	Deposited rock	33,404	-	33,404
Katy KT	Installations	1,186	934	252
	Pipelines	2,462	275	2,187
	Deposited rock	38,895	-	38,895
Kelvin TM	Installations	985	772	213
	Pipelines	3,639	747	2,892
	Deposited rock	7,359	-	7,359

Table 3.6.2: Inventory disposition				
Asset	**Inventory**	**Total (Te)**	**Planned materials to shore (Te)**	**Planned materials decommissioned *in situ* (Te)**
McAdam MM	Installations	158	158	-
	Pipelines	922	766	156
	Deposited rock	4,415	-	4,415
Munro MH	Installations	761	596	165
	Pipelines	2,316	541	1,775
	Deposited rock	7,223	-	7,223
Murdoch K.KM	Installations	93	93	-
	Pipelines	1,581	637	944
	Deposited rock	5,346	-	5,346
Watt QM	Installations	93	93	-
	Pipelines	407	223	184
	Deposited rock	51,799	-	51,799
SUB-TOTALS:	**Installations**	**4,625**	**3,792**	**833**
	Pipelines	**23,769**	**6,587**	**17,182**
	Deposited rock	**190,784**	**0**	**190,784**

NOTE:
1. There may be slight discrepancies due to rounding. The figures have not been adjusted to allow for this.

4 Environmental Appraisal overview

4.1 Environmental sensitivities (summary)

Table 4.1.1: Environmental sensitivities	
Environmental Receptor	**Main Features**
Conservation interests	**Protected habitats:** The majority of the CMS infrastructure is located within the Dogger Bank Special Area of Conservation (SAC) and the Southern North Sea SAC. The Dogger Bank SAC is the largest sandbank in UK waters and is designated for the Annex I feature '*Sandbanks which are slightly covered by seawater all the time*'. The Conservation Objectives for the site are to ensure that the features are to be in favourable condition thus ensuring site integrity in the long term and contribution to Favourable Conservation Status (FCS). This contribution would be achieved by maintaining or restoring, subject to natural change: • The extent and distribution of the qualifying habitat in the site; • The structure and function of the qualifying habitat in the site; and • The supporting processes on which the qualifying habitat relies. The Southern North Sea SAC has been identified as an area of importance for the Annex II species the harbour porpoise. This site includes key winter and summer habitat for this species. The Conservation Objectives of the site are to ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining FCS for harbour porpoise in UK waters. In the context of natural change, this will be achieved by ensuring that: • Harbour porpoise is a viable component of the site; • There is no significant disturbance of the species; and • The condition of supporting habitats and processes, and the availability of prey is maintained. The Inner Dowsing, Race Bank and North Ridge SAC is designated for 'Sandbanks slightly covered by water at all times' and for 'Reefs'. The area encompasses a wide range of sandbank types which host a diverse variety of species, and biogenic reef formed by the Ross worm, *Sabellaria spinulosa*. Both the Humber Estuary SPA and the Greater Wash SPA are designated for a number of breeding and non-breeding bird species. The Humber Estuary SPA is additionally designated for the presence of waterbird assemblages. **Protected species:** Annex II species likely to be sighted within the area of the proposed decommissioning activities include harbour porpoise, grey seals, and harbour seals. Cod *Gadus morhua* are OSPAR listed threatened and/or declining species and are known to use the CMS for spawning and as a nursery. Survey footage identified three fish belonging to the family *Gadidae*, which cod are part of, however the species

Table 4.1.1: Environmental sensitivities	
Environmental Receptor	**Main Features**
	was not identified. The ocean quahog (*Arctica islandica)* is among the longest-lived and slowest growing marine bivalves and is on the OSPAR list of threatened and/or declining species and habitats in the North Sea. It is also a Feature of Conservation Importance (FOCI) for which Marine Conservation Zones can be designated. One *A. islandica* individual was identified in a 2015 survey. A single juvenile individual was identified at in 2020. Bivalve siphons were observed in the 2020 survey throughout the CMS area however it is not possible to identify the species from the siphon alone therefore this cannot confirm the presence of more *A. islandica*. *S.spinulosa* is a small, tube-building polychaete worm and is also on the OSPAR list of threatened and/or declining species and habitats in the North Sea. 21 individuals of *S. spinulosa* were identified from samples taken at the Murdoch Hub, however none were observed in seabed imagery. A 968m stretch of *S. spinulosa* reef was observed during a 2006 survey of the PL929/PL930 between KP31.390 and KP32.358. Three smaller patches (≤2m long) of *S. spinulosa* were observed along the PL935/PL936, close to the Murdoch Hub. Faunal burrows were observed throughout the area surveyed in 2020. However, only one site at Kelvin TM displayed burrows at a density sufficient to register on the Marine Nature Conservation Review SACFOR scale as showing a level of similarity to the OSPAR habitat '*seapens and burrowing megafauna community'*. Despite this, the burrows observed cannot be confidently attributed to any of the 'megafauna' species associated with this OSPAR habitat. Instead, the burrows observed at Kelvin TM and within the CMS area more likely relate to a number of species characteristic of the Dogger Bank community, including sand eels. Therefore, this habitat is not thought to be present within the CMS area.
Seabed and benthos	The seabed near the CMS infrastructure is predominantly composed of EUNIS biotope A5.23 or A5.24: Infralittoral fine sand or Infralittoral muddy sand and A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand. The mean particle size across the CMS was consistent with the SNS UKOOA mean particle size of 243µm (fine sand). There were some observed patches of coarser sediments at Boulton BM, Munro MH, Katy KT and Hawksley EM, in addition to some gravel observed at the Murdoch Hub (where particle size was up to 2063µm). The seabed sediments remain relatively consistent along the pipelines to shore. The PL929/PL930 travelling to shore pass through a band of A5.15: Deep circalittoral coarse sediment. This is followed by an area of A5.14 Circalittoral coarse sediment, small outcrops of A5.25 or A5.26 Circalittoral fine sand or Circalittoral muddy sand may be encountered for a stretch. Finally, the pipelines pass through a thin section of A5.13 Infralittoral coarse sediment just prior to landfall. Total Hydrocarbon (THC) concentrations were below the Significant Environmental Impact (SEI) threshold across the CMS, and there is no evidence of drilling related hydrocarbon contamination. Reported Polycyclic Aromatic Hydrocarbon (PAH) concentrations were in line with levels typical of the wider SNS. Polychlorinated biphenyl (PCB) levels were below Limit of Detection (LOD). All detectable concentrations of heavy metals were above their respective OSPAR (2005) Background Concentrations. However, this is to be expected due to the heavily industrialised nature of the SNS. Organotin concentrations were below LOD, except at a single station at the Murdoch Hub.

Table 4.1.1: Environmental sensitivities	
Environmental Receptor	**Main Features**
	Spatangoida (juveniles; the order of heart urchins) and *Spipohanes bombyx*, a polychaete, featured across the CMS. Juvenile *Spatangoida* dominated the benthos by number at almost every location however, when assessing the adult-only populations, the dominant taxa were more variable across the CMS though generally were polychaetes. Only at Katy KT was the infaunal community dominated by molluscs.
Fish	The CMS is located within an area of high intensity spawning for plaice and sandeel. The following species are also known to use the area for spawning: cod, herring, mackerel, *Nephrops*, sole, sprat, and whiting. Additionally, the following species use the area as nursery grounds: anglerfish, blue whiting, cod, European hake, herring, ling, mackerel, *Nephrops*, sandeel, spurdog, sprat, and tope shark. Whiting use the area as a high intensity nursery. The probability of juvenile fish aggregations occurring is the CMS is low for: plaice, sole, hake, anglerfish, blue whiting, Norway pout, mackerel, haddock, and cod. The probability of juvenile herring, horse mackerel, sprat, and whiting being present in the CMS area is low-moderate.
Commercial fishing	The CMS area is located in International Council for the Exploration of the Seas (ICES) statistical rectangle 37F2. The associated PL929 and PL930 pass through rectangles 37F1, 36F1, 36F0, and 35F0. Fisheries landings vary throughout the project area. At the CMS area in 2019, the catch was mostly demersal and was relatively low compared to other rectangles. Closer to shore shellfish make up the majority of landings the value of which was very high; in rectangles 36F1, 36F0 and 35F0 closest to shore the value of catch was >£1,000,000 every year from 2015 onwards. Commercial fishing effort was also highest in rectangle 36F0 (2,344 days in 2019). This effort is consistently high across all months excluding January, February, November, and December when effort is moderate. Effort is much lower around the CMS (rectangle 37F2). Fishing effort in other rectangles is comparatively low (<100 days per month).
Marine mammals	Harbour porpoise, minke whale, white-beaked dolphin, and long-finned pilot whale have all been observed within the vicinity of the project. For all species but harbour porpoise, they are found in relatively low numbers in the CMS or have low abundance estimates. Harbour porpoise are common in the SNS and frequent the area throughout much of the year. They are thought to be found in the area at a density of 0.888 animals/km^2 which is relatively high compared to other areas of the North Sea. All of the cetacean species are both European Protected Species (EPS) and are covered by the UK Biodiversity Action Plan (UK BAP). Both grey and harbour seal densities are relatively low offshore in the CMS area. However, where the PL929 and PL930 arrive at the shore seal density is much higher, particularly for grey seals. Grey seals use the Humber Estuary SAC in autumn to form large breeding colonies. Comparatively, harbour seals use the Wash and North Norfolk Coast SAC (~27 km south of the TGT) for breeding and hauling-out. Both pinniped species are Annex II listed.
Seabirds	The following species are present in the CMS area across the majority of the year: northern fulmar, northern gannet, great black-backed gull, black-headed gull, common gull, herring gull, Atlantic puffin, black-legged kittiwake, common guillemot, razorbill, little auk, and lesser black-backed gull. Seabird sensitivity to oil (according to the Seabird Oil Sensitivity Index) is low throughout the year and highest in July and

Table 4.1.1: Environmental sensitivities	
Environmental Receptor	**Main Features**
	between November and January (Blocks 44/21, 44/22, 44/23, 44/17, 44/18, 44/19). Block 48/2, approximately half-way along the PL929 and PL930, is high, very high, or extremely high every month of the year. In the Blocks nearest to the coast (47/17, 47/18) sensitivity is highest between October and December, and in March.
Onshore communities	An onshore decontamination and dismantlement facility will be UK based and will be one that is deemed able to comply with all relevant permitting and legislative requirements.
Other users of the sea	The CMS is located in a mature area of the SNS with extensive oil and gas development. There are ten oil and gas surface structures within 50 km of the project, the nearest being 20.1 km away. Shipping in the project area is variable; closest to shore Blocks 47/18, 47/19, 47/20, 47/15, experience very high shipping activity, due to their proximity to the Humber Estuary. In the CMS area shipping is moderate (in Blocks 44/22 and 44/23) to high (Blocks 44/17, 44/18 and 44/19). Two telecom cables come within 1km of the Murdoch platform (Tampnet cable and MCCS). The PL929 and PL930 do not cross any third-party telecom cables. However, as there is much renewable energy activity in the area, the pipelines to shore do cross the Hornsea 1 active export cable. Furthermore, the PL929 and PL930 pass through the Hornsea 2 area for ~25 km, and through the Triton Knoll windfarm area which is currently under construction. The Race Bank windfarm (and proposed extension), and the Lincs windfarm are also both located within 15 km of the PL929/PL930. Blocks 47/18, 47/19, 47/20, 47/15, 43/29, 43/30, and 44/26 are of concern to the Ministry of Defence (MoD) as they lie within training ranges. Additionally, Block 47/17, in which the PL929 and PL930 terminate at the shore, has been excluded from consideration of granting development licenses at the request of the MoD. There are seven non-dangerous wrecks within 20 km of Murdoch. There is a single dangerous wreck 18 km from Murdoch. There are no designated historical wrecks recorded in the area.
Atmosphere	Energy will be used during decommissioning activities, and this will result in atmospheric emissions. Once decommissioning has been completed, pipeline surveys will likely be required in future, incurring further use of energy use and the resulting emissions.

4.2 Potential environmental impacts and their management

4.2.1 Environmental impact assessment summary

The potential environmental impacts associated with the decommissioning activities have been assessed and it is concluded that the proposed decommissioning of the infrastructure can be completed without causing significant adverse impact to the environment. The EA assesses the potential environmental impacts by identifying interactions between the proposed decommissioning activities and the associated environmental receptors. It also describes the proposed mitigation measures designed to avoid or reduce the identified potential environmental impacts and how these will be managed in accordance with Chrysaor's Environmental Management System (EMS) while considering responses from stakeholders. It is expected that CDP1b, CDP2 and CDP3 will be addressed as a campaign of decommissioning work, so much of the following information is explained in these terms.

Table 4.2.1: Environmental Impact Management

Activity	Main Impacts	Management
Vessel activity during installation and pipeline decommissioning activities	Atmospheric emissions	The majority of atmospheric emissions for the decommissioning of CDP1b, CDP2 [3] and CDP3 [2] combined relate to vessel use or are associated with the recycling of material returned to shore. The majority of atmospheric emissions for the decommissioning of the CMS relate to vessel use or are associated with the recycling of material returned to shore. The worst-case estimated CO_2 emissions to be generated by the selected decommissioning options are 339,358 Te, this equates to 2.6% of the total UKCS emissions in 2018 (13,200,000 Te) and includes any theoretical emissions associated with the remanufacture of infrastructure remaining *in situ*. Almost all future emissions (from project operations and vessels) will cease once decommissioning has been completed. All combustion plant including engines and generators on the vessels will be well maintained and correctly operated to ensure that they are working efficiently to minimise energy use and gaseous emissions. Vessel operations will be minimised where practical.
Decommissioning of installations and pipelines	Seabed disturbance	There is potential for decommissioning activities to generate disturbance to the seabed; including the decommissioning of pipelines *in situ* and any associated remediation, and the removal of substructures. Seabed impacts may range in duration from short-term impacts, such as temporary sediment suspension or smothering, to permanent impacts, such as the introduction of new substrate or any consequential habitat or community level changes which may transpire. The proposed decommissioning activities associated with CDP1b, CDP2 [3] and CDP3 [2] combined may impact an area of 0.093 km^2 SNS habitat. Much of this activity is due to take place within the Dogger Bank SAC (0.0697 km^2) which is designated for the presence of Annex I

Table 4.2.1: Environmental Impact Management		
Activity	**Main Impacts**	**Management**
		'*Sandbanks which are slightly covered by sea water all the time*'. While the activities may result in the mortality of some individuals, many of the taxa within the CMS area are relatively resilient; sandy communities are comparatively quick to recover from disturbance. Additionally, S. spinulosa is unlikely to be directly affected by the project activities within the CMS or associated with contingency activities along the PL929/PL930 associated with CDP3 [2]. With regards to the sediment and benthic features within the Dogger Bank SAC, the CMS activities are unlikely to affect the natural physical processes of the area. Pipelines being decommissioned *in situ* are also unlikely to have an impact on these processes and their gradual degradation over time will have a negligible impact on the surrounding sediments. Chrysaor are committed to leaving a clear, safe seabed in the wake of the decommissioning activities. The clear seabed will be validated by a verification survey over the installation sites and pipeline corridors. Non-intrusive verification techniques will be considered in the first instance, but where these are deemed inconclusive by the NFFO, seabed clearance is likely to require conventional overtrawl survey methods. The methods used will be discussed and finalised with OPRED.
Decommissioning of pipelines *in situ*	Physical presence of infrastructure decommissioned *in situ*	The preferred option from the CA is to decommission all the pipelines/umbilicals *in situ*, with some sections of some pipelines qualifying for partial removal. The physical presence of infrastructure decommissioned *in situ* has the potential to impact other sea users. The potential impacts identified to commercial fisheries were limited to the potential for legacy impacts such as the snagging of fishing gears on flowlines decommissioned *in situ*, and any snagging risk due to existing seabed depressions. The majority of pipelines within the CMS are stably buried to a suitable depth. Most of the pipeline exposures are at the pipeline ends and will be addressed when ends are cut, removed, and remediated. Two pipelines qualified for partial removal and these sections to be removed coincide with areas which have higher levels of exposure. The PL929/PL930 to shore have the highest level of exposure and the PL929 is the only pipeline along which reportable spans are located. Of the two reportable spans, one is within 100 m of the Murdoch Hub and neither are located near areas of high intensity trawling. Owing to the nature of the seabed and physical processes in the CMS, depressions are likely to become backfilled over time and the incidence of a snagging event is highly unlikely. Pipelines and stabilisation features decommissioned *in situ* will continue to be shown on Navigational charts. A clear seabed verification survey (using non-intrusive techniques in the first instance) will be undertaken following completion of the decommissioning works.

Table 4.2.1: Environmental Impact Management		
Activity	**Main Impacts**	**Management**
		The presence of stabilisation features remaining *in situ* will not compromise the integrity of the environmental feature of the seabed in the area.
Vessel activity during installation and pipeline decommissioning operations	Physical presence of vessels in relation to other sea users	The presence of a small number of vessels for decommissioning activities associated with CDP1b [2], CDP2 and CDP3 [3] will be short-term in the context of the life of the CMS fields. Activity will occur using similar vessels to those currently deployed for oil and gas installation, operation, and decommissioning activities across the SNS. Furthermore, most of the decommissioning works will be carried out within the 500 m zones, thereby using the area around existing infrastructure, and not occupying 'new' areas. Vessel presence will be spatially and temporally restricted so exclusion will only be short-term. The decommissioning of the CMS area is estimated to require eight different vessel types. They would not all be on location at the same time. For the overall campaign covering CDP1b [2], CDP2 and CDP3 [3] the vessel activities are expected to over approximately 804 days; most of these days are attributed to the removal of the surface installations. Overall levels of vessel activity attributed to the decommissioning are likely to be similar to those experienced under typical conditions. The nearshore activities associated with this project are very likely to be limited in duration and limited to passing vessels. Other sea users will be notified in advance of planned activities through the appropriate mechanisms, meaning those stakeholders will have time to make any necessary alternative arrangements during the finite period of operations.
Underwater activities during decommissioning operations	Underwater noise	A noise assessment has been completed to determine the likely impact of noise generated by the proposed operations on marine mammals in the surrounding area. On the basis of the expected noise emissions, there is no requirement to adopt additional mitigation to limited potential for impact. However, there are control measures built into the project that will ensure noise emissions are not greater than would be required to execute the decommissioning activities. For example, machinery and equipment will be well-maintained and the number of vessels will be minimised as far as possible. Given the location of the project within the Southern North Sea SAC, the generation of underwater noise is also a concern, particularly with regards to Annex II harbour porpoise for which the site is designated. Noise emissions are expected to be sufficiently low that injury will not occur from any of the activities. With regards to disturbance, potential zones of avoidance around vessels or cutting activities are not predicted to extend beyond approximately 100m. There is no intention to use underwater explosives during these activities. In the extremely unlikely

Table 4.2.1: Environmental Impact Management		
Activity	**Main Impacts**	**Management**
		event that the requirement changes, project-specific noise modelling may be undertaken to inform the risk of injury in the impact assessment and mitigation requirements. The requirement will be discussed with OPRED Environmental Management Team.
Vessel activity during installation and pipeline decommissioning operations	Discharges to sea	Discharges from vessels are regulated activities that are managed on an ongoing basis through existing legislation and compliance controls. All subsea infrastructure in the CMS area has been drained and flushed at CoP. This is a pre-decommissioning activity which has been permitted as appropriate, and therefore, falls outside the scope of the EA. Any discharges from infrastructure occurring during decommissioning activities will similarly be assessed in more detail as part of the environmental permitting process (e.g. through Master Application Templates/Subsidiary Application Templates). Controls will be in place, as relevant, through the Offshore Chemical Regulations and the Oil Pollution Prevention and Control regulations. The pipelines have already been flushed and cleaned.
Vessel activity during installation and pipeline decommissioning operations; manufacture of materials required to carry out the decommissioning activities	Resource Use	Generally, resource use from the proposed activities will require limited raw materials and be largely restricted to fuel use. Any opportunities for increasing fuel efficiency and reducing use of resources will be identified and implemented by Chrysaor where possible. The estimated total energy usage for the project is 3,635,554 GJ. This number accounts for all operations, material recycling, and the resource loss associated with decommissioning items *in situ*. This is considered low compared to the resources generated during the production phase of the project.
Waste management	Waste	The onshore treatment of waste from the CMS decommissioning activities will be undertaken according to the principles of the waste hierarchy, a conceptual framework which ranks the options for dealing with waste in terms of sustainability. Wastes will be treated using the principles of the waste hierarchy, focusing on the reuse and recycling of wastes where possible. Raw materials will be returned to shore with the expectation to recycle the majority of the returned non-hazardous material. Other non-hazardous waste which cannot be reused or recycled will be disposed of to a landfill site. Facilities requiring removal as part of the CMS DPs will be transferred to shore by a heavy lift vessel for decontamination, dismantlement, disposal, recycling or reuse. Typically, around 95% of the materials from decommissioning projects can be recycled. Hazardous waste resulting from the dismantling of the CMS facilities will be pre-treated to reduce hazardous properties or render it non-hazardous prior to recycling or disposing of it to a landfill site.

Table 4.2.1: Environmental Impact Management		
Activity	**Main Impacts**	**Management**
		The recycling and disposal of wastes are covered by Chrysaor's Waste Management Strategy, which is compliant with relevant regulations relating to the handling of waste offshore, transfer of controlled, hazardous (special) waste, and TFSW (Trans-Frontier Shipment of Waste). The Waste Management Strategy is guided by Chrysaor's HSE Policy. Only licenced contractors which can demonstrate they are capable of handling and processing the material to be brought ashore will be considered for onshore activities.
Removal of surface installations	Disturbance or destruction of seabird nests	In recent years, there has been an increase in the number of seabirds utilising offshore installations for nesting. Opportunistic species such as kittiwake and herring gull are utilising artificial nest locations and successfully rearing chicks. In some instances, colonies of several hundred birds have established and return each year. Although for most offshore platforms, the number of breeding birds remains very low. All nesting birds and nesting activities are protected from damage by conservation legislation. Under the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2017 – (OMR 17), it is an offence to: • take, damage, or destroy the nest of any wild bird while that nest is in use or being built, or • take or destroy an egg of any wild bird. This legislation is relevant to installations more than 12 nautical miles from the coast, applies to all species of bird and applies irrespective of the number of nests found. i.e. there is no de-minimus. The preferred practice is to avoid disturbance by undertaking works out with the breeding season. However, this is not always practicable. Chrysaor has been undertaking surveys to determine the presence (and if so type) of birds nesting on our platforms. We are committed to deterring birds from their installations out with the breeding season to mitigate against nesting birds on the platform. Chrysaor may employ a range of non-lethal deterrents to prevent birds nesting if required. These methods will continue throughout the duration of decommissioning. Chrysaor carried out surveys in April / May 2021 and repeat surveys are planned for the early breeding season (during Q2). Should these measures not prove successful, Chrysaor will engage with OPRED to agree any further licensing requirements, as appropriate. This process will form part of future licensing applications for subsequent offshore applications and as such is not assessed here further.
Vessel activity during installation and pipeline	Physical presence of vessels in the field	The most likely origin of an accidental event would be from an unplanned instantaneous diesel release from the largest vessel employed in the decommissioning activities. This is expected to

Table 4.2.1: Environmental Impact Management		
Activity	**Main Impacts**	**Management**
decommissioning operations		be an HLV with a maximum fuel capacity of approximately 1,569m^3. The fuel inventory of the HLV vessel is likely to be split between a number of separate fuel tanks, significantly reducing the likelihood of an instantaneous release of the full inventory. Any spills from vessels in transit or participating in decommissioning activities are covered by separate Shipboard Oil Pollution Emergency Plans (SOPEPs). Chrysaor will support response of any vessel-based loss of fuel containment through the vessel owner's SOPEP. There is a very low likelihood of vessel-to-vessel collision occurrence, an estimated one collision in 685 years which is in line with the areas' baseline collision risk. Chrysaor maintains manned bridges, navigational aids and monitoring of safety zones. Only project vessels will be present when activity taking is place within 500 m safety exclusion zones. Other vessels will not be present within the 500 m zone at any time prior to well decommissioning. OPRED will be notified of any dropped objects, noting that dropped object procedures are industry-standard and will be used. All unplanned losses in the marine environment will be attempted to be remediated, and notifications to other mariners will be sent out. The post-decommissioning Clear Seabed Verification Survey will aid in the identification of in-field dropped objects.

5 Interested party consultation

5.1 Consultation summary

Table 5.1.1: Summary of stakeholder comments		
Stakeholder	**Comment**	**Response**
INFORMAL CONSULTATIONS		
NFFO		
NIFPO		
SFF		
GMG		
STATUTORY CONSULTATIONS		
NFFO		
NIFPO		
SFF		
GMG		
Public		

6 Programme management

6.1 Project management and verification

Chrysaor has established a UK Decommissioning organisation as a department to manage and execute decommissioning projects. Chrysaor's existing processes for Operations, Planning, Project Management, Procurement, Health Safety and Environment, will be used and tailored to meet the specific requirements of decommissioning projects. Chrysaor will manage all permitting, licences, authorisations, notices, consents and consultations.

Any changes to this decommissioning document will be discussed and agreed with OPRED.

6.2 Post-decommissioning debris clearance and verification

A post decommissioning debris survey will be carried out within all 500m safety zones. Discussions are underway with OPRED regarding the level of appropriate coverage for pipeline corridor survey along each existing pipeline route. Oil and gas debris will be recovered for onshore disposal or recycling in line with existing disposal methods.

Verification of seabed state will be obtained. Whilst the worst-case seabed disturbance from overtrawl has been assessed, it is recognised that all the decommissioning activities will be occurring in the Dogger Bank SAC, therefore different methods of determining debris clearance and snag risk may be required. The methods used will therefore be discussed and finalised with OPRED. This will be followed by a statement of clearance to all relevant governmental departments and statutory consultees.

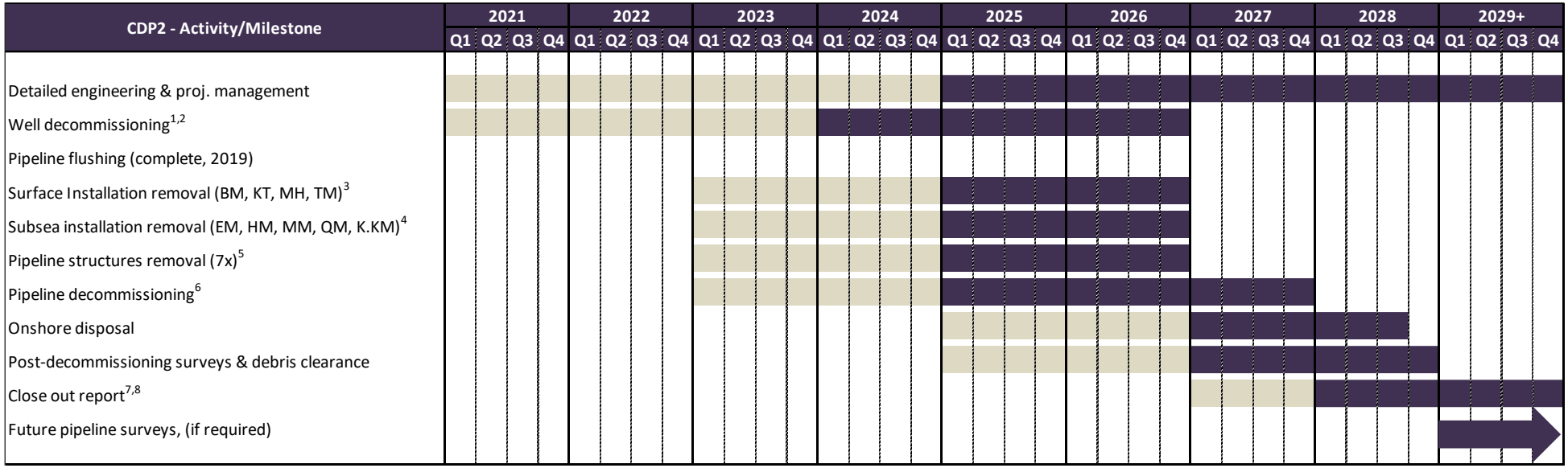
Oil and gas debris activity and verification along the remaining pipeline corridor of the infield pipeline sections not subject to actual decommissioning works will be carried out in accordance with OPRED guidance in operation at the time those activities commence. This activity will reflect the environmental setting of the Dogger Bank SAC.

The outcomes of the clear seabed verification activities in the 500m zones and the alternative survey methods of the pipelines will be reported in the Close Out Report and sent to the Seabed Data Centre (Offshore Installations) at the Hydrographic Office.

6.3 Schedule

A proposed schedule is provided in Figure 6.3.1. The activities are subject to the acceptance of the Decommissioning Programmes presented in this document and any unavoidable constraints (e.g. vessel availability) that may be encountered while executing the decommissioning activities. Therefore, activity schedule windows have been included to account for this uncertainty.

The commencement of offshore decommissioning activities will depend on commercial agreements and commitments.



Notes / Key

Earliest potential activity

Activity window to allow commercial flexibility associated with decommissioning activities

1. Well decommissioning. Hawksley EM & Watt QM completed. McAdam MM wells partially decommissioned (AB2) in 2019; Boulton HM wells to be partially decommissioned (AB2) in 2021; Murdoch K.KM wells to be partially decommissioned (AB2) in 2022. The decommissioning of the MM, HM and K.KM wells will be completed when the well conductors are removed during the same campaign as removal of the respective subsea installations. The dates quoted here are earliest dates.
2. Decommissioning of the surface installation wells is scheduled for 2022-2023; the conductors may need to be removed along as part of the removal campaign for the installations
3. The surface installations include Boulton BM, Katy KT, Munro MH, Kelvin TM;
4. The subsea installations include Boulton HM, Hawksley EM, McAdam MM, Murdoch K.KM, Watt QM;
5. The pipeline structures include Katy Tee, Kelvin-Murdoch Subsea Pigging Skid, Kelvin Pigging Manifold Assembly, Kelvin Subsea Tee Assembly, McAdam Tee, Pigging Skid Northern Lobe, Pigging Skid Southern Lobe;
6. The pipelines are already disconnected from the surface satellite installations and at Murdoch as agreed in a Preparatory Works request to OPRED on 12 Feb 2021. The pipeliens in CDP2 will likley be carriued out as part of a wider campaign with CDP1b and CDP3.
7. The close out report will be prepared on completion of offshore activities. It will contain results of environmental suveys, debris survey (identification/removal) and clear seabed verification survey;
8. The close out report will explain the strategy based on risk assessments and results of post decommissioning surveys.

Figure 6.3.1: Gantt chart of project plan

6.4 Costs

Decommissioning costs will be provided separately to OPRED and OGA.

6.5 Close Out

In accordance with OPRED guidelines, a close out report covering the completion of the offshore decommissioning scope of these Decommissioning Programmes will be submitted at time agreed by OPRED. The close out report will contain debris removal and verification of seabed clearance, the first post decommissioning environmental survey and explanation of any variations to the approved Decommissioning Programmes.

6.6 Post decommissioning monitoring and evaluation

After decommissioning activities have been concluded, pipeline status surveys and environmental surveys will be completed with the findings being sent to OPRED in the Close Out report. The frequency and scope of future surveys will be agreed with OPRED and supported by a risk assessment. Residual liability will remain with the Section 29 holders identified in Table 1.4.8 (Boulton BM), Table 1.4.9 (Katy KT), Table 1.4.10 (Kelvin TM), Table 1.4.11 (Munro MH), Table 1.4.12 (CMS III Satellites Northern Pipelines) and Table 1.4.13 (CMS III Satellites Southern Pipelines). Unless agreed otherwise in advance with OPRED, Chrysaor will remain the focal point for such matters, such as any change in ownership, for example.

A post decommissioning environmental seabed survey will be carried out once the offshore decommissioning work scope covered by this decommissioning document has been completed. The survey will include seabed sampling to monitor levels of hydrocarbons, heavy metals, and other contaminants to allow for a comparison with the results of the pre-decommissioning survey. Results of this survey will be available once the decommissioning document work scope is complete.

PIPELINE RISK BASED MONITORING PROGRAMME

All pipeline systems covered within this Decommissioning Document scope will be subject to survey. The post decommissioning pipeline (and associated stabilisation features) monitoring programme, to be agreed with OPRED, will:

- Begin with an initial baseline survey covering the full length of each pipeline;
- Be followed by a risk-based assessment for each pipeline (and associated stabilisation materials) which will inform the minimum agreed extent and frequency of future surveying. This will take account of pipeline burial, exposure and spanning data derived from the initial baseline survey, all available historical survey information and fisheries impact assessment;
- Provide a report of each required survey (with analysis of the findings, the impact on the risk-based assessment and identification of the proposed timing of the next survey in accordance with the agreed RBA approach), for discussion and agreement of OPRED;
- Include provision for remediation in the framework where such a requirement is identified. Appropriate remediation will be discussed and agreed with OPRED;
- Where remediation has been undertaken, a follow up survey of the remediated section(s) will be required;
- In the event of a reported snagging incident on any section of a pipeline, the requirement for any additional survey and/or remediation, will be discussed and agreed with OPRED;
- Will include a further fisheries impact assessment following completion of the agreed survey programme;
- Monitoring will become reactive following completion of the agreed survey programme and OPRED agreement of the analysis of the outcomes;
- Require pipeline information to be recorded on Navigation charts and FishSAFE.

The monitoring programme will also include discussion with OPRED of the long-term pipeline degradation and potential risk to other users of the sea following conclusion of the planned survey programme.

7 Supporting documents

[1] Chrysaor (2020) Caister Decommissioning Programmes CDP1a, COP-SNS-C-CM-X-PM-12-00001;

[2] Chrysaor (2020) CDP1b Decommissioning Programmes for Caister Pipelines, CYR-SNS-C-CM-X-PM-12-00001;

[3] Chrysaor 2020) CDP3 Decommissioning Programmes for Murdoch Installations and Associated Trunklines, CYR-SNS-C-CM-X-PM-12-00003;

[4] Chrysaor (2020) Environmental Appraisal Caister-Murdoch System, CYR-SNS-C-XX-X-HS-02-00003;

[5] Chrysaor (2020) Comparative Assessment for Pipelines in the Caister-Murdoch System, CYR-SNS-C-XX-X-HS-02-00001;

[6] ConocoPhillips (2017). Commercial Fisheries Baseline Characterisation: LOGGS South, LOGGS North and CMS Areas. Report No. BMM-SNS-P-XX-S-HS-02-00001;

[7] DNO (2019) Ketch Decommissioning Programmes, Final July 2019. Weblink last accessed 18 Oct 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/826988/Ketch_Decommissioning_Programme_BEIS_Final_July_2019.pdf

[8] DNO (2019) Schooner Decommissioning Programmes, Final July 2019. Weblink last accessed 18 Oct 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/826989/Schooner_Decommissioning_Programme_BEIS_Final_July_2019.pdf

[9] EU (2008) Directive 2008/98/EC on waste (Waste Directive) Weblink last accessed 27 Jan 2021: http://data.europa.eu/eli/dir/2008/98/2018-07-05

[10] Gardline (2015). SNS Decommissioning Survey Caister Murdoch System (Murdoch Hub and Caister CM). Habitat Assessment Report. August 2015. Final. Report No. 10554.1, CPUK/INT/PR-258;

[11] Gardline (2015). SNS Decommissioning Survey Caister Murdoch System (Murdoch Hub and Caister CM). Pre-decommissioning Survey Report. August 2015. Final. Report No. 10554.2, CPUK/INT/PR-258;

[12] INEOS UK SNS Limited (2020) Cavendish Decommissioning Programmes. Weblink last accessed 18 Oct 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/889054/RD-CAV-ZPL004_Rev07_CAV_Decommissioning_Programme_May2020_FINAL.pdf;

[13] OPRED (2018) Offshore Oil and Gas Decommissioning Guidance Notes. Weblink last accessed 28 Oct 2020: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/760560/Decom_Guidance_Notes_November_2018.pdf

Appendix 1 Schematics

Appendix 1.1 Murdoch MA & MD

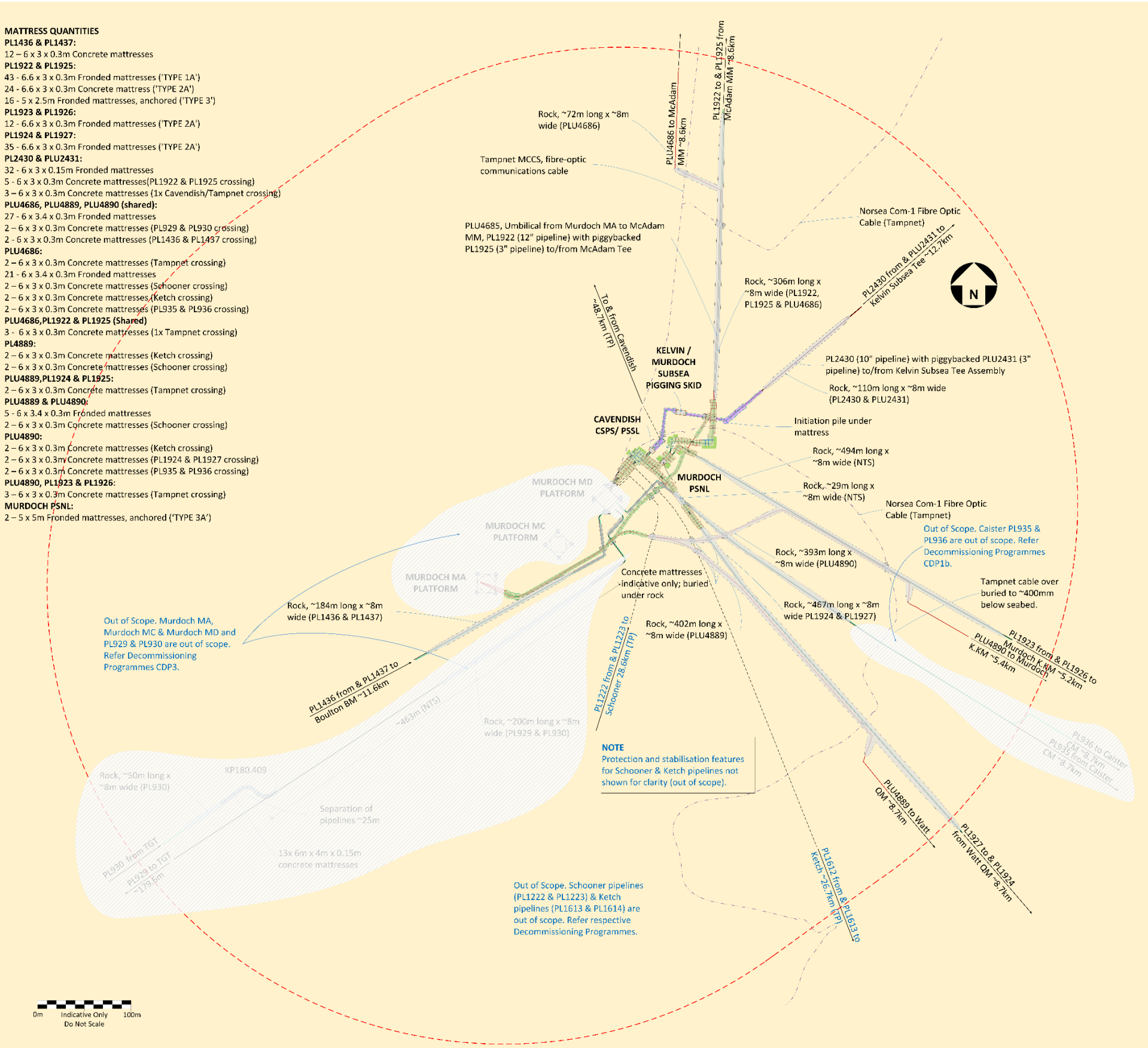


Figure A1.1.1: Schematic of pipelines near Murdoch installations

Appendix 1.2 Boulton BM

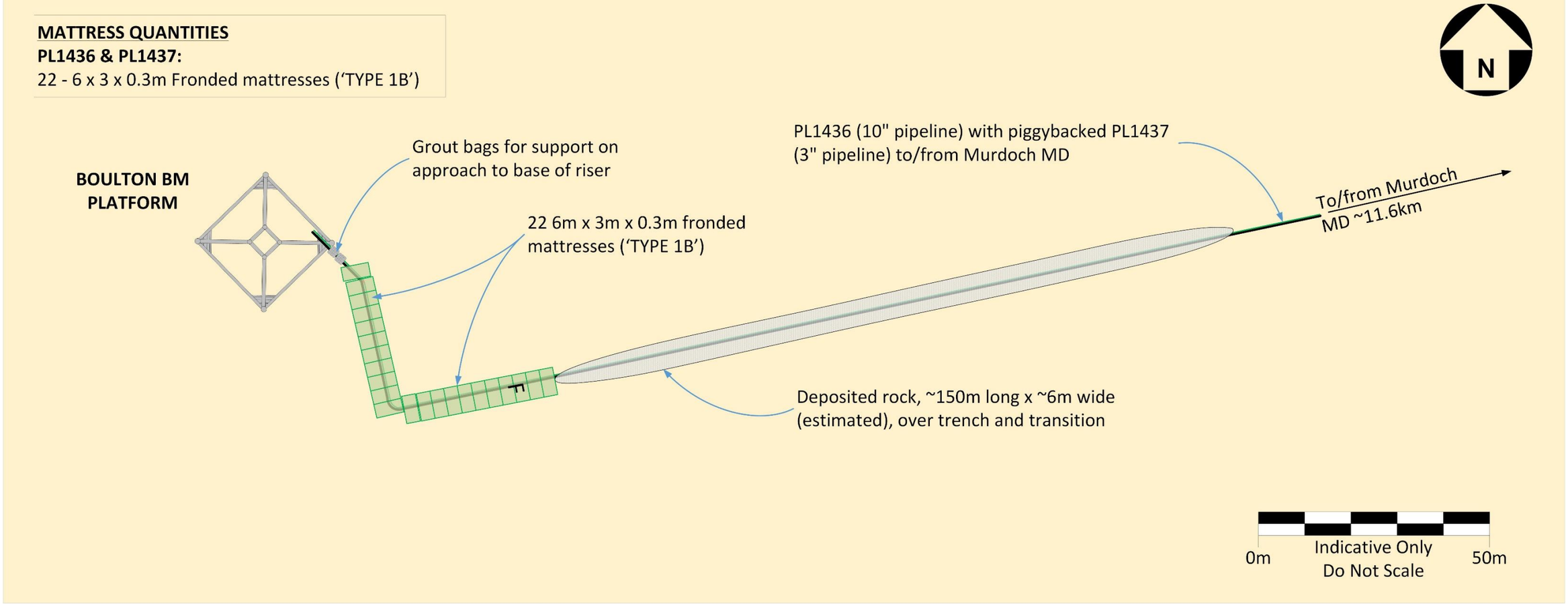


Figure A1.2.1: Schematic of pipelines near Boulton BM

Appendix 1.3 Boulton HM

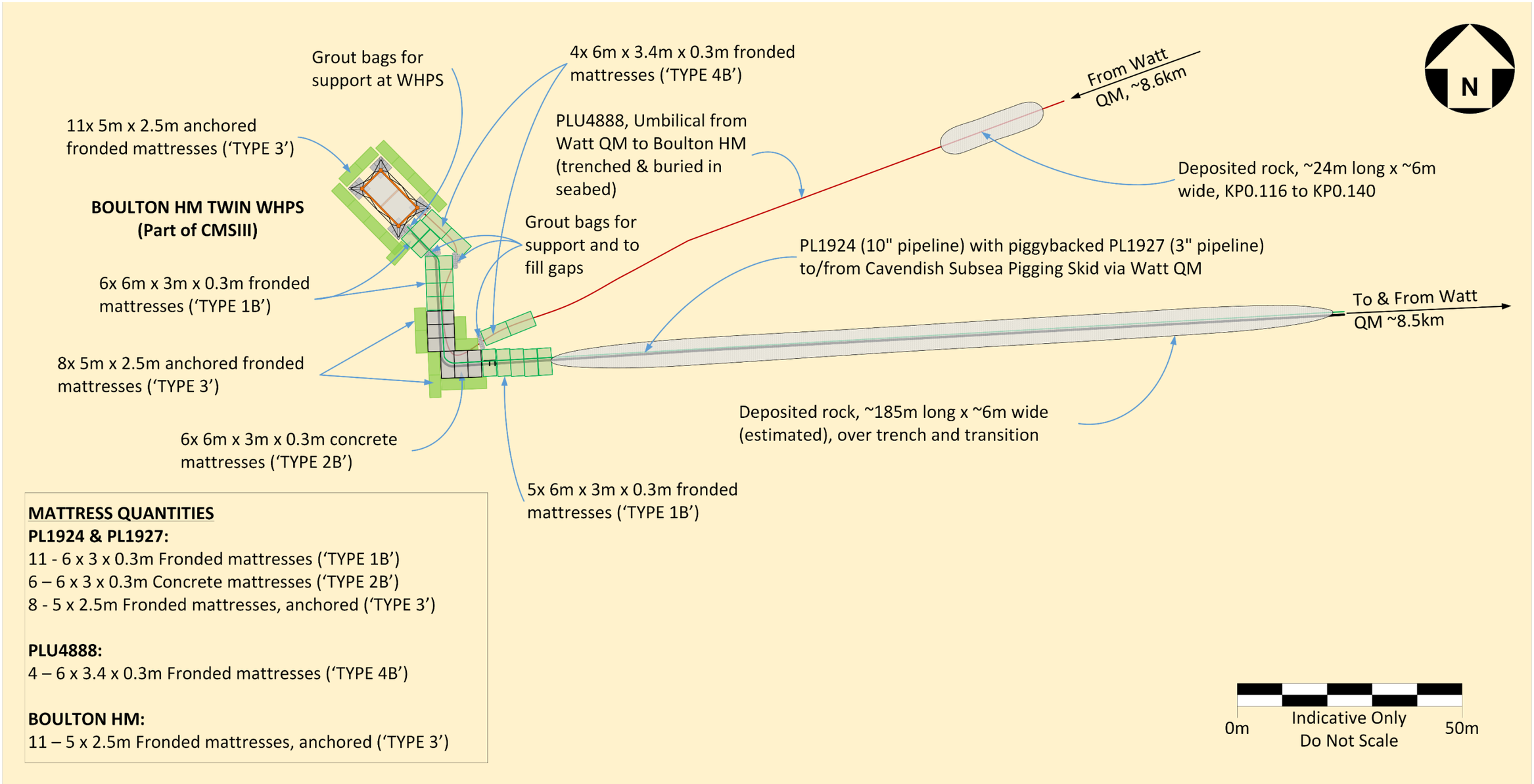


Figure A1.3.1: Schematic of pipelines near Boulton HM

Appendix 1.4 Hawksley EM

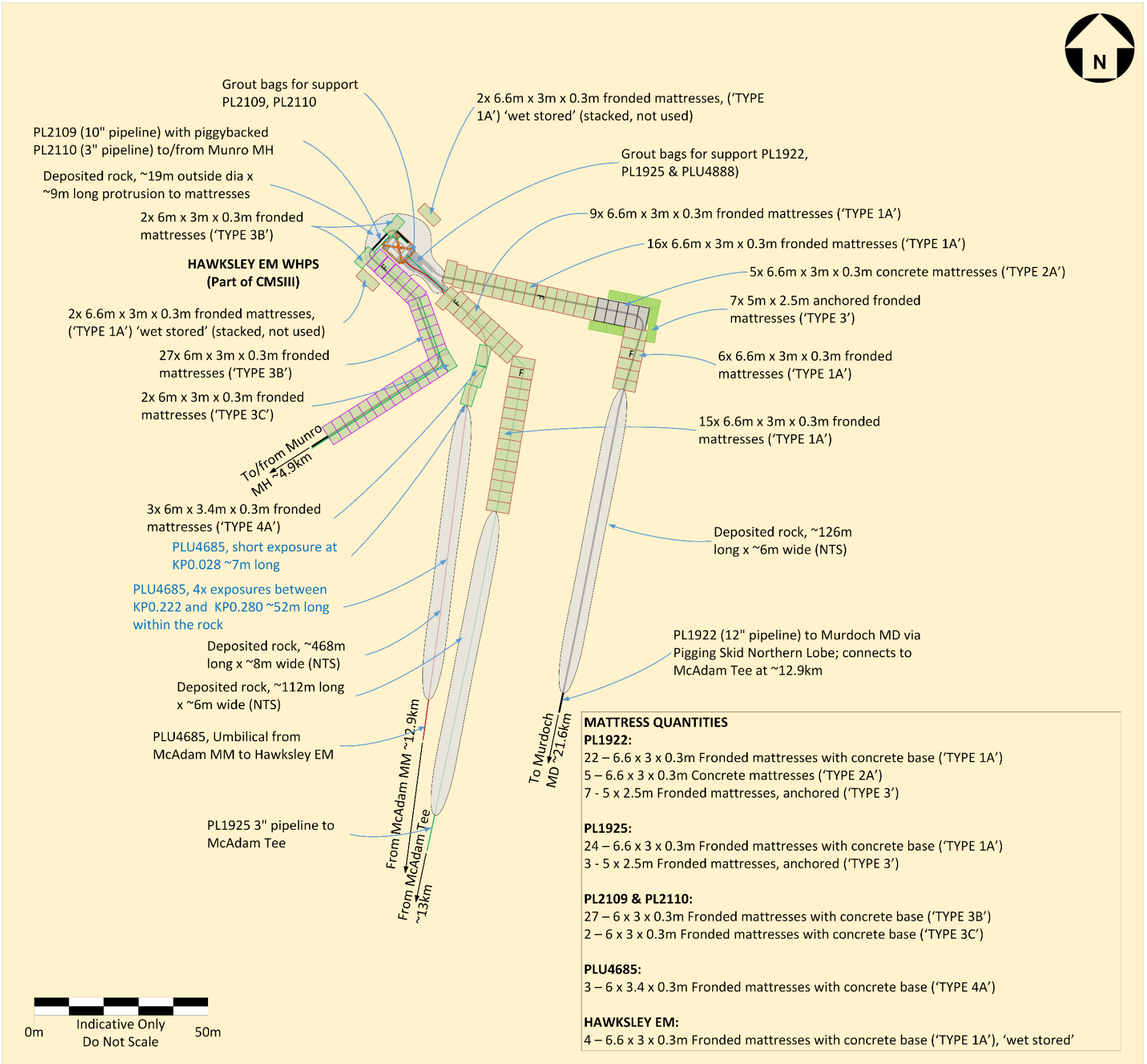
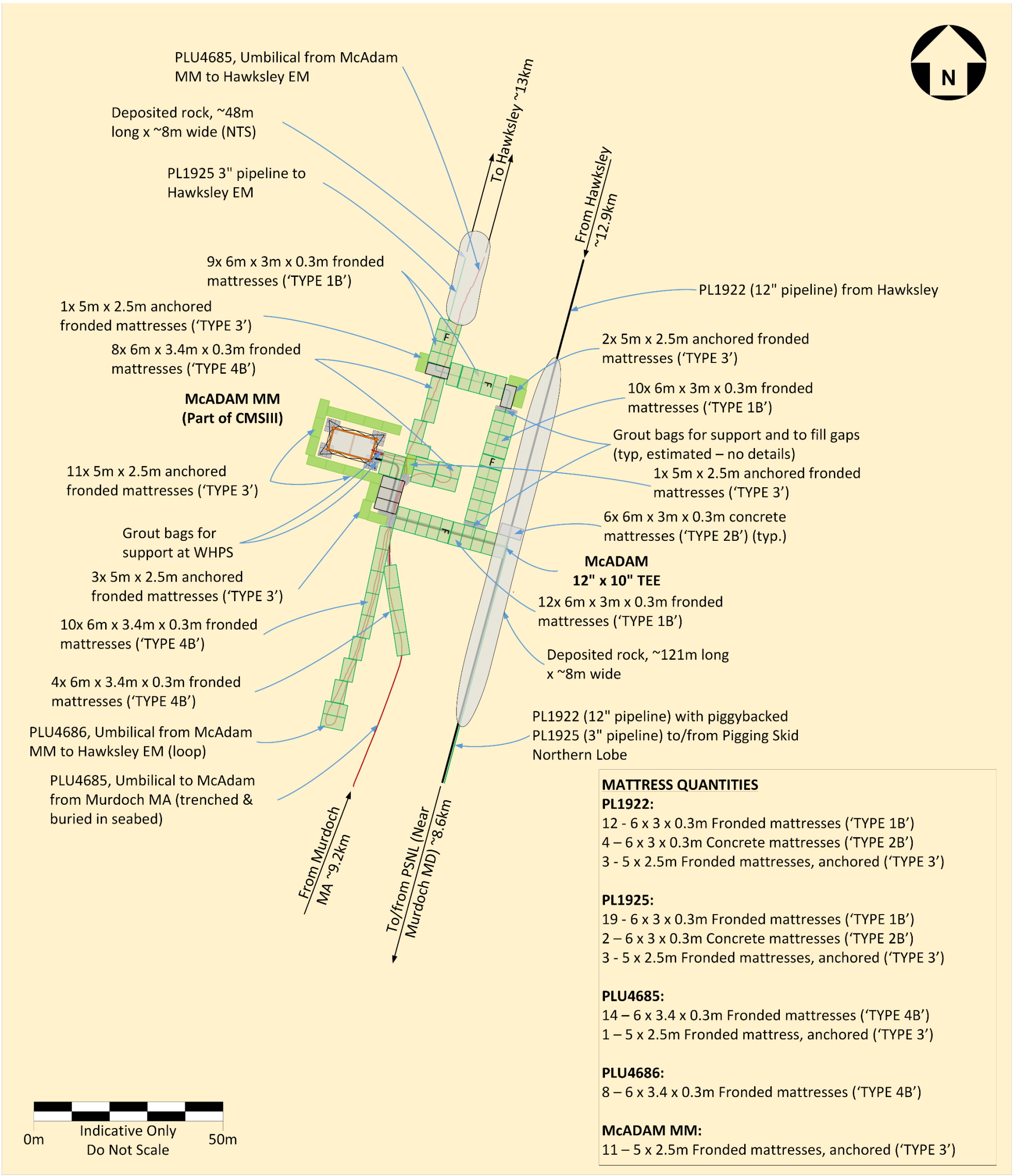


Figure A1.4.1: Schematic of pipelines near Hawksley EM

Appendix 1.5 McAdam MM



MATTRESS QUANTITIES

PL1922:
12 - 6 x 3 x 0.3m Fronded mattresses ('TYPE 1B')
4 – 6 x 3 x 0.3m Concrete mattresses ('TYPE 2B')
3 - 5 x 2.5m Fronded mattresses, anchored ('TYPE 3')

PL1925:
19 - 6 x 3 x 0.3m Fronded mattresses ('TYPE 1B')
2 – 6 x 3 x 0.3m Concrete mattresses ('TYPE 2B')
3 - 5 x 2.5m Fronded mattresses, anchored ('TYPE 3')

PLU4685:
14 – 6 x 3.4 x 0.3m Fronded mattresses ('TYPE 4B')
1 – 5 x 2.5m Fronded mattress, anchored ('TYPE 3')

PLU4686:
8 – 6 x 3.4 x 0.3m Fronded mattresses ('TYPE 4B')

McADAM MM:
11 – 5 x 2.5m Fronded mattresses, anchored ('TYPE 3')

Figure A1.5.1: Schematic of pipelines near McAdam MM

Appendix 1.6 Munro MH

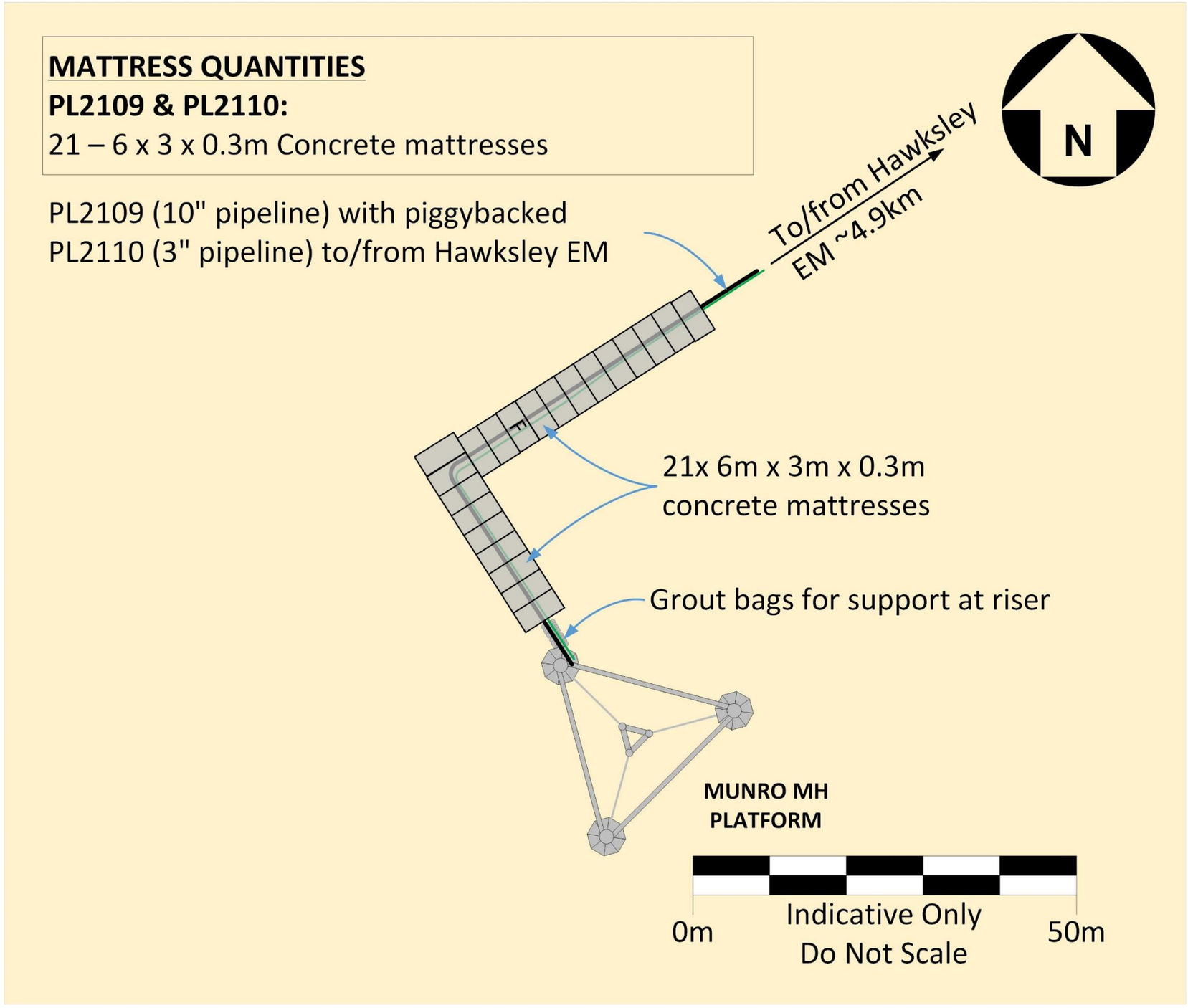


Figure A1.6.1: Schematic of pipelines near Munro MH

Appendix 1.7 Murdoch K.KM

MATTRESS QUANTITIES
PL1923 & PL1926:
16 - 6 x 3 x 0.3m Fronded mattresses with concrete base ('TYPE 1B')
6 – 6 x 3 x 0.3m Concrete mattresses ('TYPE 2B')
3 - 5 x 2.5m Fronded mattresses, anchored ('TYPE 3')

PLU4890:
16 – 6 x 3.4 x 0.3m Fronded mattresses with concrete base ('TYPE 4B')

MURDOCH K.KM:
8 – 5 x 2.5m Fronded mattresses, anchored ('TYPE 3')

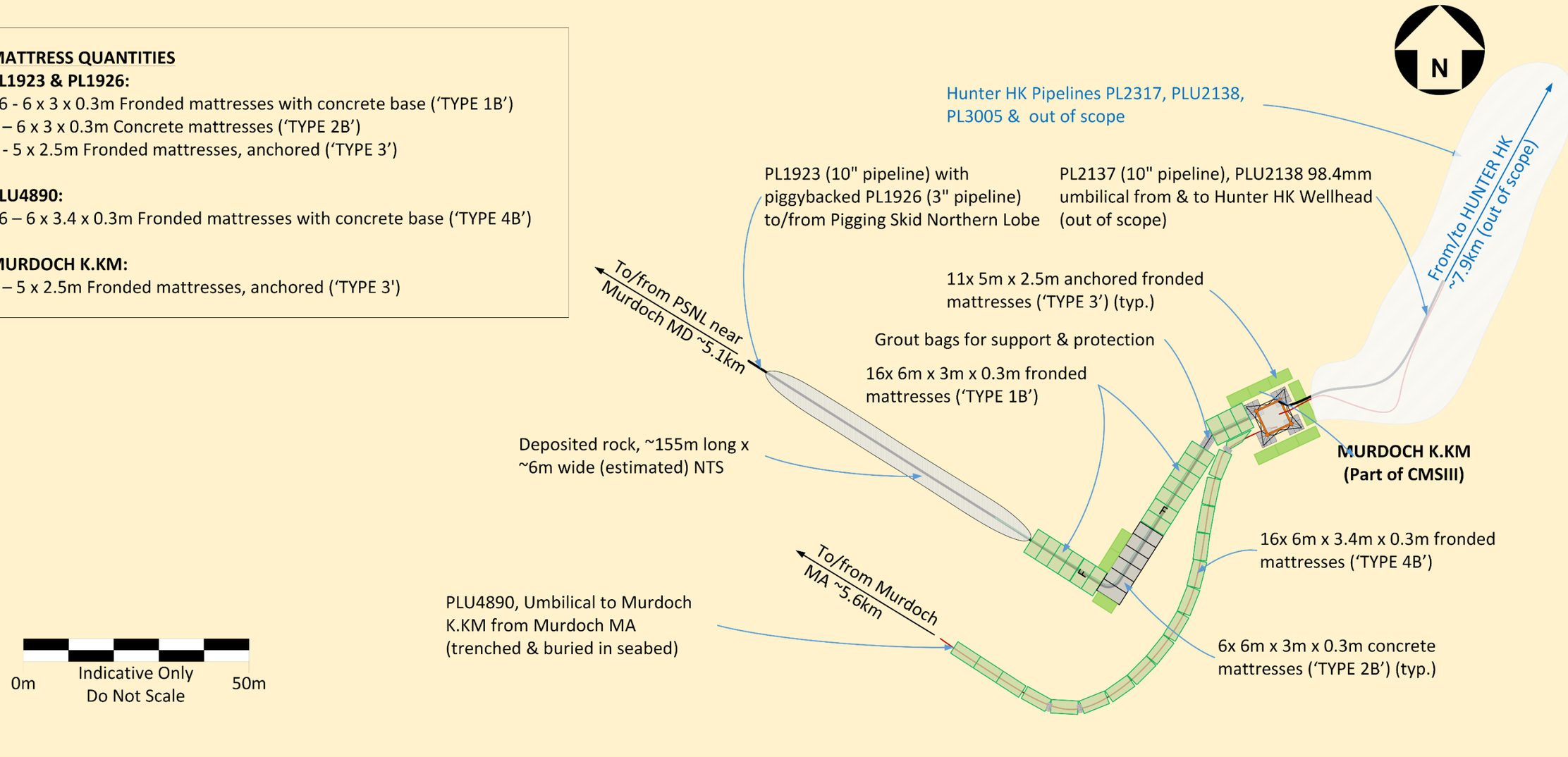


Figure A1.7.1: Schematic of pipelines near Murdoch K.KM

Appendix 1.8 Kelvin TM

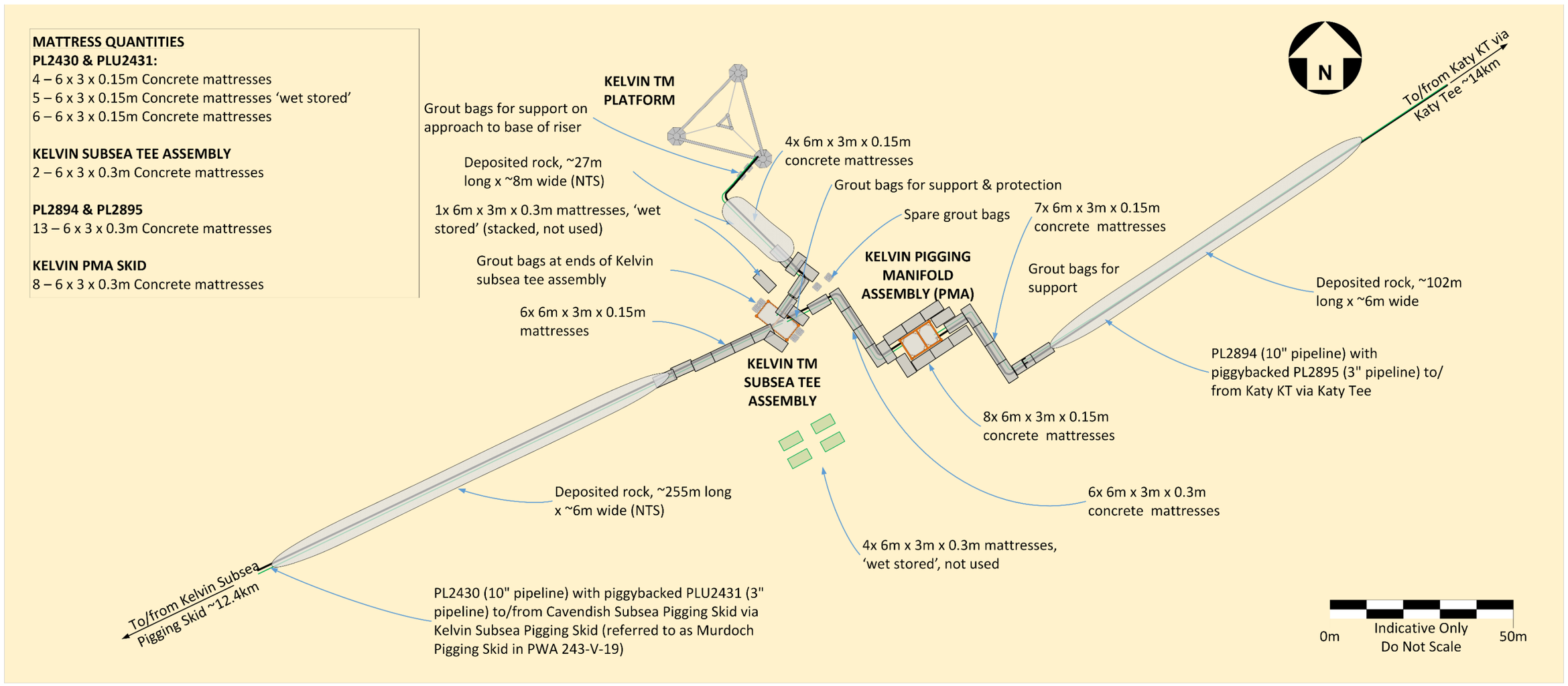


Figure A1.8.1: Schematic of pipelines near Kelvin TM

Appendix 1.9 Katy KT

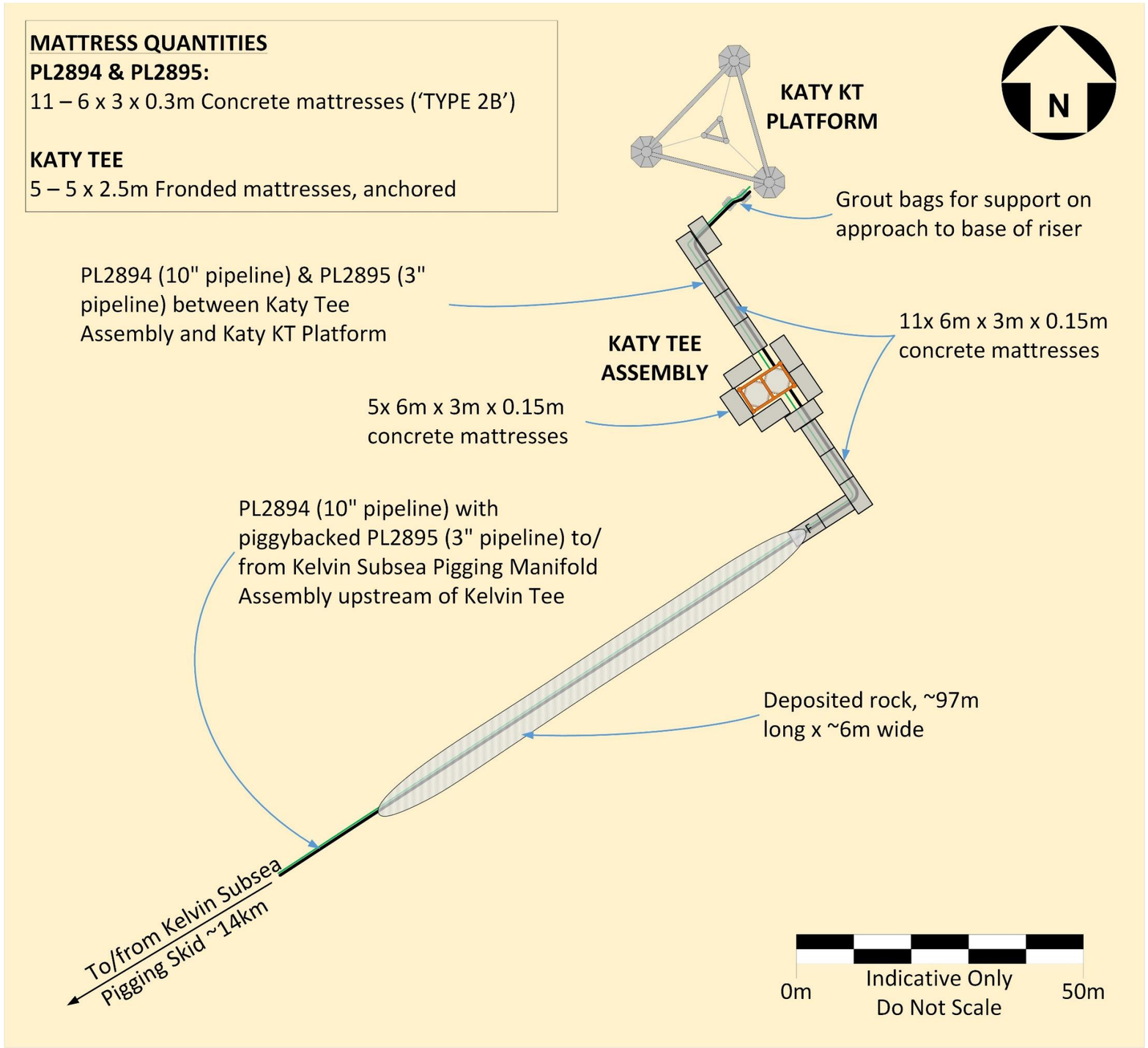


Figure A1.9.1: Schematic of pipelines near Katy KT

Appendix 1.10 Watt QM

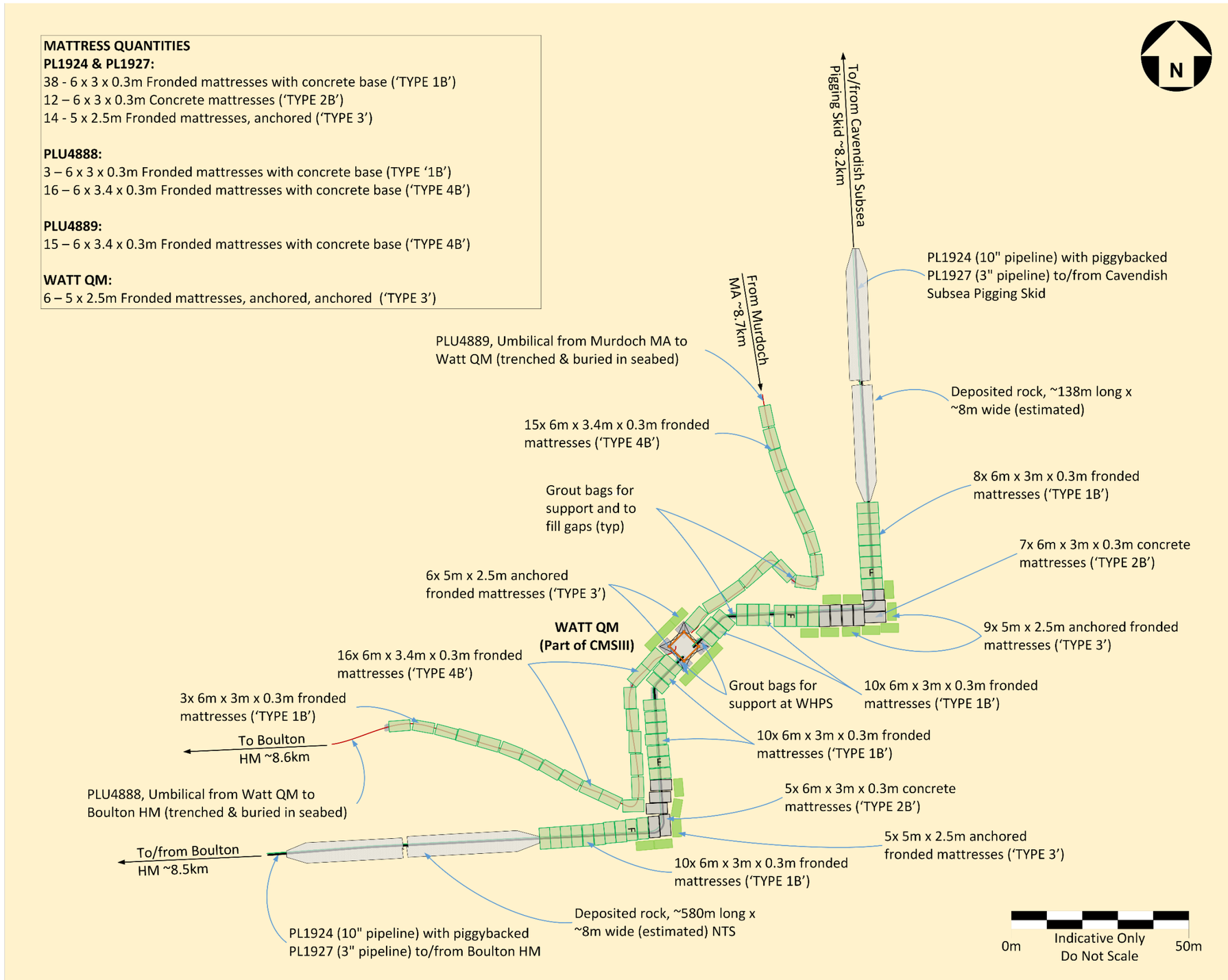


Figure A1.10.1: Schematic of pipelines near Watt QM

Appendix 2 Pipeline Crossing Schematics

Appendix 2.1 Pipeline crossings outside Murdoch 500m Zone

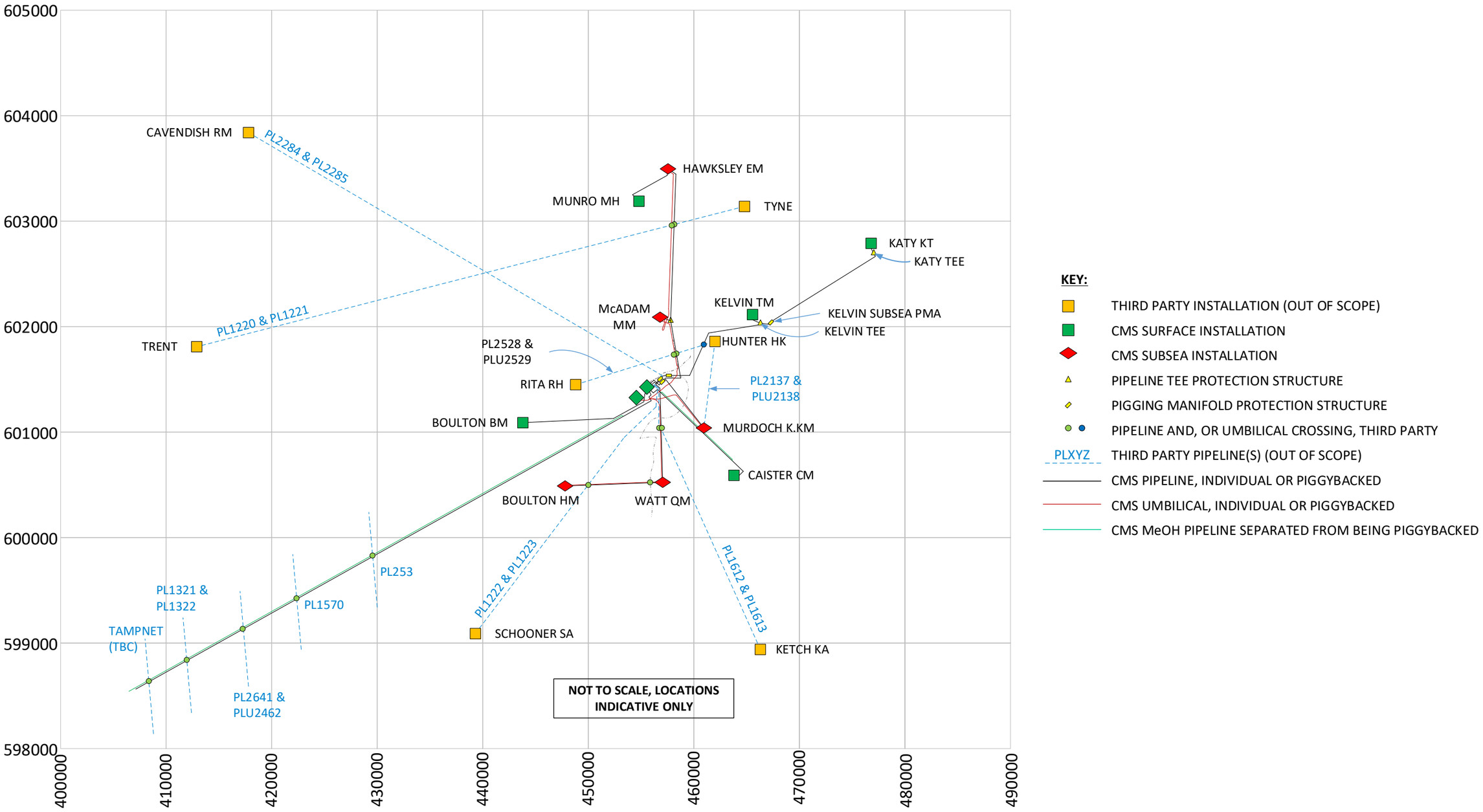


Figure A2.1.1: Schematic of pipeline crossings outside Murdoch 500m zone[8]

[8] Murdoch MC not shown, area near Murdoch complex indicative only. Refer Figure A2.2.1.

Appendix 2.2 Pipeline crossings inside Murdoch 500m zone

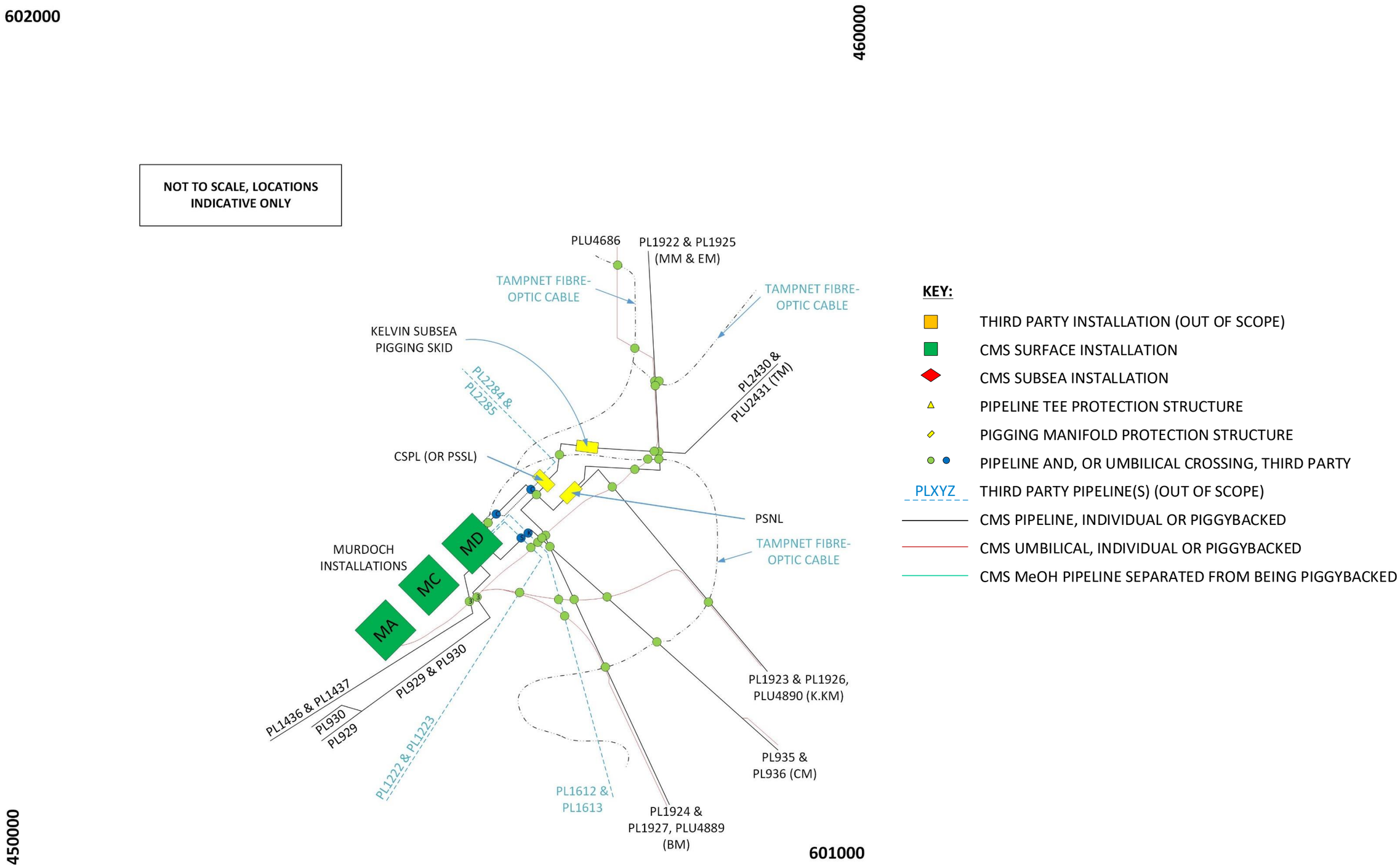


Figure A2.2.1: Schematic of pipeline crossings inside Murdoch 500m zone

Appendix 3 Deposited rock schematics

Appendix 3.1 Deposited rock outside of Murdoch 500m safety zone

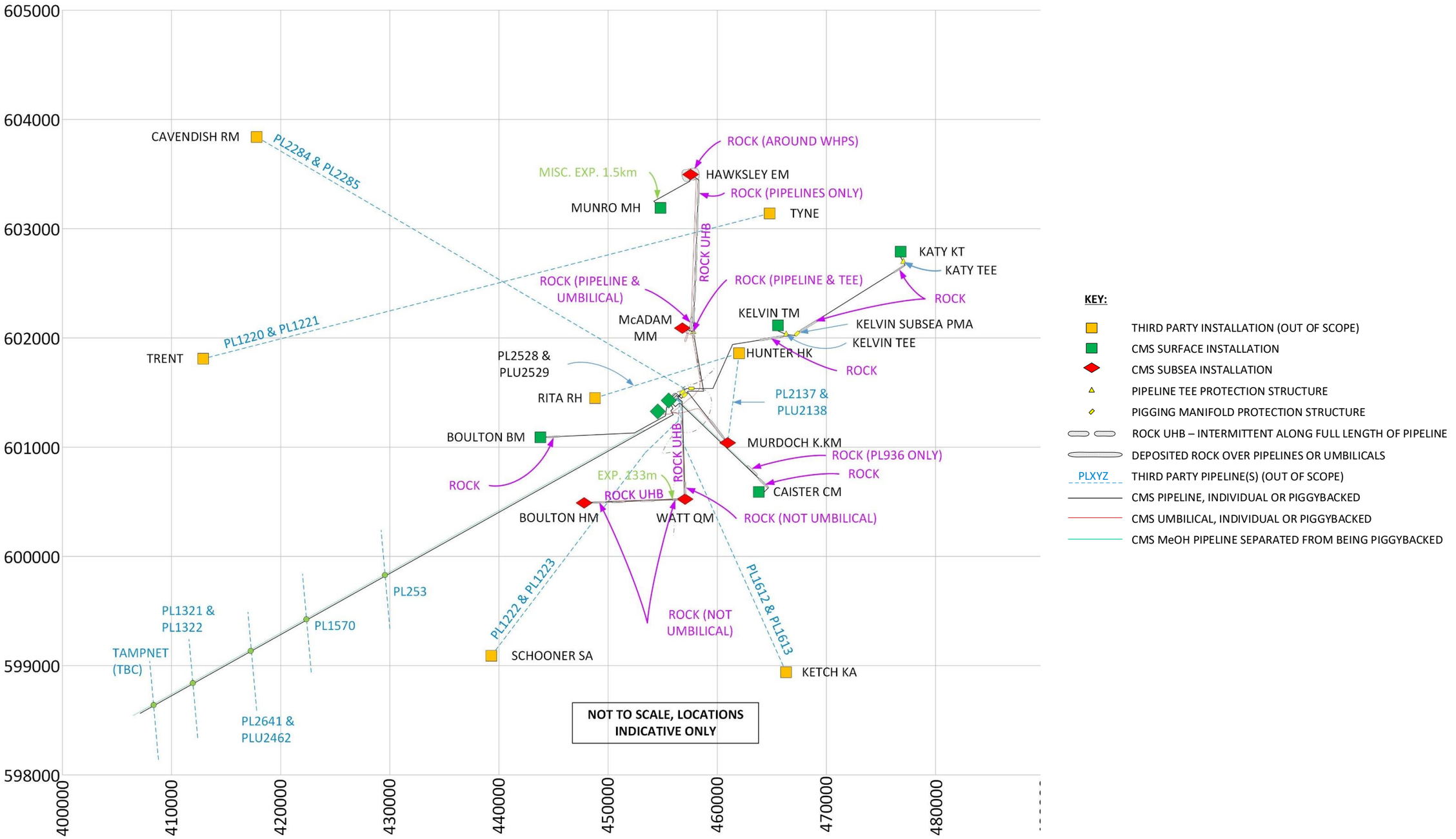


Figure A3.1.1: Schematic of deposited rock outside Murdoch 500m zone

Appendix 3.2 Deposited rock inside Murdoch 500m safety zone

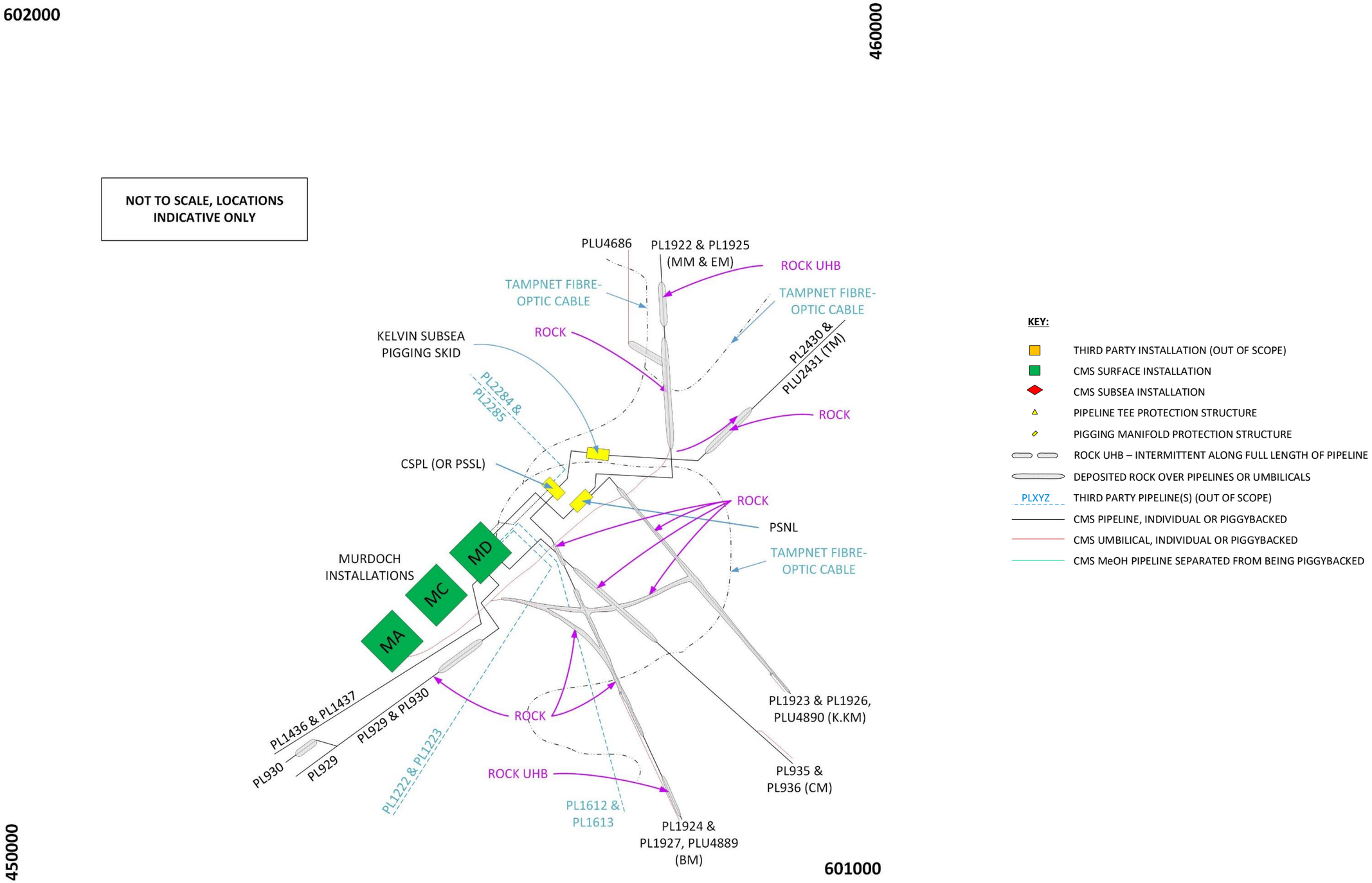


Figure A3.2.1: Schematic of deposited rock inside Murdoch 500m zone

Appendix 4 Pre-works approval communications

Appendix 4.1 Chrysaor to OPRED (6-pages)

Chrysaor Production (U.K.) Limited
Rubislaw House
Anderson Drive
Aberdeen
AB15 6FZ

Offshore Petroleum Regulator for Environment and Decommissioning (OPRED)
Department for Business, Energy and Industrial Strategy (BEIS)
Offshore Decommissioning Unit
AB1 Building
Wing C, 3rd Floor
48 Huntly Street
Aberdeen
AB10 1SH

7th January 2021

Dear Ms Livingston

Request to undertake additional disconnection works in 2021 prior to Decommissioning Programme Approval

Chrysaor Production (U.K.) Limited requests permission to undertake certain works at the Murdoch Complex in the CMS Area of the Southern North Sea (SNS) ahead of the approval of the associated Decommissioning Programmes.

The MD platform was installed in 1992 as a manned production facility and gathering system, initially for the Caister field. A compression platform, Murdoch MC, was added in 1996 and an accommodation platform, Murdoch MA, in 2002 to complete the complex as a collection hub for the Normally Unattended Installations (NUI's) in the surrounding area. At Murdoch, received gas was compressed and exported to TGT via an 188km 26" gas pipeline. At TGT, the gas was processed, sold and exported to the National Transmission System (NTS).

The works required to be undertaken are:

1. Subsea pipeline disconnections at the base of the MD and MA jackets of the Murdoch Complex including 3rd party disconnections

These scopes will be a part of the DSV campaign to be conducted between May and October in 2021 to support the removal of the Murdoch Complex in 2022.

The Decommissioning Programmes associated with the pipeline disconnections are CDP1b, CDP2 and CDP3. These decommissioning programmes will be submitted to OPRED in Q1 2021 for review prior to consultation. Approval of CDP3 (Murdoch Complex & Associated Trunklines) is anticipated by the end of 2021 and the CDP1b (Caister CM Associated Pipelines) and CDP2 (Boulton BM, Katy KT, Kelvin TM, Munro MH platforms and Associated Pipelines including CMSIII manifolds and Associated Pipelines) are expected to be approved in 2021/ 2022.

1

The detailed scope of work planned at each location in support of decommissioning, for which we request OPRED approval, is as follows:

1. **Murdoch Platform Disconnection**

   To prepare for Murdoch MD, MC, MA removal in 2022, the pipelines at Murdoch MD and umbilicals at MA are required to be disconnected to facilitate enough clearance for the removals contractor to take the platforms away. All the pipelines to Murdoch have been flushed clean and filled with inhibited seawater.

   The disconnection methodology is to use a diamond-wire saw (DWS), to cut the gas and methanol spool pieces at a minimum of 5m lateral distance from the platform. Thereafter where a closing span exists at the riser base, a further length will be removed up to the point where the pipeline touches down on the seabed. Shears will be used to cut the outboard end of the pipeline at the touchdown point. The disconnection philosophy at this stage, is to minimise pipeline intervention required proximal to the platform. To achieve this the minimum length of pipeline will be disconnected to achieve sufficient clearance for platform removal. The outboard cut will terminate at a point where the pipeline is buried beneath stabilisation material. Mattress removal will only take place where they obstruct the clearance necessary for the removal criteria. Minimum excavation will be required to expose pipelines as they have been surface-laid at the approaches. Seabed mobility may however have buried the pipelines thus requiring minor unburial to expose the section to the point where it is buried beneath stabilisation material. A ROV dredger will be on board the vessel to facilitate unburial, if necessary.

   The pipeline ends at Murdoch MD and MA will not be buried at this stage, as the assessment of the decommissioning of the pipeline ends will be communicated within the comparative assessment and agreed between stakeholders during the decommissioning approval process. The comparative assessment will be submitted to BEIS for initial review in early 2021. Any future remediation of the pipeline ends required to reach an agreed decommissioning as-left state will be undertaken as part of the post removal activities.

   The 500m zone will be retained until there are no foreseeable snagging risks to fishermen.

13 pipelines 5 gas pipelines, 5 methanol pipelines and 3 umbilicals) are proposed to be disconnected:

Pipeline Number	Pipeline Description	Removal Length (minimum)	Removed Items*
PL1436	Boulton BM to Murdoch MD 10" Gas Line	3m (Note1)	No mattresses, several grout bags
PL1437	Murdoch MD 3" MeOH Line to Boulton BM	3m (Note1)	No mattresses, several grout bags
PL929	Murdoch MD to TGT 26" Gas Line	3m (Note2)	No mattresses, several grout bags
PL930	TGT to Murdoch MD 4" MeOH Line	3m (Note2)	No mattresses, several grout bags
PL935	Caister CM to Murdoch MD 16" Gas Line	3m (Note2)	Several mattresses, several grout bags
PL936	Murdoch MD to Caister CM 3" MeOH Line	3m (Note2)	Several mattresses, several grout bags
PL1922	Hawksley EM to Murdoch MD 12"Gas Line via McAdam MM and Northern Lobe Pigging Skid (PSNL)	11m	No mattresses, several grout bags
PL1925	Murdoch MD to Hawksley EM 3" MeOH Line via McAdam MM and Northern Lobe Pigging Skid (PSNL)	11m	No mattresses, several grout bags
PL1924	Boulton H HM to Murdoch MD 10"Gas Line via Southern Lobe Pigging Skid (PSSL) via Watt QM	12m	No mattresses, several grout bags
PL1927	Murdoch MD to Boulton H HM 3" MeOH Line via Southern Lobe Pigging Skid (PSSL) via Watt QM	12m	No mattresses, several grout bags
PLU4890 (UM8)	Murdoch MA to Murdoch K KM	8m	No mattresses, several grout bags
PLU4686 (UM7)	Murdoch MA to McAdam MM	8m	No mattresses, several grout bags
PLU4889 (UM5)	Murdoch MA to Watt QM	8m	No mattresses, several grout bags

**Removed items are approximate based on as-left information, actual conditions may differ when executing the works.*
Note 1 - - Minimum separation of 3m disconnection length in 2021 for these lines due to access restrictions as they run under the MD platform which causes access issues, so it is proposed we carry out recommended disconnection to this line in 2022
Note 2 - Minimum separation of 3m disconnection length in 2021 for these lines due to access restrictions as they run under the helideck, which causes access issues with getting the vessel in close with necessary tooling etc so it is proposed we carry out recommended disconnection to this line in 2022.

Where safe to do so, all grout bags and mattresses moved to enable access will be recovered for onshore disposal. All cut sections of the pipelines will be recovered to deck for onshore disposal.

To achieve cost efficiencies during the SNS subsea campaign, Chrysaor has invited the 3rd parties that are connected to the complex to participate in the subsea disconnection scope. The 3rd party pipelines that may also be

included in the scope are DNO operated Schooner and Ketch pipelines and Ineos operated Cavendish to Murdoch cable.

The CMS infrastructure is illustrated in Fig 1. Chysoar-operated assets are highlighted in green and the pipeline disconnections for which approval is sought ahead of decommissioning programme approval will be performed at the base of the MD and MA jackets at the Murdoch Complex.

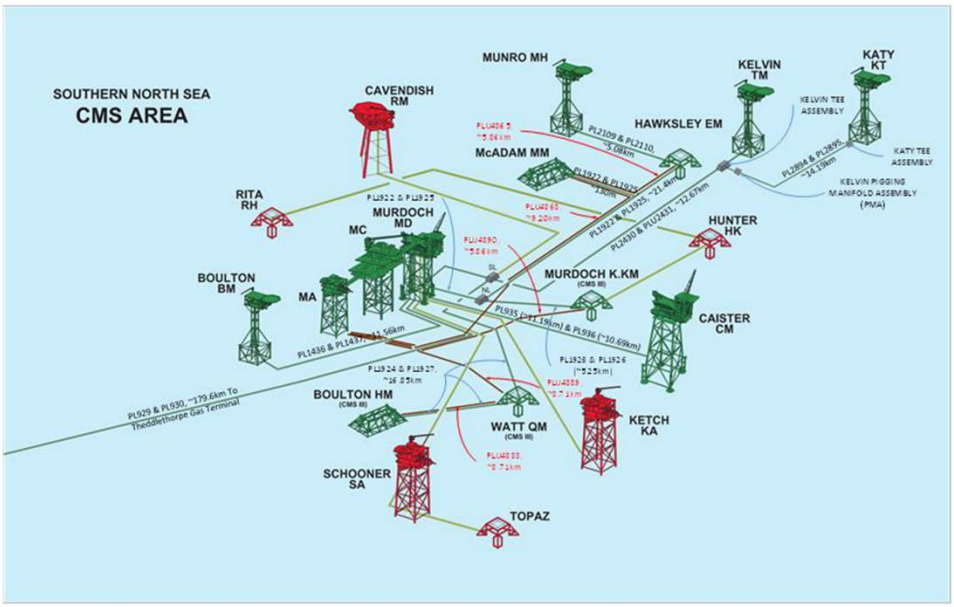


Figure 1 - CMS Gas Operation Schematic (Chrysaor operated assets coloured green)

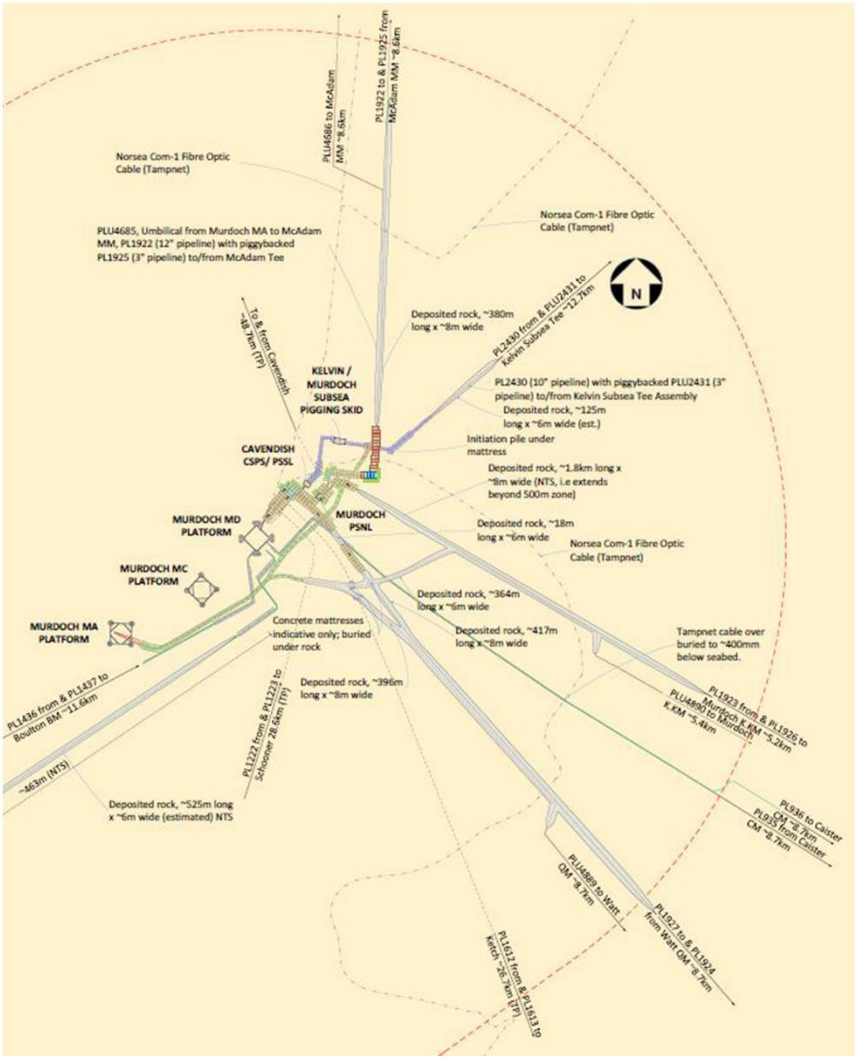


Figure 2 – Schematic of pipelines and current view of stabilization features around Murdoch based on as-left information

Environmental Permit and Consent Applications
A Decommissioning (DCA) Master Application Template (MAT) and supporting Environmental Impact Assessments (EIA) will be submitted detailing the proposed discharge of pipeline contents upon subsea pipeline disconnects and the temporary deposits, removals and seabed disturbance during the proposed subsea pipeline disconnects and spool-piece removals.

The DCA MATs will likely be supported by the following Subsidiary Application Templates (SATs):

- Oil Discharge Permits for the discharge of pipeline flush fluids containing hydrocarbons at a concentration below 30mg/l OIW;
- Marine Licence for the seabed disturbance from dredging activities and the temporary deposits of heavy duty debris baskets for recovery of mattresses/grout sacks and pipeline spool-pieces.

Pipeline Works Authorisation (PWA) variation applications will be submitted to OGA to request consent for these operations.

Chrysaor confirms that the request will not compromise or prejudice feasible decommissioning options for the remaining infrastructure. A copy of the PWR and reference of the work executed will be an appendix to the Decommissioning Programmes.

We request your permission to undertake these works ahead of the Decommissioning Programme approval to avoid the additional expenditure associated with delaying this activity.

Yours sincerely

Catharine Marston
Decommissioning Integration Lead

***T**: +44 (0)7809 781 392 **E**:* cathy.marston@chrysaor.com

Appendix 4.2 OPRED to Chrysaor (2-pages)

Offshore Petroleum Regulator
for Environment & Decommissioning

Offshore Petroleum Regulator for
Environment & Decommissioning

Department for Business, Energy &
Industrial Strategy
AB1 Building
Crimon Place
Aberdeen
AB10 1BJ
T: 01224 254042
E: kim.wood@beis.gov.uk
www.gov.uk/beis

Catharine Marston
Chrysaor Production (U.K.) Limited
Rubislaw House
Anderson Drive
Aberdeen
AB15 6FZ

12 February 2021

Dear Mrs Marston

RE: Request to undertake preparatory works in 2021 prior to the CDP1b, CDP2 and CDP3 Decommissioning Programme Approvals

I write in reply to your email of 6 January 2021, enclosing a letter dated 7 January 2021 *(sic),* containing an updated request to carry out various preparatory works prior to the approval of the CDP1b, CDP2, CDP3 decommissioning programmes.

Chrysaor proposes various subsea pipeline disconnection works at the base of the MD and MA jackets of the Murdoch complex. Thirteen pipelines (5 methanol, 5 gas and 3 umbilicals) are proposed to be disconnected by diamond-wire saw at the Murdoch MA and MD platforms. The proposed cuts will be made at a minimum lateral distance of 5m from the platforms to allow sufficient minimum clearance for the subsequent platform removals in 2022. The pipeline sections noted below will be removed; if possible, with the outboard cut terminating at a point where the pipeline is buried beneath stabilisation material.

- PL1436 - 3m section from Boulton BM to Murdoch MD
- PL1437 - 3m section from Murdoch MD to Boulton BM
- PL929 - 3m section from Murdoch MD to TGT 26" Gas Line
- PL930 - 3m section from TGT 26" Gas Line to Murdoch MD
- PL935 - 3m section from Caister CM to Murdoch MD
- PL936 - 3m section from Murdoch MD to Caister CM
- PL1922 - 11m section from Hawksley EM to Murdoch MD
- PL1925 - 11m section from Murdoch MD to Hawksley EM
- PL1924 - 12m section from Boulton H HM to Murdoch MD
- PL1927 - 12m section from Murdoch MD to Boulton H HM
- PLU4890 - 8m section from Murdoch MA to Murdoch K KM
- PLU4686 - 8m section from Murdoch K KM to Murdoch MA
- PLU4889 - 8m section from Murdoch MA to Watt QM

The proposal also notes that if any closing span exists at a riser base, a further length of pipeline may be removed up to the point where the pipeline touches down on the seabed. This specific activity may be undertaken in this disconnection campaign, or at a later phase, depending upon whether the platform is obstructing access.

Offshore Petroleum Regulator
for Environment & Decommissioning

In addition, the proposal also notes that the pipeline ends at the Murdoch MD and MA platforms will not be buried during this pipeline disconnection stage. The decommissioning of these pipeline ends will be assessed in the Comparative Assessment, accompanying the future associated Decommissioning Programmes, and agreed with OPRED as part of the decommissioning approval process.

We have considered Chrysaor's proposals, outlined in your updated letter of 7 January 2021, for the above-named pipelines, and conclude that they will not prejudice or compromise feasible decommissioning options and as such we are content to agree the proposals.

However, you are reminded that pipeline PL929, the 26" pipeline from Murdoch MD to Theddlethorpe Gas Terminal (TGT) has been identified for potential re-use and we are aware that the Oil & Gas Authority (OGA) has been discussing this aspect with Chrysaor. Agreement to the disconnection of PL929 as part of this preparatory works request is given only on the basis that PL929 is disconnected and left in such a manner that this does not preclude potential re-use options.

With regards to the PWA and MCAA applications associated with these proposals, Chrysaor must make it clear in these submissions that the only reason that some of the pipelines are being removed in two separate phases is because the platform obstructs access to some of the sections of pipelines attached to it. You are also reminded that PWA applications should be submitted well in advance of proposed work start dates, and clearly state, where applicable, whether third parties are aligned to avoid any delay in approval. Please ensure that start dates are aligned across the supporting applications.

This approval is given only in respect of the disconnections of the Chrysaor owned pipelines noted above, agreement to any associated INEOS or DNO owned pipeline disconnections will require separate approval agreed by the relevant team within OPRED-ODU.

This is the third version of this preparatory works request at the Murdoch Complex; the three iterations (1 October 2020, 1 December 2020 and 7 January 2021) have involved multiple changes to pipeline disconnection lengths, some quite considerable. Triple handling of a request is not helpful to ODU nor its internal and external consultees. This has caused unnecessary, additional workload which is time-consuming and inefficient for all involved. Chrysaor must ensure that any future preparatory works proposals are at a sufficient stage of maturity before submission to avoid this happening again.

I also draw your attention to ensuring that appropriate time is allowed for the review and approval process of decommissioning programmes. Timings for approvals are dependent on the quality and nature of information provided, but also the additional assessments that may be required due to environmental considerations.

Yours sincerely

Fiona Livingston
Senior Decommissioning Manager
Offshore Decommissioning Unit

Appendix 5 Public & consultee correspondence

Appendix 5.1 Public Notices

The Public Notices and correspondence with the Statutory Consultees will be added on completion of the Statutory Consultation.

Appendix 6 Letters of Support