Department for Business, Energy & Industrial Strategy

RECORD OF THE HABITATS REGULATIONS ASSESSMENT UNDERTAKEN UNDER REGULATION 5 OF THE OFFSHORE PETROLEUM ACTIVITIES (CONSERVATION of HABITATS) REGULATIONS 2001 (As Amended)

Project Title*: *Chrysaor Decommissioning LDP2 to LDP5

Chrysaor Production (UK) Limited

February 2021

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1 INTRODUCTION

1.1 This is a record of the Habitats Regulations Assessment (HRA) undertaken by the Department for Business Energy and Industrial Strategy (BEIS) in respect of planned decommissioning activities to be undertaken by Chrysaor Production (U.K.) Limited (formerly by ConocoPhillips (U.K.) Limited) in the North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC.

1.2 This HRA covers the planned decommissioning of oil and gas infrastructure proposed for the Lincolnshire Offshore Gas Gathering Station (LOGGS) decommissioning programmes (LDP) numbers 2 to 5 which include:

- Saturn field (LDP2),
- Jupiter field (LDP3),
- Valiant, Vanguard and Vulcan fields (LDP4)

1.3 and LOGGS four platform gas compression complex which includes:

- North Valiant PD (LDP5).

1.4 The planned decommissioning activities are presented in the relevant decommissioning plans and the associated Environmental Appraisals (Chrysaor 2020a).

1.5 This HRA builds upon a previous HRA undertaken by BEIS for the Viking Decommissioning Programme 1 (VDP1) and the LOGGS Decommissioning Programme 1 (LDP1) (BEIS 2019). It includes additional information regarding Viking Decommissioning Programmes 2 and 3 (VDP2 and VDP3) which relate to works undertaken at Viking and Victor fields.

1.6 BEIS is the competent authority for applications submitted under the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (S.I. 2001/1754) (As Amended) (referred to as the Offshore Habitats Regulations) and future decommissioning programmes submitted to the Department will be subject to the requirements of the regulations.

1.7 Chrysaor Production (U.K.) Limited ("the applicant" hereafter), has submitted to BEIS Offshore Decommissioning Unit (ODU) a Decommissioning Programme for LDP3. While the Environmental Appraisal and Comparative Assessment have been prepared for LDP2 to 5, Decommissioning Programmes for LDP2, LDP4 and LDP5 have not yet been submitted to the Department. Other additional information relating to those assets to be decommissioned has previously been supplied to the Department including an activity matrix, setting out the applicants forecast decommissioning in the North Norfolk Sandbanks and Saturn Reef SAC.

1.8 BEIS recognises that there is potential for activities presented within decommissioning programmes to impact on sites designated under the European Habitats 92/43/EC and Birds Directives 209/147 EC. BEIS also recognises that there is potential for current and future activities associated with oil and gas decommissioning to impact on these sites. Consequently, as the competent authority, BEIS has undertaken an assessment to determine whether the potential impacts from likely decommissioning activities as identified in the LDP2 to LDP5 may cause likely significant or adverse effects to the qualifying features of European designated sites and thereby affect the integrity of the sites.

1.9 As part of the assessment, potential in-combination impacts from future plans or projects including other decommissioning activities within the European designated sites have been assessed to determine whether there is potential for likely significant or adverse effects on the integrity of the sites.

1.10 The in-combination assessment also includes potential future oil and gas related activities that are not the subject of any currently submitted projects or plans. By doing so it does not pre-empt the requirement to undertake HRA when future licence applications are submitted. It does not pre-determine any decision regarding future decommissioning programmes or projects. However, where possible, it does provide a strategic overview of potential in-combination impacts from forecast activities.

1.11 This document presents the finding of the assessment undertaken by BEIS.

Habitats Regulations Assessment

1.12 The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 make changes to three statutory instruments including the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 (the Offshore Habitats Regulations), which is relevant to this assessment. The 2019 regulations ensure that the protection provided under the existing regulations, including the 2001 regulations remain as they were prior to the UKs exit of the EU. This includes the continued protection of designated sites along with their qualifying features and the requirement for a competent authority to undertake an assessment of any plans or projects that could impact on the sites or their features.

1.13 The Conservation of Habitats and Species Regulations 2017 (as amended) and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended) provide for the designation of sites for the protection of habitats and species of national importance; these sites are called Special Areas of Conservation (SACs). For the protection of birds these sites are called Special Protection Areas (SPAs). Collectively, all existing and future SACs and SPAs form a national site network[1].

1.14 Possible SACs (pSACs), candidate SACs (cSACs) and potential SPAs (pSPAs) are afforded the same levels of protection by the UK Government as sites that have already been designated. Sites designated under the Ramsar Convention are also afforded the same level of protection as a designated site.

1.15 Any plan or project which either alone or in-combination with other plans or projects would be likely to have a significant effect on a qualifying site must be subject to an Appropriate Assessment to determine the implications for a site's integrity and conservation objectives. Such a plan or project may only be agreed after ascertaining that it will not adversely affect the integrity of a national site unless there are imperative reasons of overriding public interest for carrying out the plan or project. Draft sites, i.e. those that have not been subject to any formal consultation, are not subject to the Appropriate Assessment process.

1.16 The Offshore Habitats Regulations transpose the Birds and Habitats Directives into UK law for offshore activities consented under the Petroleum Act 1998 and the Energy Act 2008.

1.17 Regulation 5(1) of the Offshore Habitats Regulations provides that: '*The Secretary of State shall, before granting any Petroleum Act licence, any consent, any authorisation, or any approval, where he considers that anything that might be done or any activity which might be carried on pursuant to such a licence, consent, authorisation or approval is likely to have a significant effect on a relevant site, whether individually or in-combination with any other plan or project, including but not limited to any other relevant project, make an appropriate assessment of the implications for the site in view of the site's conservation objectives*'.

1.18 Under the Convention on Wetlands, signed in Ramsar, Iran (1971) sites regularly supporting 20,000 water birds and/or support 1% of the individuals in the population of one species or subspecies of water bird, receive specific designation known as Ramsar designation. Under UK guidance Ramsar sites are, as a matter of policy, afforded the same protection as European designations SPAs and SACs (ODPM 2005).

1.19 The planned decommissioning programmes LOGGS LDP2 to LDP5 and impacts from previous and future decommissioning activities undertaken over a ten year period may cause a likely significant or adverse effect on the qualifying features of European designated sites and therefore, as the competent authority, BEIS is required to appropriately assess plans or projects in view of the site's conservation objectives.

[1] Prior to 1 January 2021 national sites were referred to as European sites.

1.20 This HRA is undertaken in accordance with Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (“the Habitats Directive”) and Council Directive 2009/147/EC on the Conservation of Wild Birds (“the Birds Directive”) to satisfy the Appropriate Assessment requirement.

1.21 This HRA assesses potential impacts from activities for which the BEIS Secretary of State is the competent authority. It does not assess impacts from other activities alone, but where appropriate does take those activities into consideration when addressing in-combination impacts.

1.22 A summary of the HRA process is presented in Figure 1: Summary of Habitat Regulations Assessment process (Source EC 2001).

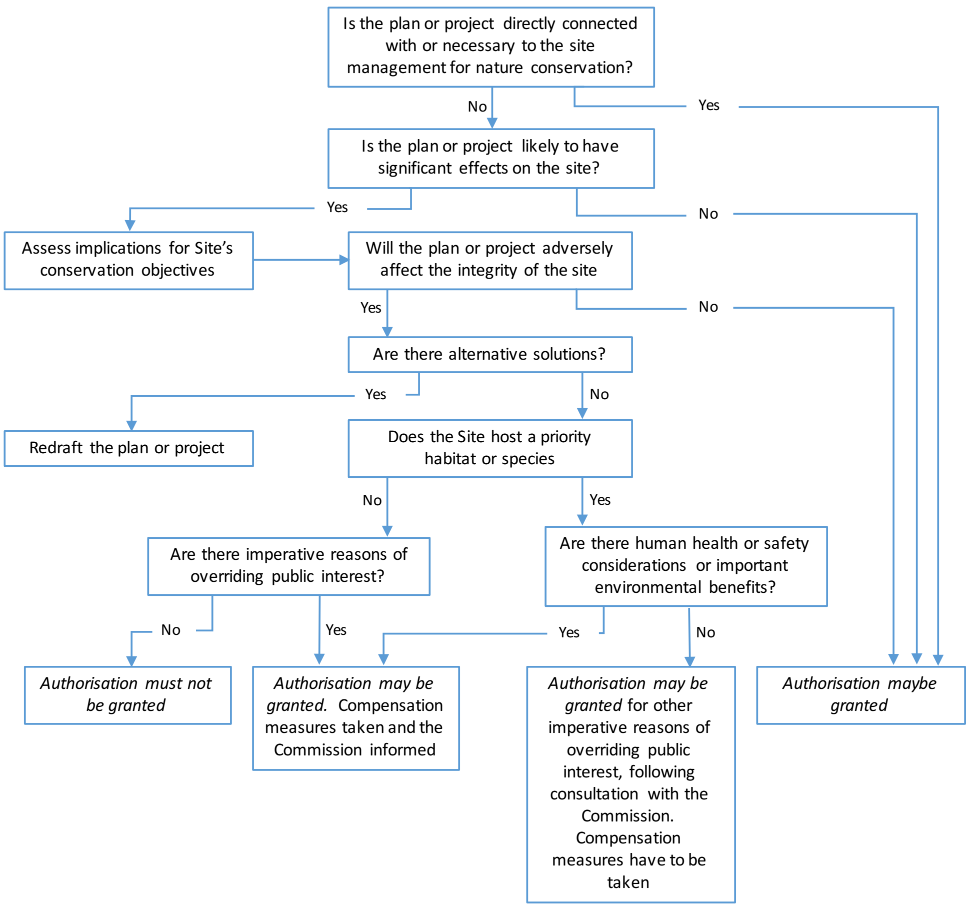


Figure 1: Summary of Habitat Regulations Assessment process (Source EC 2001).

2 CHRYSAOR SOUTHERN NORTH SEA DECOMMISSIONING PROGRAMME

2.1 Chrysaor are the operator of a number of gas fields in the southern North Sea that have been or will be subject to decommissioning programmes over a ten year period. The decommissioning programmes for sixteen installations and their associated infrastructure have previously been approved and nine platforms have been removed (in 2019). It is anticipated that all the remaining surface installations, subsea installations and associated infrastructure will be removed by 2024/25 (Table 1 and Table 2). The pipelines associated with the decommissioning plans are presented in Table 3 and will likely be largely left *in situ*.

Table 1: Chrysaor southern North Sea surface installations.

Platform	Decommissioning Plan	Approved	Removed	Planned removal Date
Viking GD	VDP1	Yes	Yes	2019
Viking HD	VDP1	Yes	Yes	2019
Viking DD	VDP1	Yes	Yes	2019
Viking CD	VDP1	Yes	Yes	2019
Viking ED	VDP1	Yes	Yes	2019
Viking LD	VDP2	Yes	Yes	2019
Viking KD	VDP2	Yes	Yes	2019
Viking AR	VDP2	Yes	No	2020
Viking BA	VDP2	Yes	No	2020
Viking BD	VDP2	Yes	No	2020
Viking BC	VDP2	Yes	No	2020
Viking BP	VDP2	Yes	No	2020
Victor JD	VDP3	Yes	Yes	2019
Europa EZ	*LDP3*	*No*	*No*	*2020*
Ganymede ZD	*LDP3*	*No*	*No*	*2020*
Vulcan UR	LDP1	Yes	Yes	2019
Valkyrie / Vampire OD	LDP1	Yes	No	2020
Viscount VO	LDP1	Yes	No	2020
Caister CM	CDP1	No	No	2020
North Valiant 2 SP	*LDP4*	*No*	*No*	*2021*
Vanguard QD	*LDP4*	*No*	*No*	*2021*
South Valiant TD	*LDP4*	*No*	*No*	*2021*
Vulcan 1 RD	*LDP4*	*No*	*No*	*2021*
North Valiant 1 PD	*LDP5*	*No*	*No*	*2022*
LOGGS PP	*LDP5*	*No*	*No*	*2021*
LOGGS PC	*LDP5*	*No*	*No*	*2021*
LOGGS PR	*LDP5*	*No*	*No*	*2021*

Platform	Decommissioning Plan	Approved	Removed	Planned removal Date
LOGGS PA	*LDP5*	*No*	*No*	*2021*
Mimas MN	*LDP2*	*No*	*No*	*2023*
Saturn ND	*LDP2*	*No*	*No*	*2022*
Tethys TN	*LDP2*	*No*	*No*	*2023*
Murdoch MD	CDP3	No	No	2022
Murdoch MA	CDP3	No	No	2022
Murdoch MC	CDP3	No	No	2022
Boulton BM	CDP2	No	No	2024
Kelvin TM	CDP2	No	No	2024
Katy KT	CDP2	No	No	2024
Munro MH	CDP2	No	No	2024

Those shaded and in italics are subject to this HRA.

Table 2: Chrysaor southern North Sea subsea installations.

Subsea assets	Decommissioning Plan	Approved	Removed	Planned removal Date
Victor JM	VDP3	Yes	No	2021
Vixen VM	VDP2	Yes	No	2020
Viking BD	VDP2	Yes	No	2020
N.W. Bell	LDP3	No	No	2022
Callisto ZM	LDP3	No	No	2022
Alison KX	LDP1	Yes	No	unknown
McAdam MM	CDP2	No	No	unknown
Boulton HM	CDP2	No	No	unknown
Hawksley EM	CDP2	No	No	unknown
Murdoch K KM	CDP2	No	No	unknown
Watt QM	CDP2	No	No	unknown

1 – Note Alison KX is a subsea development. Chrysaor operate one well here but decommissioning is the responsibility of another operator.

Table 3: Chrysaor southern North Sea pipelines subject to decommissioning plans.

Decom. Plan	Pipeline	Pipeline No.	Approved	Length (km)
LDP1	Vulcan UR to Vulcan RD	PL0462 / 0463	Yes	3.7
LDP1	Viscount VO to Vampire OD	PL1962 / 1963	Yes	11.2
LDP1	Vampire OD to LOGGS OR	PL1692 / 1693	Yes	9
LDP2	Tethys TN to PL2107 Tee	PL2234 / 2235	No	3.8
LDP2	Saturn ND to LOGGS PR	PL2107 / 2108	No	43.2
LDP2	Mimas MN to Saturn ND	PL2236 / 2237	No	13.6
LDP3	Europa EZ (Sinope) to PL1091 Tee	PL1694 / 1695	No	4.5
LDP3	Ganymede ZD to LOGGS PR	PL1093 /1094	No	19.5
LDP3	NW Bell ZX To Callisto ZM	PL1690 / 1691	No	0.08
LDP3	NW Bell ZX To Callisto ZM	PLU4177 / UM2	No	0.12
LDP3	Ganymede ZD to Callisto ZM	PLU4178 / UM3	No	13.9
LDP3	Callisto ZM to Ganymede ZD	PL1091 / 1092	No	14.3
LDP4	North Valiant SP to LOGGS PP	PL0470 / 0471	No	4.3
LDP4	Vanguard QD to LOGGS PP	PL0456 / 0457	No	7.5
LDP4	Vulcan RD to LOGGS PP	PL0458 / 0459	No	16.1
LDP4	South Valiant TD to LOGGS PP	PL0460 / 0461	No	10.6
LDP5	LOGGS PP to Theddlethorpe	PL0454 / 0455	No	118.3
VDP1	Viking BD to Viking CD	PL0089 / 0132	Yes	3.9
VDP1	Viking BD to Viking DD	PL0090 / 0131	Yes	4.1
VDP1	Viking BD to Viking ED	PL0091 / 0133	Yes	12
VDP1	Viking BD to Viking GD	PL0092 / 0066	Yes	5.1
VDP1	Viking BD to Viking HD	PL0093 / 0130	Yes	5.6
VDP2	Viking LD to KD PL1571 Tee	PL1572 / 1574	Yes	0.1
VDP2	Viking KD to Viking BD	PL1571 / 1573	Yes	13.6
VDP2	Viking AR to Theddlethorpe	PL0027 / 0161	Yes	134.9
VDP2	Viking AR to Viking BP	PL0088 / 0134	Yes	10.9
VDP2	Vixen VM to Viking BD	PL1767 / 1768	Yes	8.7
VDP2	Viking Bravo to LOGGS	PL2643 / 2644	Yes	27.5
VDP2	Viking KD to Viking BD	PL1464 / 1465	Yes	0.3
VDP3	Victor JD to Viking BD	PL0211 / 0212	Yes	13.5
VDP3	Victor JM to Victor JD	PL1095 / 1096	Yes	5.1
VDP3	Victor JD to Victor JM	PLU4039/ UM1	Yes	5.4

3 PROPOSED WORK PROGRAMME

3.1 The applicant, Chrysaor, submitted a decommissioning programme for LDP3 to the Department for Business, Energy and Industrial Strategy (BEIS) in 2019. In support of the decommissioning programme detailed environmental impact assessments have been undertaken for LDP3 and LDP2; LDP4 and LDP5 programmes which have not yet been submitted to the Department. This is presented in an Environmental Appraisal (Chrysaor 2020a). The information presented within the Environmental Appraisal has been used to inform this HRA and the key information in the documents is summarised and referenced. Additional information regarding the potential cumulative impacts and further evidence regarding the level of potential impacts arising from the proposed programmes, has also been provided to BEIS (ConocoPhillips 2018a,b and c; Chrysaor 2020b).

LOGGS LDP2 to LDP5 work programme and infrastructure

3.2 The proposed work programme for LOGGS LDP2 to LDP5 is the:

- Plug and abandon wells in accordance with the well abandonment programme.[2]
- Preparation, final cleaning and removal of mobile hydrocarbons, production chemicals and mobile solids from pipelines and topsides (gas, methanol and corrosion inhibitors) and subsequent flooding of pipelines with seawater are (covered in separate environmental assessments for relevant environmental approvals).
- Preparation of infrastructure for removal by specialist contractors to an approved onshore disposal facility.
- Leaving installations in cold suspension marked with appropriate navigational aids for up to four years.
- Removal of infrastructure by heavy lifting vessel including topsides, jackets, pigging/valve skids and manifolds. The disconnection of platforms between the riser base and point of pipeline burial and removal of well conductors which could not be removed during the preceding well abandonment.
- Dismantling and disposal of infrastructure which has been removed to an onshore reception facility.
- The *in-situ* decommissioning of cleaned and disconnected pipelines and existing deposits with rock to stabilise cut pipeline ends.

[2] Well abandonment are subject to separate decommissioning programmes but are included here as part of the overall decommissioning works programme.

LDP2 Infrastructure

3.3 The LDP2 infrastructure to be decommissioned comprises three installations: Tethys TN, Mimas MN and Saturn ND (Table 4 and Figure 2). Subsea infrastructure consists of the Tethys Tee Structure and two valve skids (Table 5). There are also six associated pipelines: PL2234, 2235, 2236, 2237, 2107 and 2108 (Table 6).

3.4 Aside from the export pipeline from the satellite platforms to LOGGS complex, all the infrastructure to be decommissioned under the LDP2 lies outwith the North Norfolk Sandbanks and Saturn Reef SAC. The Saturn ND lies outwith the Southern North Sea SAC.

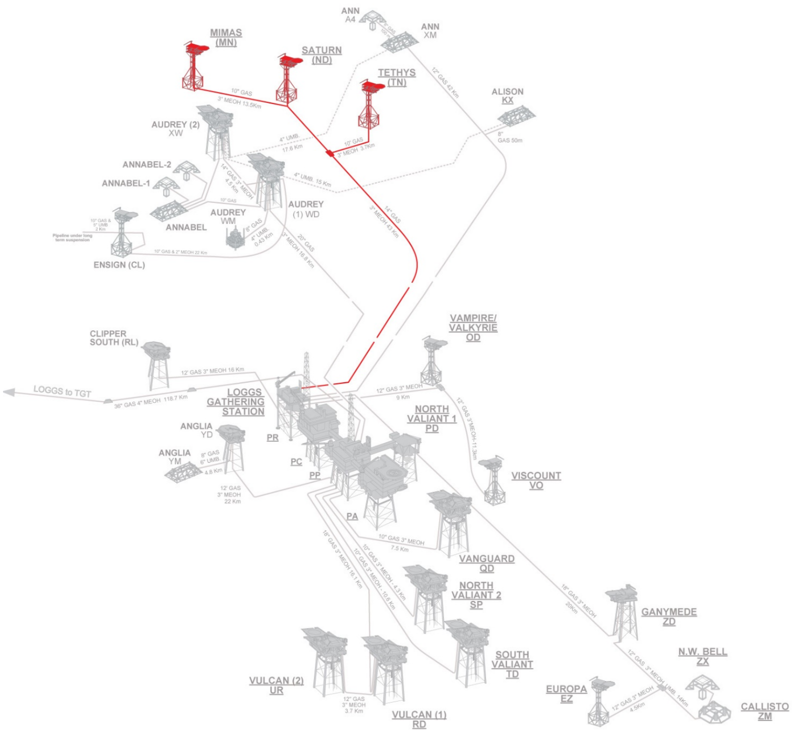


Figure 2: LDP2 Infrastructure (Source: Chrysaor 2020a).

LDP3 infrastructure

3.5 The LDP3 infrastructure to be decommissioned comprises two surface installations: Ganymede ZD and, Europa EZ platforms. Subsea infrastructure is located at NW Bell ZX and Callisto ZM (Table 4,Table 5 and Figure 3,). There are also ten associated pipelines and umbilicals: PL1093, 1094, 1694, 1695, 1690, 1691, 1091, 1092, UM2 and UM3 (Table 6). All four installations lie outwith the Southern North Sea SAC.

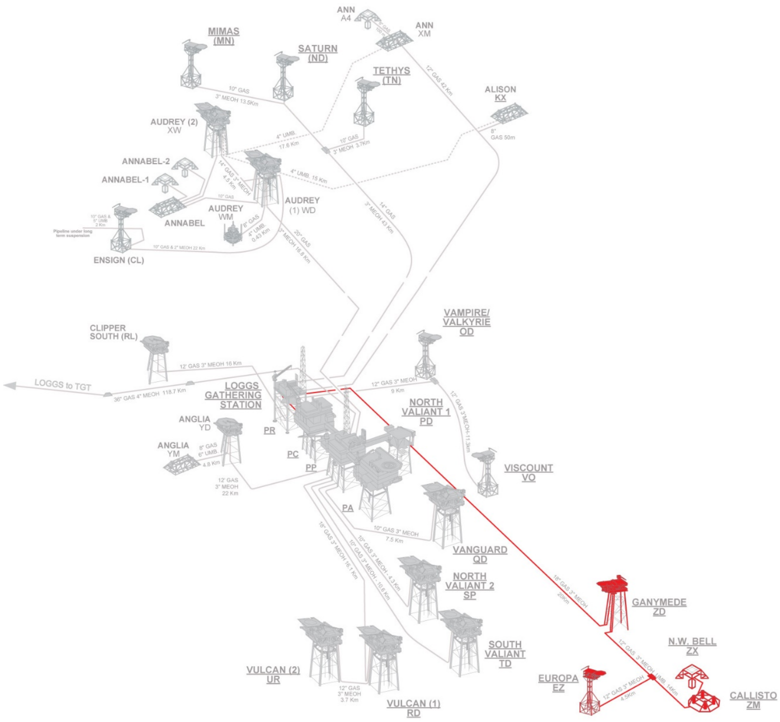


Figure 3: LDP3 Infrastructure (Source: Chrysaor 2020a).

LDP4 infrastructure

3.6 The LDP4 infrastructure to be decommissioned comprises four installations: South Valliant TD, North Valiant 2 SP, Vanguard QD and Vulcan 1 RD (Table 4, Figure 4). There are also eight associated pipelines: PL0460, 0461, 0470, 0471, 0456, 0457, 0458 and 0459 (Table 6).

Figure 4: LDP4 Infrastructure (Source: Chrysaor 2020a)

LDP5 infrastructure

3.7 The LDP5 infrastructure to be decommissioned comprises five installations: LOGGS Hub PR, LOGGS Hub PC, LOGGS Hub PP, LOGGS Hub PA and North Valiant 1 PD (Table 4, Figure 5). There are also two associated items of subsea infrastructure and two pipelines: PL0454 and 0455 (Table 5, Table 6).

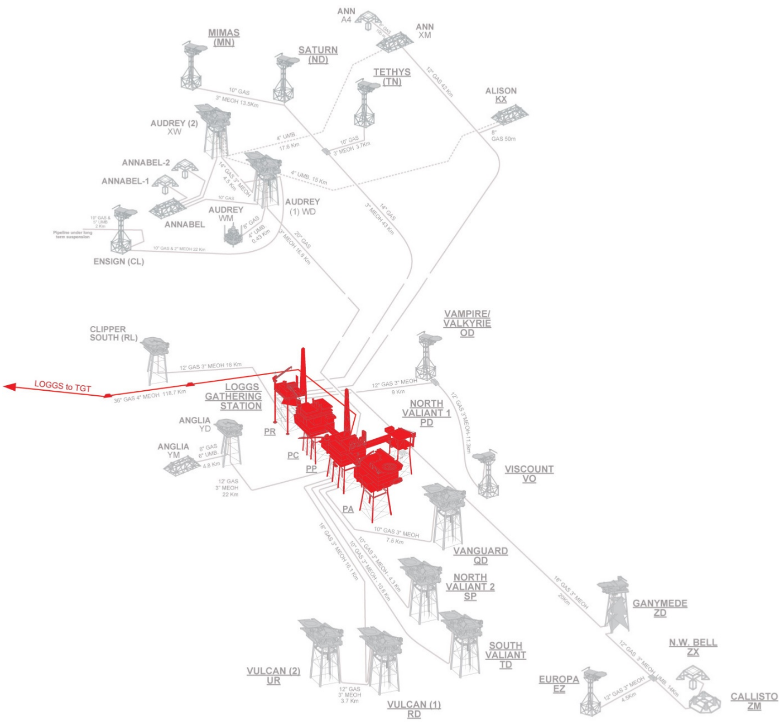


Figure 5: LDP5 Infrastructure (Source: Chrysaor 2020a).

3.8 A summary of the platform infrastructure associated with the LOGGS LDP2 to LDP5 is presented in Table 4 and the sub-surface installations and other structures are presented in Table 5.

3.9 It is proposed that all platforms subject to these decommissioning programmes will be fully removed using a heavy lift vessel. All wells will be plugged and abandoned, and conductors removed as well as subsea pigging/valve skids, manifolds and pipeline tees A total of 26 pipelines, associated methanol lines and communication umbilicals included as part of LDP2 to LDP5 will be cut and left *in situ* with associated mattresses, grout bags and other deposits laid during operational life for stabilisation. To reduce the risk of exposure to other sea users, the ends of the cut pipeline will be covered using rock. The minimum rock required to ensure pipeline stability and mitigate snagging will be used.

Table 4: LOGGS LDP2 to LDP5 Platform Infrastructure.

Installation		Number of wells	Number of piles
LDP2			
Tethys TN	Three-legged, fixed steel wellhead platform	1	3
Mimas MN	Three-legged, fixed steel wellhead platform	1	3
Saturn ND	Three-legged, fixed steel wellhead platform	4	4
LDP3			
Ganymede ZD	Four-legged, fixed steel platform	8	4
Europa EZ	Four-legged, fixed steel platform	6	4
LDP4			
South Valiant TD	Four-legged, fixed steel platform	6	4
North Valiant 2 SP	Four-legged, fixed steel platform	9	4
Vanguard QD	Four-legged, fixed steel platform	5	4
Vulcan (1) RD	Four-legged, fixed steel platform	8	4
LDP5			
LOGGS Hub PR	Four-legged, fixed steel platform	0	4
LOGGS Hub PC	Eight-legged, fixed steel platform	0	8
LOGGS Hub PP	Eight-legged, fixed steel platform	0	8
LOGGS Hub PA	Four-legged, fixed steel platform	0	4
North Valiant 1 PD	Four-legged, fixed steel platform	9	4

Table 5: Subsea infrastructure for LOGGS LDP2 to LDP5.

Decommissioning programme	Subsea infrastructure	Inside NNSSR SAC
LDP2	Tethys TN Tee Structure	No
LDP2	Tethys TN 10" (PL2334) valve skid	No
LDP2	Tethys TN 3" (PL2335) valve skid	No
LDP3	NW Bell Manifold	Yes
LDP3	Callisto ZM Manifold	Yes
LDP3	Sinope Tee Structure	Yes
LDP3	Sinope Pigging Skid	Yes
LDP5	PL0454 Tie-in Tee Structure 1	Yes
LDP5	PL0454 Tie-in Tee Structure 2	No

Table 6: Pipelines relating to LOGGS LDP2 to LDP5.

Pipelines	Type	Pipeline No.	Length (km)
LDP2			
Tethys TN to PL2107 Tee 10" gas line	Gas	PL2234	3.8 [1]
	Methanol	PL2235	3.8 [1]
Mimas MN to Saturn ND 10" gas line	Gas	PL2236	13.6 [1]
	Methanol	PL2237	13.6 [1]
Saturn ND to LOGGS PR 14" gas line	Gas	PL2107	43.2
	Methanol	PL2108	43.2 [1]
LDP3			
Callisto ZM to Ganymede ZD	Gas	PL1091	14.3
	Methanol	PL1092	14.3
Ganymede ZD to LOGGS PR	Gas	PL1093	19.5
	Methanol	PL1094	19.5
NW Bell ZX to Callisto ZM	Gas	PL1690	0.1
	Methanol	PL1691	0.1
Europa EZ to 1091 Tee	Gas	PL1694	4.5
	Methanol	PL1695	4.5
NW Bell ZX to Callisto ZM	Hydraulics	PLU4177/ UM2	0.1
Callisto ZM to Ganymede ZD	Electrical	PLU4178/ UM3	14.0
LDP4			
South Valiant TD to LOGGS PP 10" gas line	Gas	PL0460	10.6
	Methanol	PL0461	10.6
North Valiant SP to LOGGS PP 10" gas line	Gas	PL0470	4.3
	Methanol	PL0471	4.3
Vanguard QD to LOGGS PP 10" gas line	Gas	PL0456	7.5
	Methanol	PL0457	7.5
Vulcan RD to LOGGS PP 18" gas line	Gas	PL0458	16.1
	Methanol	PL0459	16.1
LDP5			
LOGGS PP to Theddlethorpe 36" gas line	Gas	PL0454	118.3
	Methanol	PL0455	118.3

[1] = Tethys, Mimas and Saturn Pipelines are not in North Norfolk Sandbanks and Saturn Reef SAC.

Well Abandonment

3.10 A total of 59 wells across LDP2 to LDP5 are to be plugged and abandoned using a jack-up drilling rig as part of the decommissioning activities. Chrysaor have included the cumulative impact from well abandonment in the environmental appraisal they undertook for the LOGGS LDP2 to LDP5 decommissioning projects (Chrysaor 2020a). Each well abandonment activity is also assessed separately at the time of abandonment via the use of MATS/SATs, OGA are the decision making authority. The well abandonment programme is integral to the impacts arising from the LOGGS decommissioning programmes 2 - 5 and therefore the impacts from well abandonment have been included in this assessment. The number of wells to be abandoned at each of the installations is presented in Table 7.

Table 7: Total number of wells associated with LDP2 to 5 decommissioning to be plugged and abandoned.

Installation	Number of wells to abandon
NW Bell	1
Callisto	1
Ganymede	8
Europea EZ	6
South Valiant	6
Vanguard QD	5
Vulcan RD	12
North Valiant SP	9
North Valiant PD	5
Tethys TN	1
Saturn ND	4
Mimas MN	1
Total number of wells	59

3.11 Decommissioning activities are proposed to be undertaken over a period of ten years. However, completion of activities may occur earlier with an estimated completion date of 2024/2025, subject to regulatory approvals and operational impacts.

3.12 Physical impacts to qualifying features may occur during decommissioning activities and these may be temporary, where the habitat may recover overtime.

3.13 Proposed activities that could cause a physical impact to habitat include:

- The use of anchors and chains during the locating of the heavy lift vessel where not using dynamic positioning (in a worst case scenario),
- The lowering of spud cans by a drilling rig during well abandonment,

- The lowering of spud cans by the jack-up accommodation work vessel,
- The removal of jacket piles (platforms), subsea infrastructure including skids and manifolds (some piled), disconnected sections of pipeline at the riser base to the point of burial and tee points, well conductors and temporary placement of debris baskets to recover items.

3.14 Proposed activities that could cause a physical loss of habitat include:

- The removal of infrastructure and smothering,
- The placement of rock for rig and accommodation work vessel stabilisation
- The placement of rock over pipeline ends, ends of former tee locations and to remediate four free spans 53.87 meters in length.
- The leaving *in situ* pipelines exposed on the seabed.

3.15 For the purposes of this assessment the physical loss of habitat is a permanent impact on the habitat.

4 DESIGNATED SITES

4.1 The proposed decommissioning activities will occur within a number of designated sites, namely:

- The North Norfolk Sandbanks and Saturn Reef SAC,
- The Southern North Sea SAC,
- Inner Dowsing, Race Bank and North Ridge SAC,
- The Greater Wash SPA,
- Humber Estuary SPA.

4.2 A significant proportion of the proposed decommissioning activities associated with the LOGGS LDP2 – 5 will be undertaken within the North Norfolk Sandbanks and Saturn Reef SAC (Figure 6). Impacts arising from the proposed activities have potential to cause a likely significant effect on the qualifying features of the site.

4.3 The proposed decommissioning activities will occur within or adjacent to the Southern North Sea SAC (Figure 7). Impacts arising from the proposed activities have potential to cause a likely significant effect on the qualifying features of the site.

4.4 The Inner Dowsing, Race Bank and North Ridge SAC is designated for Sandbanks which are slightly covered by seawater all the time and Reefs. A total of 19.32 km of the LOGGS gas export line to Theddlethorpe crosses the SAC. The pipeline is trenched and buried and will remain *in situ and* there will be no activities associated with the LOGGS LDP2 to LDP5 undertaken within or adjacent to the SAC. Consequently, there will be no impacts that will cause a likely significant effect on the qualifying features of the site.

4.5 The Greater Wash SPA is designated on the basis of supporting populations of national importance for: red-throated diver, common scoter, little gull, common tern, little tern and Sandwich tern. The LOGGS to Theddlethorpe gas export line crosses the SPA (25.9 km in total). The pipeline is trenched and buried and will remain *in situ* and there will be no activities associated with the LOGGS LDP2 to LDP5 undertaken within or adjacent to the SPA. Consequently, there will be no impacts that will cause a likely significant effect on the qualifying features of the site.

4.6 The Humber Estuary SPA is designated on the basis that it supports nationally important populations for a number of wader and wildfowl species along with hen and marsh harriers. The LOGGS gas export line to Theddlethorpe crosses the SPA (0.36km in length). The pipeline is trenched and buried and will remain *in situ* and there will be no activities associated with the LOGGS LDP2 to LDP5 undertaken within or adjacent to the SPA. Consequently, there will be no impacts that will cause a likely significant effect on the qualifying features of the site.

4.7 Based on the information presented within the application it is determined that there is potential for a likely significant effect on two designated sites:

- The North Norfolk Sandbanks and Saturn Reef SAC,
- The Southern North Sea SAC,

4.8 The North Norfolk Sandbanks and Saturn Reef SAC covers an area of 3,603 km^2 and lie entirely within UK territorial waters adjacent to the counties of Norfolk. It was formally classified as a SAC on 29 September 2017 on account of its Sandbanks which are slightly covered by sea water all the time [Habitat code 1110] and Reefs [Habitat code 1170] (Natura 2000, 2012). The basis for the classification is set out in a Natura 2000 Standard Data Form (JNCC 2010a).

4.9 The Southern North Sea SAC covers an area of 36,951 km^2 extending from the central North Sea, north of the Dogger Bank, to the Strait of Dover and is designated for harbour porpoise (*Phocoena phocoena*). It was formally classified as a SAC in February 2019 and the basis for the classification is set out in a Natura 2000 Standard Data Form (JNCC 2019a).

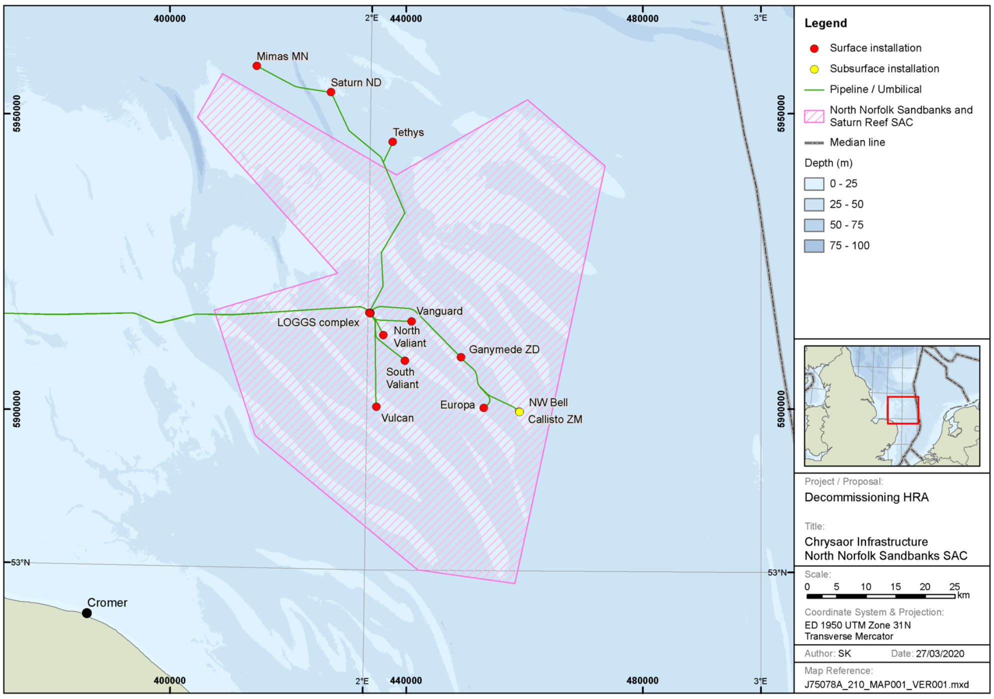


Figure 6: North Norfolk Sandbanks and Saturn Reef SAC and installations to be decommissioned as part of LDP2 to LDP5.

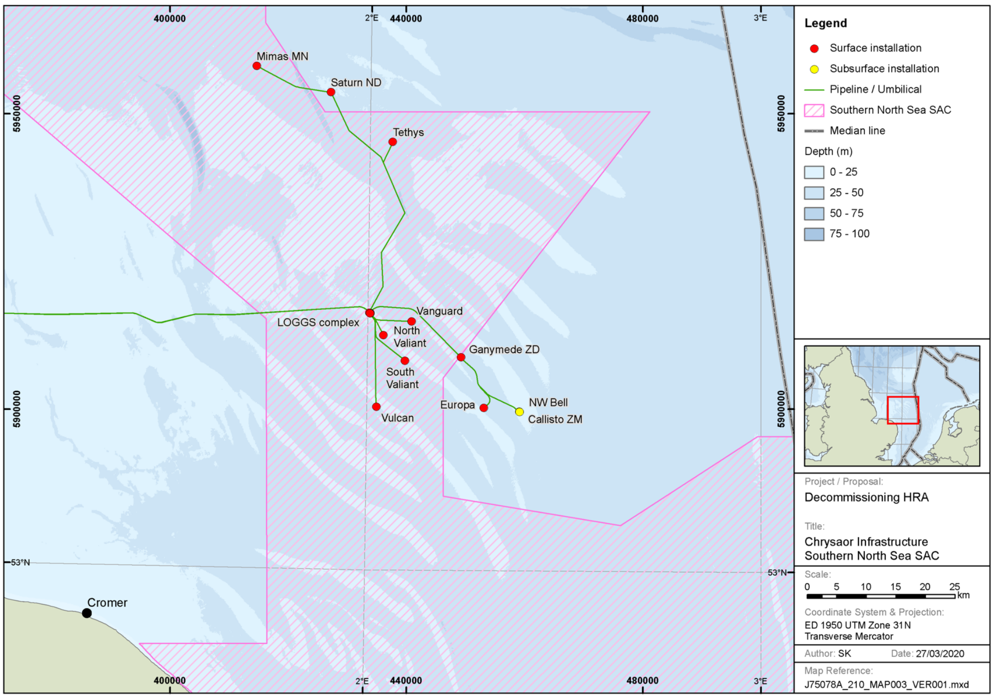


Figure 7: Southern North Sea SAC and installations to be decommissioned as part of the LDP2 to LDP5.

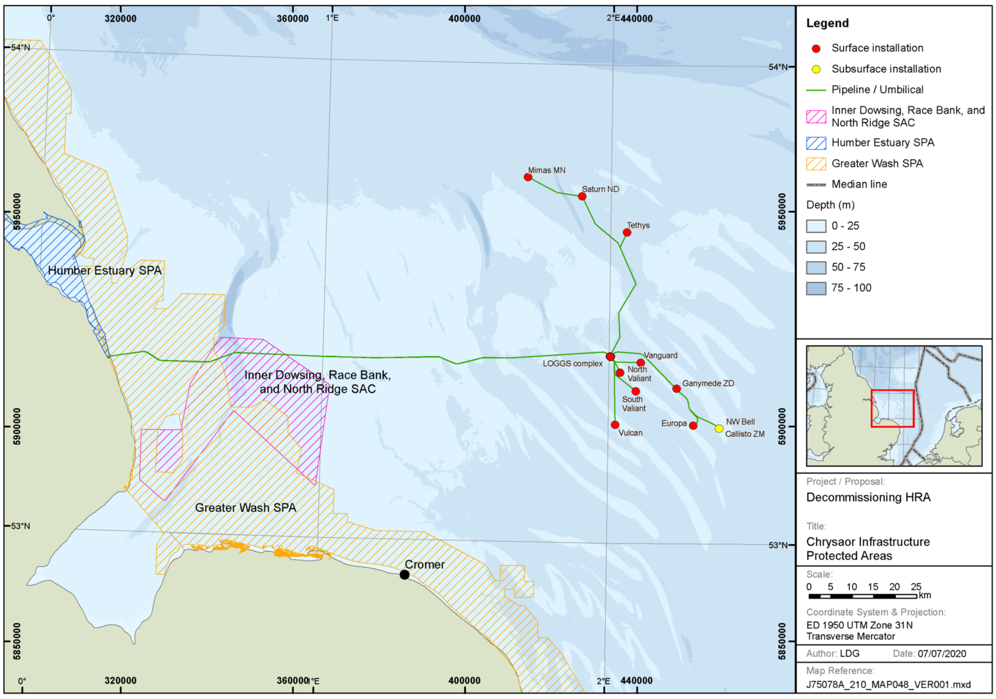


Figure 8: Inner Dowsing, Race Bank and North Ridge SAC, The Greater Wash SPA and the Humber Estuary SPA and installations to be decommissioned as part of the LDP2 to LDP5.

5 CONSERVATION OBJECTIVES

5.1 Conservation Objectives outline the desired state for any national site, in terms of the interest features for which it has been designated. If these interest features are being managed in a way which maintains their nature conservation objectives, they are assessed as being in a 'favourable condition'. An adverse effect on integrity is likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature as it did at the time of its designation (English Nature 1997).

5.2 Favourable Conservation Status is defined in Article 1(e) of the Habitats Directive as:

> *Conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species within the territory referred to in Article 2;*

5.3 The conservation status of a natural habitat will be taken as "favourable" when:

> *its natural range and areas it covers within that range are stable or increasing. the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable as defined in (i).*

5.4 Advice from the JNCC is that, in their view, both Annex 1 sandbank habitats and Annex 1 reef habitats within the North Norfolk Sandbanks and Saturn Reef SAC are in unfavourable condition. This based on their understanding that one or more of the sites attributes need to be restored or where restoration is not considered to be possible through human intervention (JNCC 2017b).

5.5 The harbour porpoise within the Southern North Sea SAC has a favourable conservation status (JNCC and NE 2019).

5.6 There are no set thresholds at which impacts on site integrity are considered to be adverse. This is a matter for interpretation on a site-by-site basis, depending on the designated feature and nature, scale and significance of the impact.

5.7 The European Court of Justice has defined '*adverse effect on site integrity*' as a plan or project that is '*liable to prevent the lasting preservation of the constitutive characteristics of the site that are connected to the presence of a priority natural habitat whose conservation was the objective justifying the designation of the site in the list of sites of Community importance*' (Sweetman 2013).

5.8 When assessing potential small scale impacts on Annex I habitats it is the relative importance of the area affected in terms of the rarity, location, distribution, vulnerability to change ecological structure which is most influential (Chapman & Tyldesley 2016).

5.9 The integrity of a site is defined as being '*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*' (ODPM Circular 06/2005).

5.10 Conservation Objectives have been used by the Department BEIS to consider whether the proposed activities have the potential for causing an adverse effect on a site's integrity, either alone or in-combination.

North Norfolk Sandbanks and Saturn Reef SAC Conservation Objectives

5.11 The Conservation Objectives of each site are required in order to undertake an Appropriate Assessment. The following Conservation Objectives have been produced by the JNCC for North Norfolk Sandbanks and Saturn Reef SAC (JNCC 2017a).

North Norfolk Sandbanks and Saturn Reef SAC Conservation Objectives:

For the features to be in favourable condition thus ensuring the integrity of the site in the long term and contribution to Favourable Conservation Status of Annex I Sandbanks which are slightly covered by sea water all of the time and Annex I reefs. This contribution would be achieved by maintaining or restoring, subject to natural change:

- The extent and distribution of the qualifying habitats in the site;
- The structure and function of the qualifying habitats in the site; and
- The supporting processes on which the qualifying habitats rely.

Source JNCC 2017c

5.12 It is noted that the qualifying features of the site are in *unfavourable condition* (JNCC 2017b).

Objective One: The extent and distribution of the qualifying habitats in the site

5.13 With regards to the first objective, supplementary advice on the Conservation Objectives of the site are:

Sandbank habitat

5.14 *JNCC understands that the site has been subjected to activities that have resulted in a change to the* ***extent and distribution*** *of the feature within the site. Installation and/or removal of infrastructure may have a continuing effect on extent and distribution. As such, JNCC advise a* ***restore objective*** *which is based on expert judgment; specifically,* *our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities i.e. oil and gas sector activities and cabling. Our confidence in this objective would be improved with longer-term monitoring and access to better information on the activities taking place within the site. Activities must look to minimise, as far as is practicable, changes in substratum and the biological assemblages within the site to minimise further impact on feature extent and distribution* (JNCC 2017c).

***Sabellaria spinulosa* biogenic reef habitat**

JNCC understands that the site has been subjected to activities that have resulted in a change to the ***extent and distribution*** *of the feature within the site. Installation and/or removal of infrastructure may have a continuing effect on extent and distribution of the biogenic reef within the site. As such, JNCC advise* ***a restore objective*** *which is based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities i.e. those associated with the oil and gas industry and demersal fishing. Our confidence in this objective would be improved with longer-term monitoring and access to better information on the activities taking place within the site. Activities must look to minimise, as far as is practicable, damaging the established i.e. high confidence reef within the site.* (JNCC 2017c).

Objective two: The structure and function of the qualifying habitats in the site

5.15 With regards to the second objective, supplementary advice on the Conservation Objectives of the site are:

Sandbank habitat

5.16 *JNCC understands that the site has been subjected to activities that have resulted in a change to the structure and function of the feature within the site. Installation and/or removal of infrastructure may have a continuing effect on* ***structure and function****, specifically the finer scale topography, sediment composition and distribution of characteristic communities. As such, JNCC advise a* ***restore objective*** *which is based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities i.e. demersal fishing, oil and gas sector activities and cabling. Our confidence in this objective would be improved with longer-term monitoring, access to better information on the activities taking place within the site and a better understanding of the species which can play key and influential roles in determining the feature's function and health. Activities must look to minimise, as far as is practicable, disturbance and changes to the sediment composition, finer scale topography and biological communities within the site* (JNCC 2017c).

***Sabellaria spinulosa* biogenic reef habitat**

5.17 *JNCC understands that the site has been subjected to activities that have resulted in a change to the* ***structure and function*** *of the feature within the site. Installation and/or* *removal of infrastructure may have a continuing effect on structure and function, specifically the characteristic communities and sediment composition and distribution. As such, JNCC advise a* ***restore objective*** *which is based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities i.e. those associated with the oil and gas industry and demersal fishing. Our confidence in this objective would be improved with long-term monitoring and access to better information on the activities taking place within the site. Activities must look to minimise, as far as is practicable, damage and disturbance to the physical structure of established reef within the site and its associated biological communities* (JNCC 2017c).

Objective three: The supporting processes on which the qualifying habitats rely

5.18 With regards to the third objective, supplementary advice on the Conservation Objectives of the site are:

Sandbank habitat

5.19 *A* ***maintain*** *objective is advised for* ***supporting processes*** *based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities. Our confidence in this objective would be improved with long-term monitoring, specifically of contaminant levels within the site and a better understanding of the hydrodynamic regime within the site. Activities must look to avoid, as far as is practicable, impairing the hydrodynamic regime within the site and exceeding Environmental Quality Standards* (JNCC 2017c).

Sabellaria spinulosa **biogenic reef habitat**

5.20 *A* ***restore*** *objective is advised for the* ***supporting habitat*** *within the site and a* ***maintain*** *objective is advised for* ***hydrodynamic regime and water quality*** *within the site. These objectives are based on expert judgment; specifically, our understanding of the feature's sensitivity to pressures which can be exerted by ongoing activities i.e. demersal fishing and oil and gas sector activities. Our confidence in these objectives would be improved with longer-term monitoring, specifically of contaminants within the site. It would also be improved with access to better information on the activities taking place within the site. Activities must look to minimise, as far as is practicable, disturbance to the hydrodynamic regime within the site and the habitats which support the reef within the site. Activities must also look to avoid, as far as is practicable, exceeding Environmental Quality Standards for aqueous contaminants* (JNCC 2017c).

5.21 The JNCC consider the entire site to represent an integrated sandbank system, with the qualifying feature occupying the entire site (JNCC 2017c).

5.22 The JNCC advise that due to the cyclical nature of reef formation and decay, it is important to conserve the feature's overall extent within a site, and that this approach includes conserving both established reef and areas of potential reef. Assessments should focus on reef extent occurring at that specific point in time, therefore a repeat survey may be required at the point of assessment. (JNCC 2017c).

Southern North Sea SAC Conservation Objectives

5.23 The following Conservation Objectives have been produced by the JNCC for the Southern North Sea SAC (JNCC and NE 2019).

> ***Southern North Sea SAC Conservation Objectives:***
>
> To ensure that the integrity of the site is maintained and that it makes the best possible contribution to maintaining Favourable Conservation Status for Harbour Porpoise in UK waters.
>
> In the context of natural change, this will be achieved by ensuring that:
>
> 1. Harbour porpoise is a viable component of the site,
> 2. There is no significant disturbance of the species, and
> 3. The condition of supporting habitats and processes, and the availability of prey is maintained.
>
> *Source: JNCC and NE 2019*

5.24 The intent of the first objective is to '*minimise the risk of injury and killing or other factors that could restrict the survivability and reproductive potential of harbour porpoise using the site. Specifically, this objective is primarily concerned with operations that would result in unacceptable levels of those impacts on harbour porpoises using the site. Unacceptable levels can be defined as those having an impact on the FCS of the populations of the species in their natural range. The reference population for assessments against this objective is the MU population in which the SAC is situated*' (JNCC and NE 2019).

5.25 Within the Conservation Objectives '*Disturbance is considered significant if it leads to the exclusion of harbour porpoise from a significant portion of the site*'. Guidance has been published on how to assess the significance of disturbance (JNCC, NE and DAERA 2020a,b). However, there has been no Governmental agreement on the proposed approach presented in the guidance and alternative approaches to assessing the significance of disturbance is possible.

5.26 The third objective '*encompass the movements and physical properties of the habitat. The maintenance of supporting habitats and processes contributes to ensuring that prey is maintained within the site and is available to harbour porpoises using the site*' (JNCC 2019b).

5.27 A **maintain** objective is advised for all three of the site's objectives (JNCC and NE 2019).

5.28 JNCC advise that it is not appropriate to use the site population estimates in any assessments of effects of plans or projects (i.e. Habitats Regulation Assessments), as it is necessary to take into consideration population estimates at the management unit level to account for daily and seasonal movements of the animals (JNCC and NE 2019).

5.29 The purpose of an Appropriate Assessment is to determine whether a plan or project adversely affects a site's integrity. The critical consideration in relation to site integrity is whether the plan or project affecting a site, either individually or in combination, affects the site's ability to achieve its conservation objectives and favourable conservation status.

5.30 The Appropriate Assessment has been carried out in light of best scientific knowledge with reference to the Conservation Objectives of the qualifying sites and the potential impacts on the integrity of the site (EC 2010, EC 2019).

6 SCOPE OF THE ASSESSMENT

6.1 Based on the likely activities predicted to occur during decommissioning it has been determined that the HRA should consider alone and in-combination the potential direct and indirect impacts on:

- Sandbanks,
- Biogenic reefs,
- Harbour porpoise.

Sandbanks

6.2 Sandbanks which are slightly covered by seawater all the time are an Annex I habitat under the Habitats Directive and are described as *Sublittoral sandbanks, permanently submerged. Water depth is seldom more than 20 m below Chart Datum*. They occur widely in UK coastal and offshore waters. There are twenty designated sites in UK waters for which this habitat is a primary feature and a further 16 sites in which the habitat occurs but not identified as a primary reason for site selection (JNCC 2020a).

6.3 Annex I Sandbanks are defined by their physiographic nature rather than by a specific biological community (JNCC 2013). There has been no significant change in recent geological times and although there may have been localised declines the overall geographic spread and distribution of offshore sand banks have not been reduced (JNCC 2013).

6.4 The total area of sandbank habitat identified in UK waters is reported to be 105,785 km^2, of which 21,979 km^2 lies within designated sites (JNCC 2019a).

6.5 The North Norfolk Sandbanks are the most extensive example of the offshore linear ridge sandbank type in UK waters (JNCC 2020). The SAC has within its boundaries a series of sandbanks including Leman, Ower, Inner, Well, Broken, Swarte and Indefatigable banks. They extend from between 40 km and 110 km off the coast of Norfolk in water depths of up to 40 m (Figure 9).

6.6 The extent of sandbank habitat within the SAC covers 3,603 km^2, 3.4% of the total habitat in UK offshore waters and 16.4% of the habitat type within offshore designated sites (JNCC 2020a).

6.7 The Norfolk sandbanks are very slowly migrating north-east. Published studies have suggested that the lateral rate of movement occurs at a rate of between 1 – 5 m/year (ABPmer 2005, Cooper *et al*. 2008). However, the internal structure of the Norfolk Banks indicates that it is at a rate of *c*.1 m/yr (Cooper *et al.* 2008). At this rate it would take over one hundred years to detect any movement of the sandbanks greater than 100 m, which is within the distance of survey and charting errors (Cooper *et al*. 2008). Furthermore, the outer Indefatigable and Swarte banks may be moribund, with their crests in deeper water, and therefore may not be mobile (Cooper *et al*. 2008). Although, there may be linear movements of the sandbanks, particularly at their ends, where movements of up to 40 m per year have been reported (ABPmer 2005).

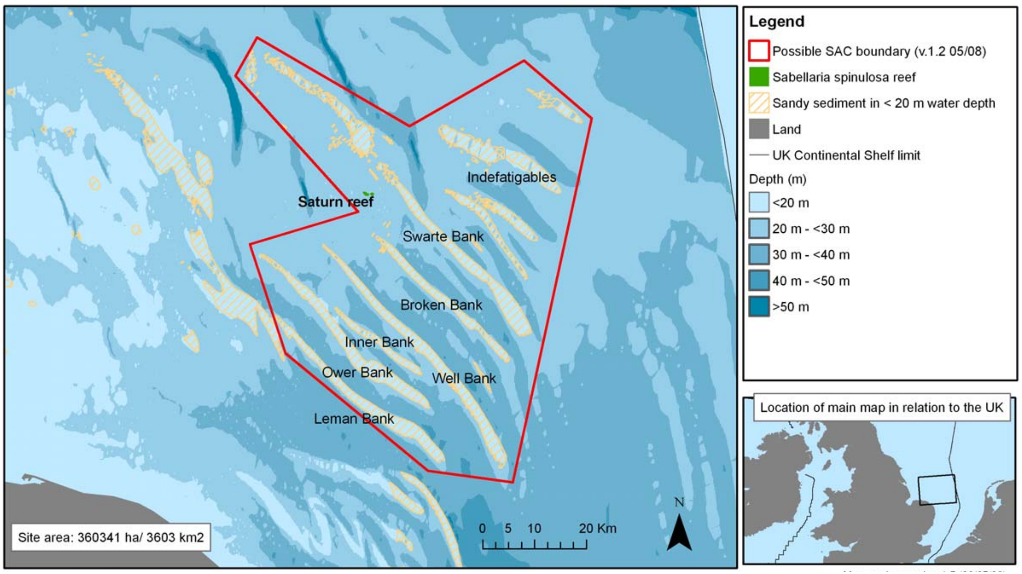


Figure 9: Sandbanks within North Norfolk Sandbanks and Saturn Reef SAC (Source JNCC 2010).

6.8 The North Norfolk Sandbank SAC comprises seven habitat types with Infralittoral fine sand or infralittoral muddy sand habitats occurring predominantly along the sandbanks and circalittoral fine sand or circalittoral muddy sand occurring predominantly between the sandbanks. Infralittoral and circalittoral course sediment habitats also occurs within the SAC (ABPMer and Ichthys Marine 2015).

6.9 Within the site there are four main biotopes circalittoral coarse sediment biotopes, circalittoral coarse sand biotopes, circalittoral sand biotope and circlittoral mixed sediment biotope (JNCC 2013).

6.10 The biological communities present on the sandbanks are representative of the infralittoral mobile sand biotope. Species typical of this biotope include the polychaete worm *Nephtys cirrosa* and the isopod *Eurydice pulchra* (JNCC 2017c). Characteristic species recorded during surveys within the SAC included *Mediomastus fragilis, Sabellaria spinulosa*, *Scalibregma inflatum* and *Notomastus*. *Bathyporeia guilliamsoniana* are more abundant in Circalittoral sand biotopes compared with others (JNCC 2013). However, differences in communities are slight with substrate type not having a very strong effect on differences in community.

6.11 Species within infralittoral mobile sand biotopes are adapted to high levels of disturbance. However, the mobility of the sediment leads to a species-poor community. They are able to withstand mobile sediments and are opportunistic (Tillin *et al*. 2019).

The faunal community is highly resilient to any level of impact with recovery often within a few days or weeks. Following severe disturbances recovery is expected to occur within 12 months (Tillin *et al.* 2019).

6.12 The communities have low sensitivity to smothering and abrasion or disturbance to the seabed surface. However, they are highly sensitive to changes to different types of sediment and the physical loss of suitable habitat (Tillin *et al*. 2019).

6.13 Communities may also be sensitive to introduced, or the spread of, non-native species. However, vessels planned to be undertaking the proposed decommissioning activities are already operating in UK waters and therefore there is no risk of the introduction of non-native species during these activities. In the event that vessels from outwith the UK are commissioned to undertake future decommissioning work within the SAC they would be subject to national and international requirements regarding the management of ballast water.

6.14 Sandbanks are characterised by relatively strong currents which produce characteristic features such as mega ripples. During certain conditions, e.g. storms, the tops of sandbanks can be removed and replaced later during calmer conditions (Elliot *et al.* 1998).

6.15 Modelling has indicated that sediments across the site are highly mobile with mobile bedforms present on the tops of the sandbanks for 85–95% of the time and in the deeper areas between the sandbanks for around 10– 80% of the time for 250 μm grain size, and 0–20% for 63 μm grain size (ABPMer and Ichthys Marine 2015).

6.16 Subtidal sandbanks are subject to continued reworking of the sediment by wave action and tidal streams and thus are dominated by species capable of tolerating severe changes in the hydrophysical regime.

6.17 Sandbanks are highly motile and so introducing solid structures to this environment can create localised artificial habitats, scouring and sediment deposits. Removal of the sandbank features, including the substratum, would result in some localised temporary loss of its ecological communities. The structure and diversity of sandbank communities are determined by environmental characteristics such as sediment particle size distribution, seabed slope and water depth. Any change in these environmental parameters (e.g. by removing or smothering part of the feature) could result in a loss of habitat and a possible shift in community organisation.

6.18 The pressures and sensitivities on the sandbank feature of the SAC to oil and gas decommissioning related activities are presented in Table 8 (JNCC 2017d).

6.19 The sensitivity of Annex I sandbanks in the UK offshore waters to oil and gas related activity is reported to be low because they act only over a small portion of the known occurrences of the habitat (JNCC 2013). However, their sensitivity to localised impacts may be higher depending on the scale of the impact. Consequently, the sensitivity of sandbanks to oil and gas activities is dependent on the extent of the activity.

6.20 The JNCC (2012) reports that '*Any construction over the sandbanks would lead to their obstruction. The natural development i.e. shift in location (and shape of a sandbank), and recovery may be prevented by any permanent infrastructure itself. This could also affect sandbank recovery through changes in the local hydrographic regime, caused by the obstruction. Sensitivity to obstruction is therefore considered high*' and the '*The sandbank feature's ecological communities is sensitive to smothering at a low level, particularly the lower lying or encrusting typical species*'.

6.21 Studies undertaken to assess the sensitivity of Marine Conservation Zone (MCZ) and Marine Protected Area (MPA) features on a broad range of pressures have identified that subtidal sand had a low to medium sensitivity from physical disturbance of the substrate. Similarly, the habitat is identified as being highly sensitive to change to another seabed type (Tillin *et al.* 2010, Tillin and Tyler-Walters 2015). The sensitivity is determined by the magnitude of the pressures and set against a benchmark. The studies recognise that the sensitivity of a habitat to a pressure may also vary depending on the frequency and duration of the pressures and their spatial extent. The temporal and spatial aspects of the pressure and spatial scale of the feature being exposed to the pressure should be considered when determining the sensitivity of habitat to a pressure (Tillin *et al.* 2010).

6.22 Potential impacts arising from the removal of infrastructure, the use of anchors by vessels and rock dumping could cause physical loss and physical impacts to sandbank habitats within the SAC.

Reefs

6.23 Reefs are an Annex I habitat under the Habitats Directive and are described as *rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide.* Two main types of reef are recognised: those where animal and plant communities develop on rock or stable boulders and cobbles, and those where structure is created by the animals themselves (biogenic reefs) (JNCC 2014b). It is biogenic reef habitat formed by the tubeworm *Sabellaria spinulosa* that occurs within the North Norfolk Sandbanks and Saturn Reef SAC.

6.24 The biogenic reef habitat formed by *S. spinulosa* occurs in both inshore and offshore waters. There are five designated sites in UK waters for which this specific reef habitat is a primary feature, of which the North Norfolk Sandbanks and Saturn Reef SAC is one (JNCC 2014b).

6.25 *Sabellaria spinulosa* occurs widely and is found in the subtidal and lower intertidal/sublittoral fringe, especially in areas of turbid seawater with a high sediment load. *Sabellaria* reef habitats are less frequent with relatively few examples occurring in UK waters

6.26 The SAC has within its boundaries the Saturn *Sabellaria spinulosa* biogenic reef. In 2003, the Reef covered an area approximately 750 m by 500 m, just to the south of Swarte Bank, varying in density over an area of 1.08 km^2 (JNCC 2014b, Natura 2000 2012). More recent surveys in the area have not found the extensive reef recorded in 2003, but whether this absence is as a result of damage to the reef structures (e.g. by bottom trawling) or whether such reefs are naturally ephemeral is not yet known. However, formation of such a substantial reef of *S. spinulosa* in this area in 2003 indicates favourable conditions for reef formation (JNCC 2010a).

6.27 The polychaete *Sabellaria spinulosa* is, in its adult form, a sedentary species of tube worm with a distribution ranging from north of Shetland to the Mediterranean and occurring throughout UK waters, including the North Sea. Where it occurs, the species is abundant with reported densities ranging from 299/m^2 up to 9,561 in 1.4 m^2 (Hiscock 2003).

6.28 *Sabellaria spinulosa* grows rapidly with adults reaching maximum biomass within months of settling from the juvenile stage (Pearce *et al*. 2007). *S. spinulosa*'s life history favours settlement and adaptation to live in frequently disturbed environments and rapid reproduction (planktotrophic larvae) rates during January and February (George & Warwick 1985, MarLIN 2011).

6.29 *Sabellaria spinulosa* preferentially colonise areas of hard substratum, typically on shell, sandy gravel or rocky substrates with moderate tidal flow. The species requires sand grains in order to form its tubes and will therefore occur in very turbid waters where sand is placed in suspension by water movement (Jones, Hiscock & Conner 2000).

6.30 Where *S. spinulosa* reefs occur, there may be an increase in both the diversity and abundance of other species (Jones, Hiscock & Conner 2000). However, this may not always be the case with studies showing areas of *S. spinulosa* reef having significant increases in abundance but not necessarily increases in biodiversity (Pearce *et al*. 2007).

6.31 Studies undertaken at aggregate extraction sites in the southern North Sea and English Channel indicate that *S. spinulosa* are able to tolerate levels of disturbance from aggregate extraction including significant levels of sediment disturbance and can re-colonise areas that had previously been dredged to a level of high abundance within three years, with re-colonisation starting within 12 months of dredging activities ceasing

(Pearce *et al.* 2007; Pearce *et al*. 2011). Consequently, it is possible for re-colonisation to occur relatively quickly if conditions are suitable.

6.32 Monitoring undertaken along a surface laid pipeline, placed 550 m from a *S. spinulosa* reef in the Southern North Sea was unable to detect any evidence of an impact from anchors or anchor wires on the seabed or the *S. spinulosa* reef less than three years after the activities had taken place. Further monitoring along the pipeline route indicated that the laying of the pipeline impacted *S. spinulosa* aggregations over an area of five metres either side of the pipeline (Witteveen and Boss 2010). Indicating the *S. spinulosa* will colonise adjacent to surface infrastructure.

6.33 Activities associated with the oil and gas industry are not specifically identified as a main pressure or threat to reef habitats in the latest Article 17 report published by the Government (JNCC 2019c). The pressures and sensitivities on *Sabellaria* biogenic reefs from oil and gas decommissioning activities are presented in Table 8 (JNCC 2017d).

6.34 Potential impacts arising from the removal of infrastructure, the use of anchors by vessels and rock dumping could cause physical loss and physical damage to *Sabellaria spinulosa* reefs within the SAC.

Table 8: Pressures and sensitivities on sandbanks and biogenic reef habitats within the North Norfolk Sandbanks and Saturn Reef SAC (selected to relate to oil and gas decommissioning activities) (JNCC 2017d)

Pressure	Biogenic reef *Sabellaria spinulosa*	Subtidal coarse sediment	Subtidal mixed sediments	Subtidal sand
Abrasion/disturbance of the substrate on the surface of the seabed	S	S	S	S
Changes in suspended solids (water clarity)	NS	S	S	S
Habitat structure changes – removal of substratum (extraction)	S	S	S	S
Introduction of other substances (solid, liquid or gas)	S	S	S	S
Introduction of spread of non-indigenous species	S	S	S	S
Litter	S	S	S	S
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	S	S	S	S
Physical change (to another seabed habitat)	S	S	S	S
Siltation rate change (low), including smothering (depth of vertical sediment overburden)	S	S	S	S
Vibration	IE	IE	IE	IE
Waterflow (tidal current) changes – local, including sediment transport considerations	S	S	S	S

S = Sensitive, IE = Insufficient Evidence, NS = Not sensitive

Harbour porpoise

6.35 The harbour porpoise (*Phocoena phocoena*) is the smallest and most abundant cetacean species in UK waters. They occur widely across shelf waters predominantly either individually or in small groups but larger aggregations have been reported (Defra 2015), with group sizes varying with season (Clark 2005).

6.36 Harbour porpoise are opportunistic feeders, foraging close to the seabed or near the sea surface, preying on a wide range of fish species including, herring, cod, whiting and sandeels, and their prey will vary during and between seasons (Santos and Pierce 2003). Studies undertaken in Denmark indicate that their local distribution may be correlated with prey availability (Sveegaard 2011). Their prey preferences within the SAC is not well known although species known to occur within the SAC include herring, cod, whiting, sandeels and sprats, all of which may be prey for harbour porpoise ((JNCC 2016, JNCC and NE 2019).

6.37 Data from ESAS and other databases indicate harbour porpoise are widespread across the North Sea and adjacent waters (Reid *et al*. 2003). Evidence from SCANS surveys indicates that there may have been a southward shift in the distribution of harbour porpoise from occurring predominantly around eastern Scotland and the northern North Sea to the southern North Sea since the early 1990's (Hammond *et al*. 2013, 2017).

6.38 Sound arising from proposed decommissioning activities have the potential to impact on harbour porpoise within or adjacent to the SAC. The range at which marine mammals, including harbour porpoise, may be able to detect sound arising from offshore activities depends on the hearing ability of the species and the frequency of the sound. Other factors that can affect the potential impact include ambient background noise, which can vary depending on water depth, seabed topography and sediment type. Natural conditions such as weather and sea state and existing sources of human produced sound can also reduce the auditory range.

6.39 Porpoises are generally considered to be 'high frequency' specialists with a relatively poor ability to detect lower frequency sounds (NMFS 2018, Southall *et al.* 2019). Studies undertaken on captive harbour porpoises indicate that porpoises have a functional hearing range of between 250 Hz and 180 kHz with their best hearing between 16 to 140 kHz and their maximum sensitivity between 100 and 140 kHz. This is within the frequency range of 130 to 140 kHz that harbour porpoise echolocate (Miller and Wahlberg 2013). Their ability to detect sound below 16 kHz or above 140 kHz falls sharply (Kastelein *et al.* 2012, 2015, Southall *et al*. 2007). Harbour porpoise are therefore most sensitive to sound sources between 16 to 140 kHz and, although audible, they are unlikely to be sensitive to sound either above or below those frequencies.

6.40 Harbour porpoise use echolocation to communicate and detect prey. Reported sound levels produced range from between 166 to 194 re: 1 μPa (rms) @ 1m and 178 and 205 dB re. 1 μPa $_{\text{(peak – peak)}}$, with a mean level of 191 dB re. 1 μPa $_{\text{(peak – peak)}}$ and within the peak frequency range of 110 to 150 kHz (Villadsgaard, *et al*. 2007, Miller & Wahlberg 2013, MMO 2015a).

6.41 Sound arising from decommissioning activities may also impact on the prey species of harbour porpoise, which could have a negative impact on harbour porpoise. Fish hearing is based on detecting particle motion directly stimulating the inner ear. However, those with swim bladders are also able to detect pressure waves and can detect a wider range of frequencies and sounds of lower intensity than fishes without swim bladders (Popper 2003). Fish with swim bladders, e.g. herring, are recognised to be hearing specialists. Those without, e.g. sandeels, are considered to have a relatively low sensitivity to noise. Most fish with swim bladders are able to detect sound within the 100 Hz to 2 kHz range, those without swim bladders are unlikely to detect sound above 400 Hz (Popper 2012).

6.42 Potential impacts on harbour porpoise or their prey arising from decommissioning include sound from vessels and cutting equipment.

6.43 Surveys across the SAC have indicated that harbour porpoise occur widely across the site, with some evidence of seasonal movements southwards during the winter and north during the summer. There is no clear preference to habitats within the site (Heinänen and Skov 2015).

7 EXTENT OF ANNEX I HABITAT

7.1 The total area of sandbank habitat classified within the North Norfolk Sandbanks and Saturn Reef SAC is, for the purposes of this assessment, 3,603 km^2 (JNCC 2020a).

7.2 Within the SAC there are seven recognised sandbank habitats, predominantly comprising of Infralittoral fine sand or Infralittoral muddy sand and Circalittoral fine sand or Circalittoral muddy sand (Table 9).

Table 9: Area of sandbank habitat types within the North Norfolk Sandbanks and Saturn Reef SAC (Source ABPMer and Ichthys Marine 2015).

Habitat	Habitat Area (km^2)	% of SAC
Moderate energy infralittoral rock	9.1	0.3
Infralittoral coarse sediment	459.6	12.7
Circalittoral coarse sediment	332.0	9.2
Deep circalittoral coarse sediment	6.3	0.2
Infralittoral fine sand or Infralittoral muddy sand	1,142.0	31.7
Circalittoral fine sand or Circalittoral muddy sand	1,609.1	44.6
Deep circalittoral sand	45.4	1.3

7.3 The total area of Annex I reef habitat classified within the site at the time of designation was 1.08 km^2 (JNCC 2017a). However, since the time of designation additional reef habitat of between low and high reefiness has been identified:

- 0.375 km^2 Saturn Reef (Jenkins *et al*. 2015, JNCC 2017b),
- 1.57 km^2 Baird Gas Storage (BSCL 2011),
- 0.70 km^2 Leman uptime compression surveys (Fugro EMU 2013),
- 0.19 km^2 Leman AC work barge deployment (Gardline 2014, Perenco 2014a),
- 0.53 km^2 Viking to LOGGS pipeline (ConocoPhillips 2008),
- 0.14 km^2 Carrack to Clipper pipeline (Shell 2014).
- 0.05 km^2 Leman tie-back[3] (Perenco 2012).
- 1.28 km^2 Dredging Area 484 (Fugro Emu 2014).
- 1.74 km^2 Leman Field (Shell 2015).
- >1.5 km^2 SAC Management Investigations Survey (Jenkins *et al*. 2015).

[3] A total of 0.63 km^2 of *S. spinulosa* reef was identified within the pipeline route surveys of which approximately 0.33 km^2 is estimated to be outwith the SAC and 0.25 km^2 is covering the same area as the later 2013 Leman AC surveys, where it was found that the area of reef had reduced.

- 0.007 km^2 Wenlock Installation (Benthic Solutions 2020).

7.4 Based on the above survey data, the total area of confirmed reef habitat within the SAC is 8.08 km^2 (0.22% of the SAC). However, large areas of the SAC will not have been surveyed and other reef habitat will occur within the site.

7.5 It is noted that *Sabellaria* reef is an ephemeral feature and can colonise suitable areas and disappear from established areas. The Saturn Reef was discovered in 2002 but subsequent surveys across the area have found no presence of it (Limpenny *et al.* 2010, Vanstaen and Whomersley 2015). However, having previously had *Sabellaria* reef present it is considered as suitable Annex I habitat for *Sabellaria* reef features.

7.6 Aggregations of *Sabellaria spinulosa* have been largely found by industry when undertaking baseline environmental surveys in support of potential developments. Other aggregations have been reported, e.g. Vanstaen and Whomersley (2015) and Jenkins *et. al.* (2015), with patches of *Sabellaria* ranging in size from between 0.004 km^2 to 1.5 km^2. However, the total area of *Sabellaria* reef habitat recorded during the surveys is not quantified and therefore it is not possible to include the additional reef habitat within this HRA at this time.

7.7 Similarly, surveys have been undertaken along the export cable route for the proposed Hornsea Three Offshore Wind Farm export cable, part of which lies within the SAC. The surveys identified two patches of *Sabellaria* described as being 'low reef', one of which was within the SAC. However, it was not possible to delineate the extent of the reef within the SAC due to patchiness of the aggregations and the lack of a clear signature in the side scan sonar data (Ørsted 2018a).

7.8 The location of known *Sabellaria* reef including a 500 m 'buffer' area around each location is presented in Figure 10 (JNCC 2019d).

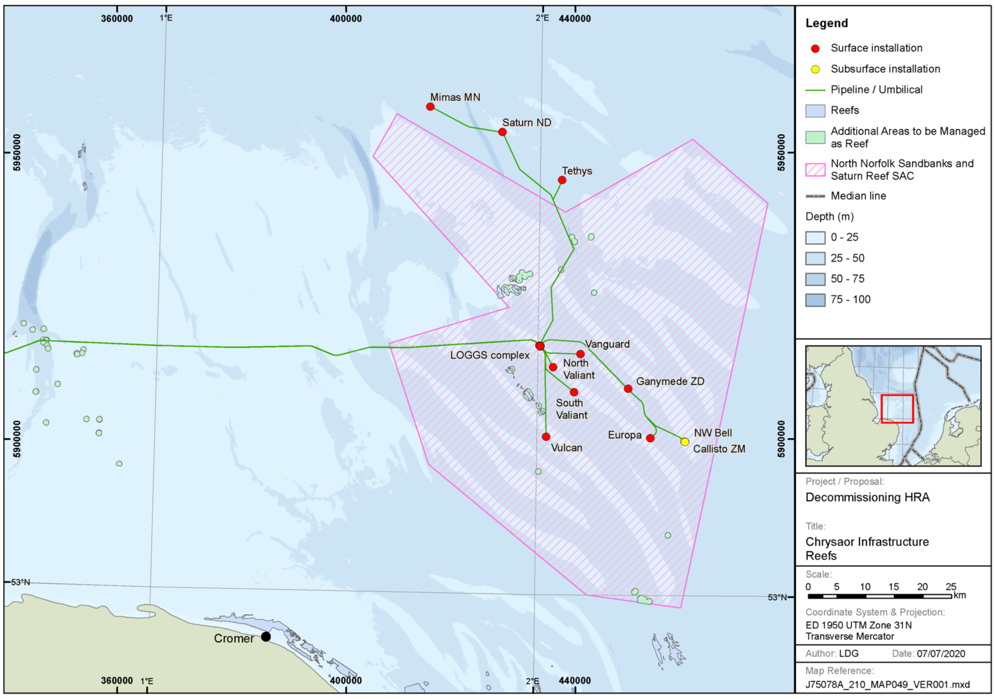


Figure 10: Locations of known *Sabellaria* reef within the North Norfolk Sandbanks and Saturn reef SAC (including 500 m 'buffer' around each reef area).

7.9 The majority of the SAC has not been surveyed and it is therefore highly likely that *Sabellaria* reefs occur elsewhere within the SAC. The exact extent of Annex I reef habitat within the SAC is unknown and the known area of 8.08 km^2 of *Sabellaria* reef used in this assessment is considered to be a minimum.

7.10 Decommissioning activities relating to VDP2 and 3 and LDP2 to 5 occur within the North Norfolk Sandbanks and Saturn Reef SAC and have potential to impact on the site's qualifying features.

7.11 Surveys undertaken by ConocoPhillips have recorded *Sabellaria spinulosa* within the area of the proposed activities. However, the structure and extent of the patches of *Sabellaria* recorded indicate that these do not constitute biogenic reef habitats as defined under JNCC definitions (Gubbay 2007, ConocoPhillips 2015a). Based on the evidence there are no biogenic reef habitats within the area of the proposed activities. However, future decommissioning activities occurring elsewhere within the SAC may be in locations where *Sabellaria* reef habitats occur and could be affected by future decommissioning activities.

8 HARBOUR PORPOISE

8.1 The Southern North Sea SAC lies in an area extending from the central North Sea, north of the Dogger Bank, to the Strait of Dover and covers an area of 36,951 km^2 (JNCC and NE 2019). The site recognises the seasonal variations in harbour porpoise distribution with identified 'summer' and 'winter' areas. The northern 'summer' area is approximately 27,088 km^2 and covers the period from between April to September. The southern 'winter' area is approximately 12,687 km^2 and covers the period between October and March (Heinänen and Skov 2015). The proposed decommissioning activities occur in an area of SAC recognised for its summer populations of harbour porpoise.

8.2 Based on data collected during the SCANS-II survey it is estimated that the site potentially supports approximately 18,500 harbour porpoise (95% Confidence Interval: 11,864 - 28,899) for at least part of the year as seasonal differences are likely to occur (JNCC 2019b).

8.3 The European Atlantic Shelf harbour porpoise population is estimated to be 375,358 (95% CI 256,304 - 549,713) individuals, of which 227,298 (95% CI 176,360 - 292,948) occur in the North Sea Management Unit. In the UK sector of the North Sea Management Unit, the harbour porpoise population is estimated to be 110,433 (80,866 - 150,811) (IAMMWG 2015).

8.4 The Southern North Sea SAC therefore potentially supports 17.5% of the harbour porpoise population within the UK sector of the North Sea Management Unit (JNCC and NE 2017) Densities of harbour porpoise will vary across the site and across seasons. Although no mean densities are provided, modelling used to identify the site boundaries indicate that densities of >3.0 harbour porpoise/km^2 occur widely across the SAC (Heinänen and Skov 2015).

9 POTENTIAL IMPACTS

9.1 The potential impacts arising from the planned activities identified in the likely work programme that could affect qualifying features and the three conservation objectives of the North Norfolk Sandbanks and Saturn Reef SAC along with those which have an associated impact on the habitat supporting harbour porpoise in the Southern North Sea SAC (conservation objective 3 of the SAC) are:

- Physical impacts during removal of platforms,
- Physical impacts from removal of subsea infrastructure,
- Physical impacts from the cutting and removal of pipeline ends,
- Physical impacts from the plugging and abandonment of wells including conductor removal,
- Physical impacts from vessel anchoring and setting down spud cans,
- Physical impact from recovery of debris,
- Physical loss of habitat from rock placement for vessel stabilisation and scour,
- Physical loss of habitat from free-span remediation,
- Physical loss of habitat due to rock placement at cut pipeline ends,
- Physical loss of habitat due to existing presence of pipelines and associated deposits.

9.2 Physical loss or physical impacts to habitats may be permanent if they are unable to recover or the effects may be temporary if recovery occurs after the activity causing the impact has ceased.

9.3 The potential impacts arising from the planned activities identified in the likely work programme that could affect qualifying features and conservation objectives one and two of the Southern North Sea SAC are sound arising from:

- Physical injury or disturbance from vessel activities.
- Physical injury or disturbance from cutting equipment.
- Physical impacts to their relevant habitats from the cutting of jacket piles, cutting and removal of pipeline ends and tee-pieces, manifolds, and well conductor removal.

9.4 Impacts arising from noise cease once the activity has stopped, although the effects of the impact on the qualifying features may last longer.

9.5 No other sources of potential impact likely to cause a significant effect have been identified.

9.6 Potential activities related to the LDP2 to LDP 5 decommissioning programme will occur within the North Norfolk Sandbanks and Saturn Reef SAC and the Southern North Sea SAC. Three assets: Mimas MN, Saturn ND and Tethys TN lie outwith the North Norfolk Sandbanks and Saturn Reef SAC. Five assets: Saturn ND, Ganymede ZD, Europa, NW Bell and Callisto ZM lie outwith the Southern North Sea SAC.

Physical impacts during removal of platforms

9.7 The removal of all platforms associated with LDP2 to LDP5 will be undertaken using a heavy lift vessel (HLV). Chrysaor have stated that for LDP2 to LDP5 all heavy lift vessel activities will be undertaken using dynamic positioning and there will be no use of any anchors by heavy lift vessels (Chrysaor 2020a). This reduces the extent of physical impact on the seabed during the removal of platforms.

9.8 In order to remove each platform the seabed around each of the platform's piles will need to be cleared so that the piles can be cut. Based on the worst-case scenario of a 14 m diameter pit around each pile, the total area of seabed disturbed around each pile is 154 m^2 and the total area of seabed impacted by the cutting of piles is 0.0126 km^2 (Table 10) (Chrysaor 2020a). However, the Mimas MN, Saturn ND and Tethys TN lie outwith the SAC and therefore the impacts from the decommissioning of these platforms will not impact on the qualifying features of the site and the total area of impact within the North Norfolk Sandbanks and Saturn Reef SAC is 0.0096 km^2.

Table 10: Potential physical impact on seabed as a result of cutting platform piles for LDP2 to LDP5.

Decommissioning Programme	Structure	No. of piles	Total direct seabed impact (km^2)
LDP2	Mimas MN	3	0.0013 *
LDP2	Saturn ND	3	0.0005
LDP2	Tethys TN	3	0.0013 *
LDP3	Europa EZ	4	0.0006
LDP3	Ganymede ZD	4	0.0006
LDP4	North Valiant 2 SP	4	0.0006
LDP4	South Valiant TD	4	0.0014 *
LDP4	Vanguard QD	4	0.0006
LDP4	Vulcan (1) RD	4	0.0014 *
LDP5	LOGGS Hub PA	4	0.0006
LDP5	LOGGS Hub PC	8	0.0012
LDP5	LOGGS Hub PP	8	0.0012
LDP5	LOGGS Hub PR	4	0.0006
LDP5	North Valiant 1 PD	4	0.0006
		Total	0.0126
		Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.0096
		Total within the Southern North Sea SAC	0.0108

* Denotes additional area of impact included to account for impact from legs (Chrysaor 2020a).

9.9 Prior to the removal of each platform an accommodation works vessel (AWV will be positioned alongside each platform location. The accommodation works vessel is a jack-up vessel with four legs that are placed on the seabed. Each of the legs has an area of 30 m^2 and therefore at each location the legs of the accommodation work vessel will impact on 120 m^2 of seabed. There will be one movement of the vessel at each of the 14 installations subject to LDP2 to 5 and therefore a total area of seabed predicted to be impacted is 0.0017 km^2, of which 0.0013 km^2 is within the North Norfolk Sandbank and Reef SAC and 0.0014 km^2 is within the Southern North Sea SAC (Table 11) (Chrysaor 2020a).

Table 11: Area of physical impact on the seabed from the use of accommodation works vessel for LDP to LDP5.

Decommissioning Programme	No. of deployments	Total direct seabed impact (km^2)
LDP2	3	0.00036
LDP3	2	0.00024
LDP4	4	0.00048
LDP5	5	0.0006
Total		0.0017
Total within the North Norfolk Sandbanks and Saturn Reef SAC		0.0013
Total within Southern North Sea SAC		0.0014

Physical impacts from removal of subsea infrastructure

9.10 There are nine items of subsea infrastructure included in LDP2 to 5, of which five are within the North Norfolk Sandbanks and Saturn Reef SAC (Table 5). The physical footprint from each of the structures and the physical impact from the removal of seabed required in order to cut the piles are presented in Table 12 and Table 15 (Chrysaor 2020a). It is noted that the physical area of impact is greater when piles are removed than the physical footprint of the infrastructure alone. Not all items of subsea infrastructure are piled and for these items the impact is only caused by the footprint of those items. Table 14 presents the combined total of seabed disturbance from the removal of subsea infrastructure. The total area of disturbance within the North Norfolk sandbanks and Saturn Reef SAC is estimated to be 0.0025 km^2 and within the Southern North Sea SAC it is estimated that 0.0008 km^2 of seabed may be disturbed.

Table 12: Area of physical footprint from subsea infrastructure in LDP2 to LDP5.

Decommissioning Programme	Structure	Total direct seabed impact (km^2)
LDP2	Tethys TN Tee Structure	0.000078
LDP2	Tethys TN 10” (PL2334) valve skid	0.0000056
LDP2	Tethys TN 3” (PL2335) valve skid	0.00000075
LDP3	NW Bell Manifold	0.00016
LDP3	Callisto ZM Manifold	0.00018
LDP3	Europa EZ/ Sinope Tee Structure	0.000072
LDP3	Europa EZ/ Sinope Pigging Skid	0.000075
LDP5	PL0454 Tie-in Tee Structure	0.00038
LDP5	PL0454 Tie-in Tee Structure	0.00038
	Total	0.0013
	Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.0008
	Total within the Southern North Sea SAC	0.0008

Table 13: Area of seabed disturbance from cutting subsea structure piles.

Decommissioning Programme	Structure	No. of piles	Total direct seabed impact (km^2)
LDP2	Tethys TN Tee Structure	0	0
LDP2	Tethys TN 10" (PL2334) valve skid	0	0
LDP2	Tethys TN 3" (PL2335) valve skid	0	0
LDP3	NW Bell Manifold	4	0.0006
LDP3	Callisto ZM Manifold	4	0.0006
LDP3	Europa EZ/ Sinope Tee Structure	4	0.0006
LDP3	Europa EZ/ Sinope Pigging Skid	0	0
LDP5	PL0454 Tie-in Tee Structure	4	0.0006
LDP5	PL0454 Tie-in Tee Structure	4	0.0006
		Total	0.003
		Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.018
		Total within the Southern North Sea SAC	0

Table 14: Combined total area of physical impact from subsea infrastructure in LDP2 to LDP5.

Decommissioning Programme	Structure	No. of piles	Total direct seabed impact (km^2)
LDP2	Tethys TN Tee Structure	0	0.000078
LDP2	Tethys TN 10" (PL2334) valve skid	0	0.0000056
LDP2	Tethys TN 3" (PL2335) valve skid	0	0.00000075
LDP3	NW Bell Manifold	4	0.0006
LDP3	Callisto ZM Manifold	4	0.0006
LDP3	Europa EZ/ Sinope Tee Structure	4	0.0006
LDP3	Europa EZ/ Sinope Pigging Skid	0	0.000075
LDP5	PL0454 Tie-in Tee Structure	4	0.0006
LDP5	PL0454 Tie-in Tee Structure	4	0.0006
		Total	0.0032
		Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.0025
		Total within the Southern North Sea SAC	0.0008

Physical impacts from cutting pipeline ends

9.11 Where pipelines are required to be cut as part of the decommissioning programmes an area of approximately 50 m^2 of seabed may be disturbed in order to access the pipelines. The area of seabed that could be disturbed from the cutting of pipelines is estimated to be 0.0015 km^2, of which 0.0013 km^2 is within the North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC (Table 15) (Chrysaor 2020a).

Table 15: Area of seabed disturbed by cutting pipeline ends.

Decommissioning Programme	Area of impact (km^2)
LDP2	0.0003
LDP3	0.0006
LDP4	0.0004
LDP5	0.0002
Total	0.0015
Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.0013
Total within Southern North Sea SAC	0.0013

Physical impacts from well abandonment

9.12 A total of 59 wells across LDP2 to LDP5 are to be plugged and abandoned using a jack-up drilling rig as part of the decommissioning activities. Chrysaor have included the cumulative impact from well abandonment in the environmental appraisal they undertook for the LOGG LDP2 to LDP5 decommissioning projects (Chrysaor 2020a). Each well abandonment activity is also assessed separately at the time of abandonment via the use of MATS/SATs environmental approvals which inform the decision process for the consenting authority, the OGA. The well abandonment programme is integral to the impacts arising from the LOGGS decommissioning programmes 2 - 5 and therefore the impacts from well abandonment have been included in this assessment.

9.13 In total 145 wells are planned to be plugged and abandoned across the Southern North Sea by Chrysaor over a period of ten years (Chrysaor email dated 15th April 2020).

9.14 The area of direct physical impact on the seabed from the drilling rigs spud cans is estimated to be 589.8 m^2 (0.0006 km^2) at each location (ConocoPhillips 2017, Chrysaor 2020a, Chrysaor 2021).

9.15 Once in position the drill rig lowers three legs onto the seabed until stable. To assist in rig stabilisation during well abandonment operations a single anchor and associated anchor chains will be required. The area impacted by the anchor and chains is estimated to be between 2,400 m^2 (0.002 km^2) and 3,020 m^2 (0.003 km^2) at each rig location (ConocoPhillips 2017, Chrysaor 2020a, Chrysaor 2021). Based on the larger area of seabed impacted it is estimated that an area of seabed 3,609.8 m^2 will be impacted at each rig location.[4] There may be up to 12 abandonment locations, of which nine are within the North Norfolk Sandbank and Saturn Reef SAC; more than one well will be abandoned at each location. For the purposes of this assessment it is estimated that there may be two rig movements at each of the locations.

9.16 The total estimated area of seabed physically impacted from all well abandonment activity is 0.0866 km^2, of which three well abandonment locations associated with the Mimas, Tethys and Saturn developments are outwith the North Norfolk Sandbanks and Saturn Reef SAC. Therefore, the estimated area of impact within the SAC is 0.0650 km^2 (Table 16). Similarly five of the twelve well abandonment locations are predicted to be outwith the Southern North Sea SAC. Consequently the estimated impact within the SAC is 0.0506 km^2.

[4] Note previous assessments have been based on an overall area of impact from spud cans, anchors and chains of 2,989.8 m^2 (ConocoPhillips 2017, Chrysaor 2020a). However, based on the use of the ENSCO-92 jack-up for well abandonment the area of seabed estimated to be impacted by the anchors and chains has increased (Chrysaor 2021). Consequently, the overall area of seabed impacted has increased to 3,609.8 km^2.

Table 16: Estimated area of seabed physically impacted by LDP2 to LDP5 well abandonment.

Disturbance activity	Impacted area		
	Per location (m^2)	LDP2 to LDP5 (km^2)	LDP2 to LDP5 two rig movements (km^2)
Anchor and anchor wires (rig location)	3.020 *	0.0362	0.0724
Spud cans (rig location)	589.8	0.0071	0.0141
Total	3,609.8	0.0433	0.0866
Total within the NNSSR SAC (nine locations)		0.0325	0.0650
Total within SNS SAC (seven locations)		0.0253	0.0506

* Area based on known contracted rig (Chrysaor 2021).

Physical impacts from removal of conductors

9.17 A total of 59 conductors will be removed during the proposed decommissioning activities at LDP2 to LDP5, with 53 within the North Norfolk Sandbanks and Saturn Reef SAC and 36 within the Southern North Sea SAC (Table 7). It is estimated that the removal of each conductor will impact on approximately 3.14 m^2 of seabed (Chrysaor 2020a, Chrysaor 2021). Consequently, approximately 185.26 m^2 of seabed may be disturbed by the removal of the conductors, of which 166.42 m^2 (0.0002 km^2) will be within the North Norfolk Sandbanks and Saturn Reef SAC and 113.04 m^2 (0.0001 km^2) in the Southern North Sea SAC.

Physical impacts from over-trawl surveys

9.18 Over-trawl surveys will not be undertaken following completion of the decommissioning operations and therefore there will be no physical impact on the seabed from this activity.

Physical loss of habitat from accommodation works vessel

9.19 The accommodation works vessel can, depending on the seabed conditions, require stabilisation to ensure the vessel's spud-cans do not penetrate the seabed and risk destabilising the vessel. Vessel stability is achieved based on soil stability limits and ensuring scour does not undermine vessel stability. To achieve this, sufficient rock is placed on to the seabed to ensure the stability of the vessel.

9.20 It is estimated that in the event that rock is required it will impact on the seabed over an area of 1,100 m^2 and a total area of seabed impacted will be 0.017 km^2, of which 0.014 km^2 will be within the North Norfolk Sandbanks and Saturn Reef SAC and 0.13 km^2 in the Southern North Sea SAC (Table 17) (Chrysaor 2020a).

Table 17: Contingency rock placement for accommodation works vessel at LDP2 to LDP5.

Decommissioning Programme	No. of deployments	Total direct seabed impact (km^2)
LDP2	3	0.0033
LDP3	2	0.0022
LDP4	4	0.0061 *
LDP5	5	0.0055
Total		0.0171
Total within the North Norfolk Sandbanks and Saturn Reef SAC		0.0138
Total within Southern North Sea SAC		0.0132

* Includes 0.001681 km^2 for rock pad redistribution required to accommodate the drill rig.

Physical loss of habitat from cutting pipeline ends

9.21 In order to minimise the risk to other sea users rock may also be required to be placed over the ends of cut pipelines. Chrysaor estimate that the worst-case scenario is for each rock berm to have an average footprint of 13.3 m^2 and impact over an area of 0.0004 km^2 across all LDP2 to LDP5 activities and 0.0002 km^2 within the North Norfolk Sandbanks and Saturn Reef and the Southern North Sea SACs (Table 18).

Table 18: Rock placement over cut pipeline ends.

Decommissioning Programme	Area of impact (km^2)
LDP2	0.000798
LDP3	0.0001596
LDP4	0.0001064
LDP5	0.0000532
Total	0.000399
Total within the North Norfolk Sandbanks and Saturn Reef SAC	0.000253
Total within the Southern North Sea SAC	0.000239

Physical loss of habitat from free-span remediation

9.22 Pipeline route surveys indicate that rock will be required for the remediation of a free-span along a total of 53.87 m length of line as part of the LDP2 to LDP5. Assuming rock placement impacts along a 10 m corridor then a total of 538.7 m^2 (0.0005 km^2) of seabed will be impacted.

9.23 It is not possible to predict any remedial works that may be necessary to deal with future free-spans. Where pipelines are left *in situ* free-spans can develop as a result of natural sediment relocation. However, their number, location and extent cannot be accurately predicted and they can sometimes be transient features due to the migration of the substrate. Monitoring surveys will be carried out on pipelines that are abandoned *in situ* to determine the future status of the lines, including the development of potentially hazardous free-spans. If rock placement is required in order to remediate free-spans assessments in accordance with the Habitat Regulations will be undertaken at the time.

Physical loss of habitat from well abandonment

9.24 There is potential for rig stabilisation and scour protection to be required at some of the well abandonment locations. If required, a total of 3,000 tonnes of gravel or rock could be placed onto the seabed impacting an estimated area of 400 m^2 (0.0004 km^2) (ConocoPhillips 2017, Chrysaor 2020c). However, the use of rock for rig stabilisation and scour protection is a contingency measure and has so far only been required at the Vulcan RD location. The inclusion of it as an impact at each of the locations is a worse-case scenario (Chrysaor 2020c, Chrysaor 2021).

9.25 Assuming two rig moves are required at each of 12 well abandonment locations, the estimated area of seabed physically lost from all well abandonment activity is 0.0096 km^2, of which three well abandonment locations associated with the Mimas, Tethys and Saturn developments are outwith the North Norfolk Sandbanks and Saturn Reef SAC and five are outwith the Southern North Sea SAC. Therefore the estimated area of impact within each of the SACs is 0.0072 km^2 and 0.0048 km^2 respectively (Table 19).

Table 19: Estimated area of seabed physically impacted by LDP2 to LDP5 well abandonment.

Disturbance activity	Impacted area	
	Per well (m^2)	LDP2 to LDP5 – (km^2)
Scour mitigation (gravel / rock)	400	0.0096
Total	400	0.0096
Total within the North Norfolk Sandbanks and Saturn Reef SAC		0.0072
Total within Southern North Sea SAC		0.0048

Physical loss of habitat from existing LOGGS pipelines

9.26 A total of 388.33 km of pipeline are subject to LOGGS LDP2 to LDP5. It is planned that all pipelines will be left *in situ*, although a small length of approximately 310 m could be removed (Chrysaor 2020a). The total length of line within the North Norfolk Sandbanks and Reef SAC is estimated to be 165.33 km. Assuming all the pipelines left *in situ* are on the surface of the seabed and impact along an area of 10 m, there is potential for 1.65 km^2 of seabed within the SAC to be permanently impacted by the presence of pipelines. Surveys undertaken by Chrysaor along a total 557 km of pipeline reported 51 km of pipeline exposed on the seabed, of which 1 km was identified as spans (Chrysaor 2020b). On this basis, 91% of the existing pipelines are below the seabed and therefore not impacting on the seabed surface and the physical loss of habitat. Within the North Norfolk Sandbanks and Saturn Reef SAC the estimated impact from exposed surface pipelines is 0.15 km^2 and within the Southern North Sea SAC it is 0.13 km^2 (Table 20).

Table 20: Length of LOGGS LDP2 to LDP5 pipelines.

Pipeline	Length of line (km)	SNS SAC		NNSSR SAC (km^2)	
		Length (km)	Area (km2)	Length (km)	Area (km2)
LDP2	60.6	52.89	0.5289	26.66	0.2666
LDP3	52.32	18.93	0.1893	51.84	0.5184
LDP4	38.5	38.48	0.3848	34.17	0.3417
LDP5	236.6	37.90	0.3790	52.66	0.5266
	Total	148.2	1.4820	165.33	1.6533
Area exposed on seabed		13.34	0.13	14.88	0.15

9.27 Rock has previously been used to address free-spans that have formed along the pipelines following their installation. The exact extent of existing rock is not known. However, for the purposes of this assessment the area of impact from rock along the existing exposed pipelines is presumed to occur within the 10 m corridor footprint used in this assessment. Therefore, the physical loss of habitat from rock placement is already accounted for as a worst-case scenario.

9.28 No new mattresses or grout bags are to be placed on the seabed and it is proposed to leave those present *in situ* with minimal disturbance. Therefore, there will be no additional impacts arising from the decommissioning activities. The number of mattresses present at LDP2 to LDP5 is unknown. However, mattresses that need to be moved in order to access existing infrastructure will, wherever possible, be removed and those that are along existing pipelines and may be left *in situ.* do not increase the potential loss of habitat that is already considered under the pipelines.

Chemical usage and discharge

9.29 Chemicals may be used and discharged during the well abandonment and plugging operations. The exact type and volume of chemical used may vary across individual wells, they largely comprise of cement and spacer chemicals washed out after completing these activities which is used to plug the wells and water based muds (WBM) used to mill out wells requiring remedial cementing and for well control. An estimated 10 tonnes of cement cuttings per well may be discharged and 200 bbls of WBM and associated brine. In total up to 600 bbls of waste may be discharged for each well, along with 300 bbls of 'slops' from the drilling rig (Chrysaor 2020c, 2021). Any waste fluids for discharge follows a hierarchy of disposal down a donor well, if that is not available, waste is returned to shore, WBM may be re-used and discharge is only permitted when there is no risk to the marine environment.

9.30 If the existing contents of wells are assessed not to pose a risk to the marine environment they may be discharged. Typical well contents and quantities, in tonnes, are presented in Table 21 (ConocoPhillips 2017).

Table 21: Typical wellbore and annulus contents (Source ConocoPhillips 2017).

Chemical used	Closest equivalent today	Estimated amount per well (Tonnes)
Magnesium chloride	Magnesium chloride	2
Sodium chloride	Sodium chloride	17
Potassium chloride	Potassium chloride	3
DF Viscosifier (Xanthan Gum)	Flowzan® Biopolymer, Drispac® Regular Polymer	0.4
Bentonite	Bentonite	40
Barite	Barite	1
Caustic soda	Caustic soda	1
FLR-100, idflo	Impermex	1

Vessel noise

9.31 The offshore oil and gas industry have used, and will continue to use, vessels in support of the vast majority of offshore activity. Vessels are used extensively as supply vessels support operating platforms along with safety vessels permanently present in development areas. During decommissioning, drill rigs are used for the abandonment of wells, accommodation work vessels for cleaning and preparatory decommissioning activities associated with platforms and pipelines and heavy lift vessels for platform and other asset removal are used.

9.32 Vessel movements are the largest contributor to anthropogenic ocean noise and in deeper water are the dominant noise source in the lower frequencies, between 50-300 Hz (Ulrick 1967). Measurements undertaken in the Southern North Sea indicate that shipping noise is the dominant anthropogenic noise in the region predominantly in the frequency range of between 40 and 200 Hz (de Haan *et al.* 2007). In general, vessels that use dynamic positioning thrusters tend to generate higher levels of underwater sound. The individual noise output produced by a vessel is dependent upon a number of factors including the speed of the vessel, age, load, maintenance and oceanographic conditions.

9.33 Shipping noise is continuous and varies depending on the type of vessel being used. The primary sources of sound from vessels are propellers, propulsion and other machinery; the dominant noise source is from propeller cavitation (Ross 1976, Wales and Heitmeyer 2002, Arveson and Vendittis 2000). Source levels typically increase with increasing vessel size, with smaller vessels (< 50 m) having source levels 160-175 dB re 1µPa (rms SPL), medium size vessels (50-100 m) 165-180 dB re 1µPa (rms SPL) and larger vessels (> 100 m) 180-190 dB re 1µPa (rms SPL) (summarised by Richardson *et al*. 1995). Commercial vessels in transit have reported sound source levels of between 178.6 and 190.3 dB re 1 µPa -m (Genesis 2011, Johanson & Anderson 2012), whereas supply and maintenance vessels produce generally lower sound source levels of between 130 and 184 dB re 1 µPa (rms SPL), with frequencies of between 20 Hz and 10 kHz. However, sound levels depend on the operating status of the vessel with vessels equipped with dynamic positioning systems exhibiting increased sound levels in the spectrum from 3 Hz to 30 Hz (Nedwell & Edwards 2004, OSPAR 2009). Most of the acoustic energy from vessels is below 1 kHz, typically within the 50-300 Hz range, although cavitation from propellers produces sounds at frequencies of between 1 kHz and 125 kHz (Genesis 2011, Hermannsen *et al.* 2014). Consequently, vessel noise has historically thought to have a greater potential to impact marine mammals with relatively low frequency sensitivities e.g. seals and baleen whales rather than high frequency specialists, e.g. porpoise (Okeanos 2008). However, more recent studies indicate that high frequency sound from vessels of between 0.25 and 63 kHz and at mean sound levels of 123 dB re 1 µPa (rms SPL) can cause increased porpoising behaviour in harbour porpoise at distances greater than 1 km from the sound source (Dyndo *et al*. 2015).

9.34 Studies undertaken to measure ambient noise levels in the southern North Sea and Irish Sea indicate that at frequencies below 1 kHz, general shipping noise increases background noise levels to above 120 dB re 1 µPa (rms SPL), with levels of exceeding 140 dB re 1 µPa (rms SPL) in areas of intensive shipping (Nedwell *et al*. 2003).

9.35 Current levels of shipping noise within the SAC has been shown to influence on the presence or absence of harbour porpoise and could cause displacement and disturbance of harbour porpoise within the SAC (Heinänen and Skov 2015).

9.36 Studies undertaken on seven harbour porpoise in Danish waters indicated that there was variation in how individual porpoises responded to vessel noise with some individuals showing a behavioural response to vessel noise at levels of 96 dB re 1 µPa (rms SPL), causing changes in the foraging behaviour and others showing no behavioural response. Individuals exposed to relatively high levels of sound ceased foraging and swam to deeper water (Wisniewska *et al*. 2018a). Other studies have indicated that noise arising from shipping is capable of causing disturbance to beyond 1 km from a vessel (Dyndo *et al*. 2015, Hermannsen *et al*. 2014, Wisniewska *et al*. 2018b). Studies on the behavioural effects of shipping on harbour porpoise indicate that the level of displacement effects from shipping on harbour porpoise decrease with increasing distance from the vessel with some levels of displacement occurring out to 400 m from the vessel (Akkaya Bas *et al*. 2017, Polacheck 1990). However, the behavioural impacts are temporary with porpoises resuming activities relatively quickly once the vessel has passed (Hermannsen *et al*. 2014, Wisniewska *et al*. 2018b).

9.37 Based on an avoidance or a behavioural response out to 400 m from a vessel, an area of 0.5 km^2 may be impacted around each vessel. A maximum of eight vessels may occur in the area at one time (Chrysaor 2020c) Although, the vessels will be operating in the same area and noise from the vessels will overlap, a worst-case scenario is that all eight vessels impact an area of 0.5 km^2 and therefore a total area of 4 km^2 may be affected by vessel noise at any one time.

Cutting noise

9.38 Cutting equipment will be required to cut the jacket legs and the pipeline ends. Either diamond wire cutters or water jetting tools are to be used. Perforating guns or jet explosive cutters may be used when undertaking well abandonment operations Chrysaor 2020a).

9.39 Noise studies undertaken during diamond wire cutting of a conductor in the North Sea indicate that sound levels in the one-third octave band increased between 4 dB and 15 dB at frequencies above 5 kHz (Pangerc *et al.* 2016). However, other sources of sound from the associated vessels may have masked sound at lower frequencies. The level of sound arising from cutting tool is relatively low and is not predicted to be significantly, if at all, greater than that arising from the accompanying vessels.

9.40 There is limited information available on the sound levels arising from the use of water jetting tools, with one study reporting sound from high pressure water jets of 175.5 (A) re 1 µPa (Molvaer and Gjestland 1981). However, this figure is weighted for human hearing frequencies.

9.41 There is limited information on the noise arising from perforating guns or explosive cutters. However, the equipment will only be used approximately 200 ft (61 m) below the mudline and their use will be limited in duration being required only at each of the wells to be abandoned (Chrysaor 2020a). The impacts from noise within the water column arising from the use of this equipment is predicted to be minimal due to the activities being undertaken 200 ft below the seabed.

9.42 Although the information available is limited, it is predicted that noise from cutting equipment will not be significantly greater than that arising from the accompanying vessels and therefore no additional impacts beyond that estimated from noise arising from the accompanying vessels are predicted to occur.

Potential impacts from LDP to LDP 5 Decommissioning – Summary

9.43 Based on the above it is recognised that there is potential for impacts arising from the proposed decommissioning activities to cause physical impact and loss of habitat to the qualifying features of the North Norfolk Sandbanks and Reef SAC and the Southern North Sea SAC.

9.44 The total area of physical impact arising from LDP2 to LDP5 decommissioning activities within the Norfolk Sandbanks and Saturn Reef SAC is estimated to be 0.0799 km^2 and in the Southern North Sea SAC it is estimated to be 0.0650 km^2 (Table 22).

9.45 The total area of physical loss of habitat within the Norfolk Sandbanks and Saturn Reef SAC, including the leaving *in situ* of exposed pipelines, is estimated to be 0.1717 km^2 and in the Southern North Sea SAC, is estimated to be 0.1487 km^2 (Table 23).

9.46 Noise arising during the decommissioning activities is not predicted to extend beyond that caused by vessels, i.e. 400 m. Consequently, noise likely to cause significant disturbance will occur over an area of 0.5 km^2 for each vessel and maximum area of 4 km^2 for a worst-case scenario of 8 vessels.

Table 22: Estimated area of seabed physically impacted from the proposed decommissioning activities associated with the LOGGS LDP2 to LDP5.

Activity	Physical Impact	
	Total area of seabed impacted within NNSSR SAC (km^2)	Total area of seabed impacted within SNS SAC (km^2)
Decommissioning impacts		
Accommodation works vessel – spud cans	0.0013	0.0014
Platform removal – Cutting of piles	0.0096	0.0108
Removal of subsea infrastructure	0.0065	0.0008
Cutting pipeline ends	0.0013	0.0013
Well abandonment – spud cans and anchors	0.0253	0.0506
Removal of conductors	0.0002	0.0001
Over-trawl survey [1]	0.0000	0.0000
Total area of physical impact	**0.0799**	**0.0650**

[1] There will be no over-trawl survey as part of the LDP2 to LDP5 decommissioning programmes

Table 23: Estimated area of seabed physically lost from the proposed decommissioning activities associated with the LOGGS LDP2 and LDP5.

Activity	Area of Impact (km^2)	
	NNSSR SAC	**SNS SAC**
Decommissioning impacts		
Accommodation works vessel – stabilisation	0.0138	0.0132
Cutting pipeline ends – rock protection	0.0002	0.0002
Free-span remediation – rock protection	0.0005	0.0005
Well abandonment – rig stabilisation	0.0072	0.0048
Total	0.0217	0.0187
Existing impacts		
Leave *in situ* existing pipelines [1]	0.15	0.13
Total area of habitat loss	**0.1717**	**0.1487**

1 – Existing mattresses and rock overlay existing pipelines and therefore are within the 10 m wide corridor of estimated impact caused by the physical presence of the pipelines and do not increase the overall area of seabed potentially impacted.

10 IN-COMBINATION IMPACTS

10.1 Under the Habitats Regulations there is a requirement for the competent authority to consider the in-combination effects of plans or projects on national sites when undertaking an HRA. In-combination effects refer to effects, which may or may not interact with each other, but which could affect the same receptor or interest feature (i.e. a habitat or species for which a national site is designated).

10.2 The in-combination assessment includes plans or projects that are:

- Under construction,
- Permitted application(s), but not yet implemented,
- Submitted application(s), not yet determined,
- Projects identified in the relevant Development Plan (and emerging Development Plans),
- Sites identified in other policy documents, as development reasonably likely to come forward.

10.3 For the purposes of this assessment, on-going impacts from current activities have not been included within the in-combination assessment where the influence of the projects upon a receptor, that may also be predicted to be significantly affected by the development, is considered to be captured within the baseline. For some on-going activities, e.g. fishing, shipping and dredging disposal, it is technically not possible to determine what the baseline conditions would be without the influence the impacts from these on-going activities have on the qualifying features of the sites. However, it is recognised that they may be having an effect on the qualifying features of the sites.

Existing Chrysaor decommissioning

10.4 The LOGGS LDP2 to LDP5 decommissioning programmes are part of a series of decommissioning activities being undertaken by Chrysaor since the initial plans were submitted by ConocoPhillips for VDP1 and LDP1 in 2015. Subsequent to those, additional decommissioning programmes have been submitted and approved for VDP2 and VDP3 in 2017. For each of these decommissioning programmes the physical impacts on the seabed and habitat loss arising from the plans have been estimated. A summary of the physical impacts and habitat loss arising from activities associated with the decommissioning programmes is presented in Table 24 and Table 25[5].

10.5 The estimated area of seabed physically impacted by previous decommissioning activities undertaken by ConocoPhillips/Chrysaor is estimated to be 0.19 km^2 and a further 64.8 km^2 has been disturbed by over-trawl surveys. The total area estimated to have been physically impacted within the North Norfolk Sandbanks and Saturn Reef SAC is 36.29 km^2 and within the Southern North Sea SAC it is 42.69 km^2 (Table 24).

[5] Note that these figures may be slightly different than those presented in the LDP 2 to 5 environmental assessment due to slight changes in the ways the areas have been calculated and also presented. However, the differences in the results are relatively small and do not make any material difference to the conclusions of this assessment.

10.6 Decommissioning activities associated with these decommissioning programmes were undertaken in 2019 and 2020. A total of 0.10 km^2 of seabed may have been lost due to the addition of material associated with decommissioning and 0.25 km^2 may be impacted by exposed pipelines. Within the North Norfolk Sandbanks and Saturn reef SAC an estimated 0.16 km^2 of habitat many have been lost by decommissioning activities associated with LDP1/VDP1 and VDP2/VDP3 and 0.25 km^2 within the Southern North Sea SAC (Table 25).

Table 24: Estimated area of physical impact arising from consented Chrysaor decommissioning activities.

Activity	Area (km^2)		
	VDP1 and LDP1	VDP2 and VDP3	Total
Platform removal – Cutting piles [1]	0.0087	0.0096	0.0183
Heavy lift vessel anchors [1]	0.0120	0.0180	0.0300
Accommodation works vessel – spud cans [1]	0.0630	0.0394	0.1024
Removal of subsea infrastructure	n/a	0.0037	0.0037
Cutting of subsea structure piles and pipeline ends	Inc in platform removal impact	Inc in platform removal impact	0
Well abandonment –anchors and chains [1, 2]	0.0192	0.0120	0.0312
Well abandonment – spud cans [1]	0.0047	0.0029	0.0076
Removal of conductors [1, 2]	0.0001	0.0001	0.0002
Total	0.1077	0.0820	0.1897
Total over-trawl survey [1, 3]	17.2	47.6	64.8
Over-trawl survey within NNSSR [4]	17.2	18.9	36.1
Over-trawl survey within SNS[5]	17.2	25.3	42.5
Total area of physical impact	**17.31**	**47.68**	**64.99**
Total area of physical impact in NNSSR SAC	**17.31**	**18.98**	**36.29**
Total area of physical impact in SNS SAC	**17.31**	**25.38**	**42.69**

1 - Figures for LDP1/VDP1 and VDP2/3 obtained from Chrysaor (2020d).

2 - From ConocoPhillips (2018b).

3 - Figures for area of impact from over-trawl surveys are estimated based on 200 m wide corridor along pipelines and 500 m radius around each installation (ConocoPhillips 2018c).

4 - Based on 54.8 km of pipeline within NNSSR SAC for LDP1/VDP1 and 109.5 km of pipeline for VDP2/VDP3.

5 - 54.8 km of pipeline in SNS SAC for LDP1/VDP1 and 7 platforms and one manifold plus 106.5 km of pipeline for VDP2/VDP3.

Where available the extent of actual impacts from now decommissioned assets have replaced previously forecasted estimated impacts used in previous HRA’s.

This HRA has included over-trawl surveys from previous decommissioning programmes in the in-combination assessment. Impacts from over-trawl surveys is the largest contributor to physical impact on the habitat. However, BEIS policy has evolved with regard to the removal of debris following decommissioning. The identification, recovery and verification of a clear seabed must be done by non-intrusive means.

Table 25: Estimated area of habitat loss arising from consented Chrysaor decommissioning activities.

Activity	Area (km²)		
	VDP1 and LDP1	VDP2 and VDP3	Total
Accommodation works vessel – stabilisation [1]	0.0473	0.0394	0.0867
Redistribution of rock [2]	0.0037	0.0038	0.0075
Cutting pipeline ends – rock protection [1]	0.0002	0.0004	0.0006
Free-span remediation – rock protection [1]	0.0002	0.0004	0.0006
Well abandonment – rig stabilisation [1]	0.0032	0.002	0.0052
Total	0.0546	0.046	0.1006
Existing impacts			
Leave *in situ* existing pipelines [3]	0.0498	0.2001	0.2499
Total area of habitat loss	**0.1044**	**0.2461**	**0.3505**
Total area of habitat loss in NNSSR SAC including *in situ* loss [4]	**0.1036**	**0.0560**	**0.1596**
Total area of habitat loss in SNS SAC including *in situ* loss [5]	**0.1036**	**0.1430**	**0.2466**

1 - Figures obtained from Chyrsaor (2020d).

2 - The redistribution of rock has been required at two out of 14 locations for LDP2 -5 and increased the footprint of the rock at those locations by an average of 39%. No information is available on whether similar levels of rock redistribution were required for previous decommissioning undertaken at VDP1, 2 and 3 and LDP1. For the purposes of this assessment it is presumed that rock redistribution has at two previous locations for both VDP1/LDP1 and VDP2/VDP3 and on average increased the footprint at each of the locations by 39%.

3 - Based on 9.1% of the pipelines exposed on the seabed impacting an area of 5 m either side (See Table 3 for length of pipelines and Chrysaor 2020b for the proportion of lines exposed).

4 - Based on 54.8 km of pipeline within NNSSR SAC for LDP1/VDP1 and 109.5 km of pipeline for VDP2/VDP3.

5 - Based on 54.8 km of pipeline in SNS SAC for LDP1/VDP1 and 106.5 km of pipeline for VDP2/VDP3.

It should be noted that the calculation assumptions between these documents and the Environmental Appraisal for LDP2-5 have changed, including additional impact from the redistribution of rock deposited for AWV stabilisation to accommodate the siting of a drill rig later at the same platform that an AWV visited previously.

Actual impact figures have replaced previously forecast figures for work which has already been done.

Other oil and gas activity

10.7 Figure 11 presents the existing oil and gas infrastructure in the North Norfolk Sandbanks and Saturn Reef SAC. This area is extensively developed with numerous existing pipelines, wells and platforms. It is not known what other projects may be planned in the future and so it is not possible to include all future activities within the in-combination assessment. However, any future developments would be required to undertake a Habitats Regulations Assessment that would take into consideration the potential in-combination impacts, including those arising from the proposed decommissioning activities.

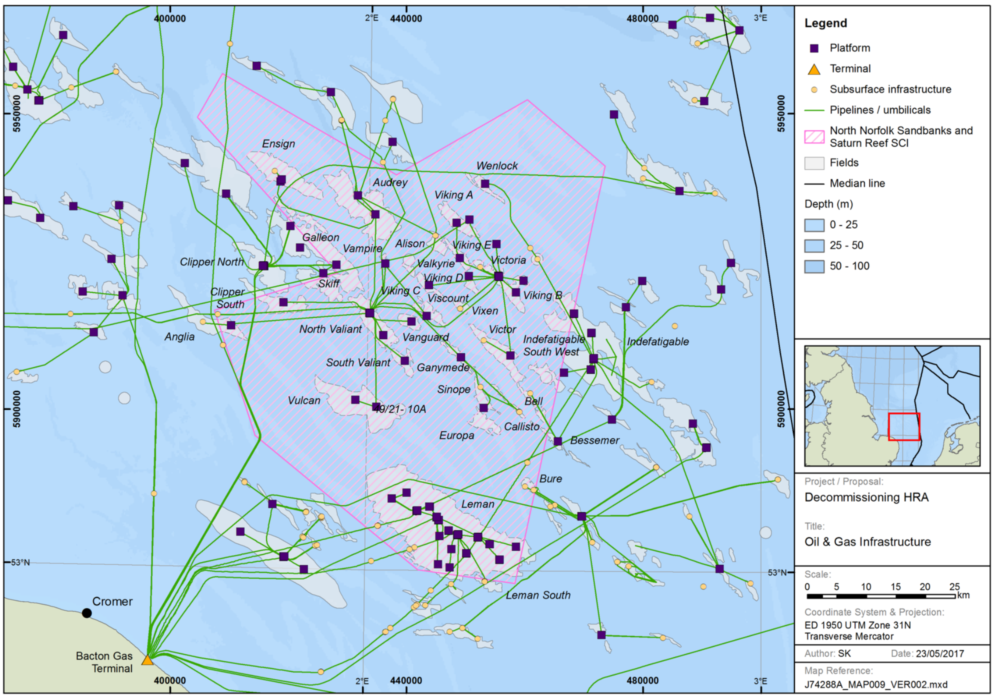


Figure 11: Existing oil and gas infrastructure within the North Norfolk Sandbanks and Saturn Reef SAC.

10.8 Within the North Norfolk Sandbanks and Saturn Reef SAC there were 75 surface installations, including the 11 relating to LOGGS LDP2 to LDP5 (Appendix C, Table 4). Since the removal of nine installations in 2019 and a further nine in 2020[6], the number of installation present within the North Norfolk Sandbanks and Saturn Reef SAC has been reduced to 57.

10.9 In the Southern North Sea SAC there were 132 surface installations (Appendix D), of which 17 have been removed, leaving 115 platform in place, of which ten are subject to this HRA.

10.10 The majority of the installations were installed over ten years ago and there have been no new installations installed within the North Norfolk Sandbanks and Saturn Reef SAC since 2013.

10.11 The area of physical impact on the seabed from the existing installations is dependent on the size of each installation. Based on the known size of 34 Southern North Sea installations the average installation footprint is 726 m^2 [7]. Consequently, the estimated area of physical impact caused by existing 57 platforms within the North Norfolk

[6] The platforms removed in 2019 and 2020 were associated with the VDP1, VDP2, VDP3 and LDP1 decommissioning programmes.

[7] The area of each jacket leg is unknown and therefore the 'footprint' refers to the area within the platform jacket legs and not the physical impact from the actual legs on the seabed. Consequently, this is a very much worse-case estimate.

Sandbanks and Saturn Reef SAC is 41,382 m^2 (0.041 km^2). In the Southern North Sea SAC the remaining installations have an estimated total footprint of 83,490 m^2 (0.083 km^2).

10.12 It is recognised that buried pipelines can both resurface and re-bury overtime due to sediment movement. Data from pipeline surveys undertaken since 1994 across the Viking field indicate that pipelines buried over sandy sediments largely remain buried, whereas those buried across gravelly sand are more at risk of becoming exposed (ConocoPhillips 2016). Along five pipelines within the Viking field a total of 31.1 km of gas pipeline have been surveyed for burial depth and free-spans. A total of 13.9 km of the lines were buried at the time of installation. Of the 13.9 km of line trenched and buried at the time of installation a total of 1.0 km (7.5%) is now on the surface of the seabed. Of the pipelines that were laid on the surface of the seabed at the time of installation (the Viking ED and GD pipelines), 63.7% of the pipeline is currently buried. This indicates that overtime a significant proportion of the existing pipelines that were laid on the surface of the seabed may become buried.

10.13 The results of the surveys indicate that the depths at which surface laid pipelines become self-buried varies over the years, with intermittent exposure on the seabed surface occurring in areas of gravelly sand and complete burial across sandbanks where the sediment comprises predominantly of sand.

10.14 Buried pipelines may become exposed where megaripples have moved since the pipelines have been laid. This suggests that buried pipelines do not affect the movement of surface sediments.

10.15 Surveys and monitoring around installations within the SAC indicate that scour can occur around relatively large infrastructure such as installations but not all of them and that following removal any scour pits are in-filled over time. Similarly, rock and mattresses can become buried, although this does vary upon the local conditions and the proximity to installations, with little or no coverage occurring closer to the platforms (Chrysaor 2020b). Buried pipelines will not affect the structure, function or integrity of the site.

10.16 A total of 721.57 km of gas pipeline is present within the North Norfolk Sandbanks SAC (Appendix A). This does not include the smaller diameter methanol, chemical and hydraulic lines that are normally piggy-backed or laid alongside (within the same trench) larger lines. For the purposes of this assessment, unless it is known otherwise, these small diameter lines are presumed to be piggy-backed or alongside the existing gas lines and therefore their presence does not increase the overall area of seabed impacted.

10.17 Based on an estimated 10 m corridor of impact along each pipeline, a total area of 7.1 km^2 of seabed within the SAC is estimated to have been impacted by the installation of existing gas pipelines. However, following burial the seabed is known to recover and only pipelines remaining on the seabed surface cause on-going loss of habitat. Within the SAC, 94% of all pipelines are trenched and buried and do not affect the surface of the seabed. Surveys undertaken by Chrysaor identified 9.1% of the pipeline as being exposed on the seabed (Chrysaor 2020b). Consequently, of the 721.57 km of pipeline in the North Norfolk Sandbanks and Saturn Reef SAC approximately 65.6 km may be exposed and impacting an area of seabed of 0.657 km^2.

10.18 Within the Southern North Sea SAC the total length of pipeline is 2,657 km, of which 89.4% was trenched and buried. If 9.1% of all pipeline line laid within the SAC is exposed then an estimated 241.8 km of pipeline could be exposed on the seabed within the Southern North Sea SAC. This equates to an estimated physical impact of 2.4 km^2.

10.19 Historical deposits of rock for rig stabilisation have been made over the years. The exact volume and area of seabed impacted is unknown. However, known deposits made within the North Norfolk Sandbanks and Saturn reefs SAC since 2011 cover an area of 0.0714 km^2 (Table 26) The area of rock deposited within the Southern North Sea SAC by the oil and gas industry since 2011 is 0.2185 km^2 (Table 27).

10.20 These totals are recognised to be a minimum. Applications for contingency rock dumping for rig stabilisation are made but it is not known whether it was required. However, it is recognised that the data are incomplete and a larger area of the SAC will have been impacted by historical contingency rock placement, prior to the sites being designated.

Table 26: Known area of rock deposits in the North Norfolk Sandbanks and Saturn Reef SAC.

Location	Year	Area (km^2)
Vanguard QD [1]	2013	0.0024
South Valiant TD [1]	2014	0.0052
North Valiant 1 PD [1]	2014/15	0.0033
Block 48/20 – pipeline [1]	2018	0.0019
Block 53/1 [1]	2018	0.0007
Ann/Alison [2]	n/a	0.0096
NNSSR SAC [3]	2011 - 2016	0.0483
	Total	0.0714

Note – the total includes both the total deposits made between 2011-2016 as well as the individual deposits listed above including those made between 2013 and 2015. Consequently some deposits may have been accounted for twice.

1 – Chrysaor 2020a; 2 – Centrica 2017b, Genesis 2020.

Table 27: Known rock deposits in the Southern North Sea SAC.

Location	Year	Area (km^2)
Vanguard QD [1]	2013	0.0024
South Valiant TD [1]	2014	0.0052
North Valiant 1 PD [1]	2014/15	0.0033
Block 48/20 – pipeline [1]	2018	0.0019
Block 53/1 [1]	2018	0.0007
Ann/Alison [2]	n/a	0.0096
SNS SAC [3]	2011 - 2016	0.1954
	Total	0.2185

Note – the total includes both the total deposits made between 2011-2016 as well as the individual deposits listed above including those made between 2013 and 2015. Consequently some deposits may have been accounted for twice.

1 – Chrysaor 2020a; 2 – Centrica 2017b, Genesis 2020.

10.21 A significant majority of existing oil and gas infrastructure has been present prior to the site becoming designated and therefore the impacts on the qualifying features of the site are part of the baseline environment.

10.22 In addition to the planned and potential future decommissioning programmes to be undertaken by Chrysaor, other gas installations and their associated infrastructure will be decommissioned by other operators and could cause an in-combination impact.

Anglia Field Decommissioning

10.23 The Anglia field lies within the North Norfolk Sandbanks and Saturn Reef SAC and is due to be decommissioned between 2023 and 2025 (Ithaca 2019a, b).

10.24 The field comprises of:

- Anglia A normally unmanned installation,
- Anglia West B subsea manifold (outwith the SAC),
- 11 wells, (six in NNSSR SAC),
- Anglia A to Anglia West B 5 km export line (trenched and buried),
- Anglia A to LOGGS 24 km export line (trenched and buried),
- Protective materials, mattresses, grout bags and rock.

10.25 All 24 km of the Anglia A to LOGGS export line is within the North Norfolk Sandbanks and Saturn Reef SAC. Surveys undertaken in 2018 confirmed that 519 m of the line was exposed on the seabed and 97 m of it was identified as being free-spans. Consequently, 2.2% of the line was exposed. A further 68 m of free-spans were identified along the 10 km of interfiled umbilicals (Ithaca 2019a,b). Total length of free-spans is therefore 165 m. For the purposes of this assessment a precautionary presumption has been made that all free-spans will require rock placement which will impact a 10 m wide corridor.

10.26 The Anglia West B subsea manifold lies outside of the North Norfolk Sandbanks and Saturn Reef SAC and the impacts from its removal will not impact on the features of the site. Neither Anglia A nor Anglia West B lie within the Southern North Sea SAC.

Table 28: Estimated area of seabed physically impacted from the proposed decommissioning activities associated with the Anglia decommissioning.

Activity	Total area of seabed impacted (km^2)	
	NNSSR SAC	SNS SAC
Decommissioning impacts [1]		
Platform removal – Cutting of piles	0.01	0
Platform removal – HLV anchors and chains	0.02	0
Removal/moving of subsea protective material	0.006	0
Removal of 2.5 km of infield umbilical	0.003	0
Well abandonment – spud cans and anchors	0.001	0
Over-trawl survey [2]	5.59	3.60
Total area of physical impact (km^2)	**0.040**	**0**
Total area of physical impact including over-trawl survey (km^2)	**5.63**	**3.60**

1 – Ithaca 2019a, b

2 - Area of over-trawl survey has been estimated based on a 200 m corridor along the 24 km of export line and one survey in 500 m radius of installation.

Table 29: Estimated area of seabed physically lost from the proposed decommissioning activities associated with the Anglia decommissioning.

Activity	Total area of seabed impacted (km^2)	
	NNSSR SAC	SNS SAC
Decommissioning impacts		
Free-span remediation – rock protection [1]	0.0016	0
Well abandonment – rig stabilisation [2]	0.002	0
Existing impacts		
Leave *in situ* existing exposed pipelines [2]	0.007	0
Total area of habitat loss (km^2)	**0.0106**	**0**

1 - Based on rock placement across 165 m of identified free-spans impacting a 10 m wide corridor of seabed.

2 – Ithaca 2019a

10.27 It is estimated that Anglia decommissioning activities could cause physical impact of 0.041 km^2 and loss of habitat covering 0.0106 km^2 within the North Norfolk Sandbanks and Saturn Reef SAC. In the event that an over-trawl survey is undertaken the area of seabed disturbed increases to an estimated 5.63 km^2. Within the Southern North Sea SAC the only potential impact is from a contingent over-trawl survey along the 18 km of pipeline within the site and could cause an estimated area of seabed disturbance of 3.60 m^2.

Ann A4, Ann, Alison, Audrey and Saturn (Annabel) Fields Decommissioning

10.28 Collectively the Ann A4, Ann, Alison, Audrey and Saturn (Annabel) fields are referred to as the A-fields.

10.29 The planned decommissioning activities are presented in the relevant decommissioning plans and the associated Environmental Impact Assessments (EIA) (Centrica 2017a, b, Spirit Energy 2018). Decommissioning at all the fields has commenced, although some activities have been delayed and remain to be undertaken. Consequently, these remaining activities have been subject to HRA (BEIS *in prep*.)

10.30 The estimated area of physical seabed disturbance from the A-field decommissioning to be undertaken is presented in Table 30. The estimated total area of seabed disturbance from decommissioning activities at the A-fields within the North Norfolk Sandbanks and Saturn Reef SAC, including the impacts from intrusive over-trawl surveys, is 19.824 km^2. If non-intrusive over-trawl surveys are undertaken that do not impact on the seabed, the estimated area of seabed disturbance from decommissioning activities at the A-fields is 0.653 km^2. The estimated total area of seabed disturbance from decommissioning activities at the A-fields, including the impacts from intrusive over-trawl surveys in the Southern North Sea SAC, is estimated to be 26.308 km^2. If non-intrusive over-trawl surveys are undertaken that do not impact on the seabed, the estimated area of seabed disturbance from decommissioning activities at the A-fields is 0.657 km^2.

Table 30: Potential extent of physical impact on the seabed as a result of decommissioning activities.

Field	Activity	Area Impacted (km^2)	
		NNS&SR	SNS
Ann	Removal of piles from subsea template	0.000	0.000
	Removal of pipeline ends	0.001	0.001
	Removal of grout bags and mattresses	0.135	0.135
	Post-decommissioning over-trawl surveys	7.314	10.874
Alison	Removal of piles from subsea template	0.004	0.004
	Removal of pipeline ends	0.081	0.081
	Removal of grout bags and mattresses	0.074	0.074
	Post-decommissioning over-trawl surveys	2.025	2.025
Audrey	Removal of Audrey A and B installations	0.240	0.240
	Removal of piles	0.019	0.019
	Cutting pipeline ends and removal of pipelines	0.023	0.023
	Removal of grout bags and mattresses	0.036	0.036
	Post decommissioning over-trawl surveys	5.732	5.732
Annabel	Removal of subsea template	0.001	0.005
	Removal of cut pipeline ends	0.000	0.039
	Removal of grout bags and mattresses	0.039	0.000
	Post decommissioning over-trawl surveys	4.100	7.020
North Norfolk Sandbanks and Saturn Reef SAC			
Maximum area of seabed disturbance (excluding over-trawl surveys) = 0.653 km^2			
Maximum area of seabed disturbance (including over-trawl surveys) = 19.824 km^2			
Southern North Sea SAC			
Maximum area of seabed disturbance (excluding over-trawl surveys) = 0.657 km^2			
Maximum area of seabed disturbance (including over-trawl surveys) = 26.308 km^2			

10.31 There will be no rock required for rig stabilisation during well abandonment.

10.32 A total of 85.68 km of pipeline subject to A-fields decommissioning will be left *in situ* within the North Norfolk Sandbanks and Saturn Reef SAC following decommissioning and 112.65 km will remain within the Southern North Sea SAC (Table 31). Surveys undertaken along each of the pipelines have indicated that all lines are buried and not exposed on the seabed except near to installations, where they will be removed, or at pipeline crossings where they are covered by rock and other stabilising materials. Consequently, the physical presence of the pipelines themselves will not cause a permanent loss of habitat within the SACs.

10.33 Rock has previously been used to address free-spans that have formed along the pipelines following their installation and to reduce the risk of upheaval buckling. Rock is also used in the construction of pipeline crossings. The exact extent of existing rock along the pipelines is largely unknown and it is not possible to quantify the area of seabed impacted by existing rock from the information presented within the decommissioning plans (Centrica 2017a, b, Spirit Energy 2018).

10.34 The number of pipeline crossings that will remain following decommissioning is presented in Table 32. The area of impact at each pipeline crossing is unknown but for the purposes of this assessment it is estimated that each pipeline crossing extends along 250 m of pipeline and impacts an area 5 m either side of the pipeline[8]. On this basis, it is estimated that a total length of rock at pipeline crossings associated with the A-fields is 7,000 m and will cover an area of seabed 70,000 m^2 (0.07 km^2).

10.35 No new mattresses or grout bags are to be placed on the seabed. Existing mattresses and grout bags that are covered by rock will be left *in situ*.

Table 31: Length of A-field pipeline within SACs following decommissioning.

Installation	Pipeline No.	Length of line (km)	
		NNS&SR	SNS
Ann A4	PL2164	0	0
Ann A4	PL2165	0	0
Ann	PL947	30.18	39.43
Ann	PL948	6.37	14.94
Alison	PL947	0	0
Alison	PL1099	6.2	6.2
Audrey	PL496 and PL497	16.89	16.89
Audrey	PL575	0	0
Audrey	PL576	0	0
Audrey	PL723 and PL724	3.99	3.99
Annabel	PL2066 JW12	0	0
Annabel	PL2067 JW12	0	0
Annabel	PL2066 JWAB2	0	0
Annabel	PL2067 JWAB2	0	0
Annabel	PL2066	13.35	17.8
Annabel	PL2067	8.70	13.4
	Total length of line	109.7	136.7

[8] The estimated length of rock at each pipeline crossing is based an average of four known rock dump deposits reported at crossings along pipelines associated with the Ensign decommissioning (Spirit Energy 2019a).

Table 32: Estimated extent of seabed loss by pipeline crossings at the A-fields.

Field	No. of pipeline crossings	Estimated length of rock dump (m)
Ann A4	0	0
Ann	13	3,250
Alison	0	0
Audrey	10	2,500
Annabel	0	0
Annabel	5	1,250
Estimated total length of seabed impacted		7,000

Ensign Field Decommissioning

10.36 The Ensign field lies within both the North Norfolk Sandbanks and Saturn Reef SAC and the Southern North Sea SAC. Spirit Energy submitted a decommissioning plan for the removal of the Ensign platform and associated infrastructure in 2019 along with an environmental appraisal (Spirit Energy 2019a,b; 2020).

10.37 Decommissioning involves the removal of the Ensign installation and the cutting and leaving *in situ* the associated pipelines and umbilicals (PL2838, PL2839, PLU2840 and PL2841).

10.38 The estimated area of impact from the decommissioning of the Ensign field is presented in Table 33. The estimated area of physical impact from the decommissioning activities associated with the Ensign field within the North Norfolk Sandbanks and Saturn Reef SAC is 0.242 km^2 and within the Southern North Sea SAC it is 0.227 km^2. There will be no intrusive over-trawl surveys undertaken at the Ensign field.

Table 33: Potential extent of physical impact on the seabed as a result of decommissioning activities at Ensign field.

Field	Activity	Area Impacted (km^2)	
		NNSSR	SNS
Ensign	Removal of Installation	0.161	0.161
	Removal of piles	0.004	0.004
	Removal of pipeline ends	0.007	0.007
	Removal of grout bags and mattresses	0.046	0.046
	Well abandonment at Audrey and Ensign	0.024	0.009
North Norfolk Sandbanks and Saturn Reef SAC			
Maximum area of seabed disturbance = 0.242 km^2			
Southern North Sea SAC			
Maximum area of seabed disturbance = 0.227 km^2			

10.39 There will be no rock required for rig stabilisation during well abandonment. Existing rock at the cut pipeline ends may be required to be re-distributed or additional rock may be deposited to ensure the cut pipeline ends remain buried (Spirit Energy 2019a).

10.40 A total of 24.04 km of pipeline will remain in both SACs following decommissioning (Table 34); the pipelines are buried and will not require any additional rock. Pipelines PL2838 and PL2841 may require rock to be placed at the four cut pipeline ends. The area of seabed that may be impacted by either the redistribution of rock or the placement of additional rock is unknown. Assessments undertaken for decommissioning activities being undertaken elsewhere in the area indicate that the average footprint of each rock berm placed over the end of cut pipelines is 13 m^2 (Chrysaor 2020a). On this basis, the area of seabed that could be impacted by rock placed on the cut pipeline ends associated with the Ensign field is 52 m^2 (<0.001 km^2).

10.41 Rock has previously been used to address free-spans that have formed along the pipelines following their installation and to reduce the risk of upheaval buckling. A total of 2,544 m of the Ensign PL2838 / 2839 pipelines are covered by rock and at least 259 m of rock occurs along the Ensign PL284 / PLU2840 pipeline (Spirit Energy 2019b, 2020). A total of 1,700 m of rock along these lines has been deposited for mitigation in order to reduce the risk of upheaval buckling; the remaining rock is for pipeline crossings. Assuming a 10 m wide area of impact, the estimated area of seabed impacted by reported existing rock deposited for upheaval buckling is estimated to be 28,030 m^2 (0.003 km^2).

10.42 No new mattresses or grout bags are to be placed on the seabed. Existing mattresses and grout bags that are covered by rock will be left *in situ*.

10.43 The total area of seabed predicted to be physically lost due to Ensign decommissioning activities is 0.003 km^2.

Table 34: Length of Ensign pipeline within SACs following decommissioning

Installation	Pipeline No.	Length of line (km)	
		NNS&SR	SNS
Ensign	PL2838 and PL2839	22.12	22.12
Ensign	PL2841 and PLU2840	1.92	1.92
	Total length of line	24.04	24.04

Victoria Field Decommissioning

10.44 The Victoria field lies within both the North Norfolk Sandbanks and Saturn Reef SAC and Southern North Sea SAC. NEO Energy submitted two decommissioning plans and an associated environmental appraisal in 2020. The field is due to be decommissioned between 2021 and 2025 (NEO Energy 2020a,b).

- The field comprises of:
- Victoria subsea well with well head protection structure
- Valve skid,
- Pipeline and umbilical from well to valve skid (27 m),
- Pipeline and umbilical from valve skid to main pipeline (126 m),
- Umbilical at Victoria valve skid (150 m),
- Pipeline to Viking BD valve skid (78 m),
- Umbilical to Viking BD valve skid (120 m),
- Production export pipeline and umbilical (3.95 km).

10.45 The estimated area of impact from the decommissioning of the Victoria field is presented in Table 38 and Table 39. The overall extent of seabed disturbance arising from the planned decommissioning of the Victoria field within both SACs is estimated to be 0.0328 km^2 and potential area of seabed habitat that may be lost is estimated to be 0.0006 km^2.

Table 35: Estimated area of seabed impacted by decommissioning the Victoria Field.

Activity	Assumptions	Area of seabed disturbed (km^2)
Anchoring jack-up vessel for well abandonment	No anchors or rig stabilisation material will be required.	0
Location of Jack-up vessel spud cans	4 x 5.2 m diameter spud cans.	0.00009
Pipeline section and umbilical removal	532 m of pipeline to be removed. Pipeline ends will be trenched and naturally buried.	0.0052
Victoria valve skid removal	Presumed same area of seabed disturbed as pile removal	0
Valve skid piles	Cut of four piles	0.0027
Wellhead removal	Cut of well tubing allowing 4 m deep with radius of 3 m.	0.0002
Concrete mattress removal	109 concrete mattress 6 m x 2.4 m. 176.9 m^2 for each mattress.	0.0193
Frond mattress removal	13 frond mattresses 6 m x 2.4 m. 176.9 m^2 for each mattress.	0.0053
Post decommissioning over-trawl surveys	Applicant has stated that over-trawl surveys will be non-intrusive	0
	Total area impacted (km^2)	0.0328

Note: Area of pipeline section and removal is based on seabed disturbance of 10 m corridor and not 5 m as per application.

Area of impact from pile removal 929 m^2 for each pile (see Spirit Energy 2020).

Area of seabed disturbance around each mattress of 5 m.

Hewett Field Decommissioning

10.46 The Hewett field lies partially within Southern North Sea SAC but lies beyond 7 km from the North Norfolk Sandbanks and Saturn Reef SAC. ENI submitted a decommissioning plan for the removal of six platforms: 48/29A-FTP, 48/29A-P, 48/29A-Q, 48/29B, 48/29C, 52/5A. and associated infrastructure in 2020 (ENI 2020).

10.47 Decommissioning involves the removal of all six installations and the cutting and leaving *in situ* the associated pipelines and umbilicals (PL020, PL021, PL084, PL085, PL086, PL087, PL584 PL1173 and PL1177).

10.48 The proposed removal activities will be undertaken between 2021 and 2028.

10.49 The estimated area of impact from the decommissioning of the Hewett field is presented in Table 36 and Table 37. The overall extent of seabed disturbance arising from the planned decommissioning of the Hewett field within the Southern North Sea SAC is estimated to be 0.6518 km^2 and potential area of seabed habitat that may be lost is 0.076 km^2.

Table 36: Estimated area of seabed impacted by decommissioning Hewett fields (Source: ENI 2020).

Activity	Assumptions	Area of seabed disturbed (km^2)
External cutting of jacket legs	To excavate to 4 metres below the seabed, excavations will extend laterally 7 m from each jacket leg impacting an area of c. 154 m^2. Platform 48/29A-Q has 4 legs and all other platforms have 8 legs.	0.0067
Removal of riser and cut of pipeline ends	The area of seabed disturbance assumes a corridor width of 4 m for the 12 m length from the riser impacting an area of 48 m^2	0.0006
Removal of mattresses and other stabilisation materials	Mattresses and other stabilisation materials will only be removed from areas requiring excavation. Temporary placement of equipment and items has been included in the lateral extent for the excavation	Included in above estimates
Use of an anchor moored HLV to remove topsides and jackets	Each anchor will cover an area of 25 m^2. There will be 600 m of each anchor line in contact with the seabed. it is assumed that the anchor lines on the seabed are subject to a lateral movement of ca. 5 m. This equates to an area of seabed of 11,146 m^2 per anchor line being disturbed	0.7149
Over-trawl survey	No over-trawl survey is within the decommissioning programme	0
Total area impacted (km^2)		0.7475
Total area impacted in SNS SAC [1]		0.6518

1 - Installation 48/29b lies outwith the SNS SAC.

Table 37: Estimated are of seabed physically lost due to the decommissioning of the Hewett fields (Source: ENI 2020).

Infrastructure	Assumptions	Area of seabed lost (km^2)
Use of W2W HLV jack-up vessel	It is assumed that the vessel has 4 spud cans, each of which has a radius of 7 m, impacting an area of 154 m^2, equating to 616 m^2 for all four. However, in the event that pre-lay rock needs to be deposited for stabilisation it is assumed that a radius of 20 m around each spud can would be disturbed, impacting an area of 1,257 m^2. Any rock deposited for scour mitigation would be within this disturbance area	0.025
Decommissioned pipelines left *in situ*.[1]	Area is calculated based on length of lines in Appendix B. 56.31 km of pipeline. Assuming 9.1% of the pipelines are exposed on the seabed and impact 10 m wide corridor.	0.051
	Total area impacted	0.076
	Total area lost in SNS SAC	0.076

1 – No assessment has been made within the decommissioning plan of impacts from leaving *in situ* pipelines.

Cavendish

10.50 The Cavendish field lies within Southern North Sea SAC but 81 km from the North Norfolk Sandbanks and Saturn Reef SAC. INEOS submitted a decommissioning plan for the removal of one platform and one pipeline (PL2284), one umbilical (PL2285) and one fibre optic cable (PL4612); all of which are laid within the same trench (INEOS 2019a,b).

10.51 Decommissioning involves the removal of the Cavendish installation and the cutting and leaving *in situ* the associated pipeline, umbilical and cable.

10.52 The proposed removal activities will be undertaken in 2020 and all decommissioning activities will be completed by 2023 (INEOS 2019a,b).

10.53 The estimated area of impact from the decommissioning of the Cavendish field is presented in Table 38 and Table 39. The overall extent of seabed disturbance arising from the planned decommissioning of the Cavendish field within the Southern North Sea SAC is estimated to be 0.0295 km^2 and potential area of seabed habitat that may be lost is 0.0471 km^2.

Table 38: Estimated area of seabed impacted by decommissioning the Cavendish Field (Source: INEOS 2019b).

Activity	Assumptions	Area of seabed disturbed (km^2)
Anchoring HLV	14 anchors each 4x4x4 m. 500 m long chains 90% in contact with seabed, buried to 0.5 m with 4 m lateral movement.	0.0254
Location of Jack-up vessel spud cans	4x18 m diameter spud cans to a depth of 0.5 m	0.001
Pipeline section and umbilical removal	Est. 275 m	0.0008
Jacket and pile removal	Cut of jacket piles allowing 4m deep with a radius of 3m. 4 No. piles	0.0001
Wellhead removal	Cut of well tubing allowing 4 m deep with radius of 3 m.	0.0001
Mattress removal	139 mattress	0.0021
	Total area impacted (km^2)	0.0295
	Total area impacted in SNS SAC	0.0295

Table 39: Estimated are of seabed physically lost due to the decommissioning of the Cavendish field.

Infrastructure	Assumptions	Area of seabed lost (km^2)
Decommissioned pipelines left *in situ*.[1]	Area of impact within SAC is calculated based on length 47,075 m of pipeline being left *in situ*. Assuming 9.1% of the pipelines are exposed on the seabed and impact 10 m wide corridor.	0.0471
	Total area impacted	0.0471
	Total area lost in SNS SAC	0.0471

1 – No assessment has been made within the decommissioning plan of impacts from leaving *in situ* pipelines.

Leman BH Field

10.54 The Leman BH field lies within the North Norfolk Sandbanks and Saturn Reef SAC. Shell submitted a decommissioning plan for the removal of the Leman BH platform and associated infrastructure in 2015; the installation was removed in 2017.

10.55 The decommissioning involved the removal of the Leman BH installation only. No other infrastructure was decommissioned (Shell 2017).

10.56 The installation was removed by the use of a heavy lift vessel that used anchors to maintain position. The estimated area of impact on the seabed from the worst-case scenario was 0.41 km^2 (Shell 2015).

10.57 No other impacts were identified.

10.58 It is recognised that future decommissioning activities will be undertaken within the North Norfolk Sandbanks and Reef SAC. Currently, the timing of future activities are unknown. However, it is possible that the following installation may be subject to decommissioning plans prior to 2024 (email from Perenco 18th March 2020):

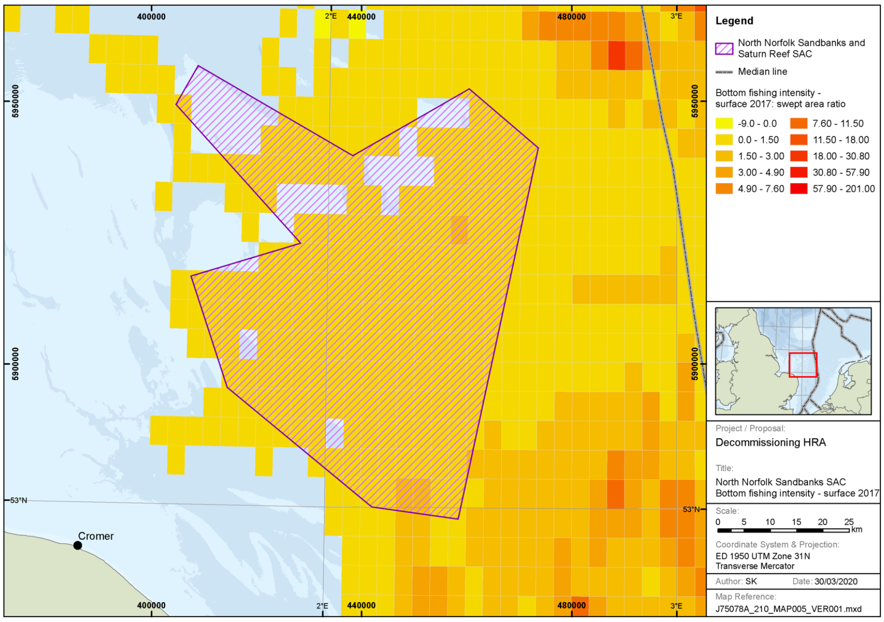
- Indefatigable (Inde) 18A (49/18A),
- Leman 27J (49/27J),
- Leman 27E (49/27E),
- Waveney (48/17c).

10.59 There is no information on how or when decommissioning of these, or other, installations will be undertaken but it is recognised that future plans and projects will be subject to the requirements of the Habitats Regulations once applications have been made.

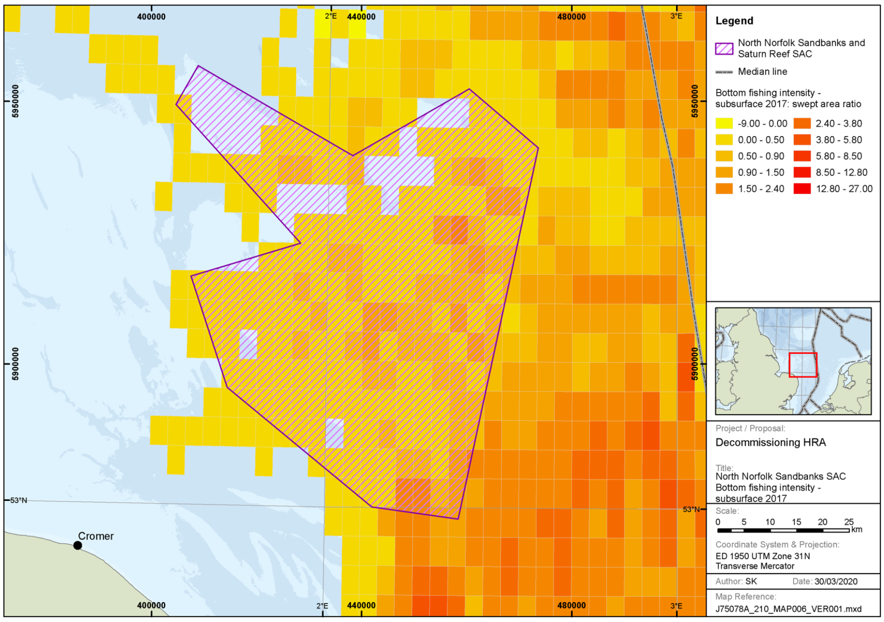
Fishing

10.60 Fishing occurs widely across the southern North Sea and has also been on-going for many hundreds of years. The predominant fishing activity within the North Norfolk Sandbank and Saturn Reef SAC is beam trawling, mainly by Dutch and UK registered vessels targeting demersal species such Dover sole, plaice and lemon sole (MMO 2011, ConocoPhillips 2015a). Bottom fishing causes a physical impact on the seabed and the intensity of bottom fishing across the SAC is presented in Figure 12. The figures show the swept area ratio[9] in each block from surface and subsurface fishing within the SAC during 2017 [10] (ICES 2019).

[9] The swept area ratio is the annual area of seabed impacted per year divided by the surface area of each cell.
[10] Surface fishing is where fishing gear does not penetrate more than 2 cm below the seabed surface. Sub-surface fishing is where fishing gear impacts greater than 2 cm below the seabed surface.



a) Surface fishing intensity in North Norfolk Sandbanks and Saturn Reef SAC



b) Sub-surface fishing intensity in North Norfolk Sandbanks and Saturn Reef SAC.

Figure 12: Surface and sub-surface fishing intensity in North Norfolk Sandbanks and Saturn Reef SAC.

10.61 Based on studies undertaken on the impacts of beam trawling on the seabed, the potential extent of seabed disturbance on average per year within the North Norfolk Sandbanks and Saturn Reef SAC has been estimated to be 1,312 km^2 per year (36.4%

of the SAC) (ABPMer and Ichthys Marine 2015). Over a period of five years an estimated 39% of the SAC is physically impacted by beam trawling.

10.62 Within the Southern North Sea the majority of current fish landings are obtained from areas adjacent to the SAC but there is widespread fishing activity in the southern half and north-eastern edge of the SAC and relatively moderate to high level of fishing activity along the western edge of the central part of the SAC (Figure 13) (MMO 2017a). Note however, this does not include the activities of non-UK registered vessels that will occur within the site or vessels less than 10 m in length.

10.63 The predominant fishing activity within the SAC is beam trawling, mainly by Belgian and Dutch vessels targeting Dover sole, plaice and lemon sole (MMO 2017b). Otter trawling and seine netting also occur for flat fish and sandeel fishing is also undertaken by trawling primarily around the western edge of Dogger Bank. The significant majority of fish taken and landed in the UK are plaice, sole, skates and rays caught by demersal and beam trawlers.

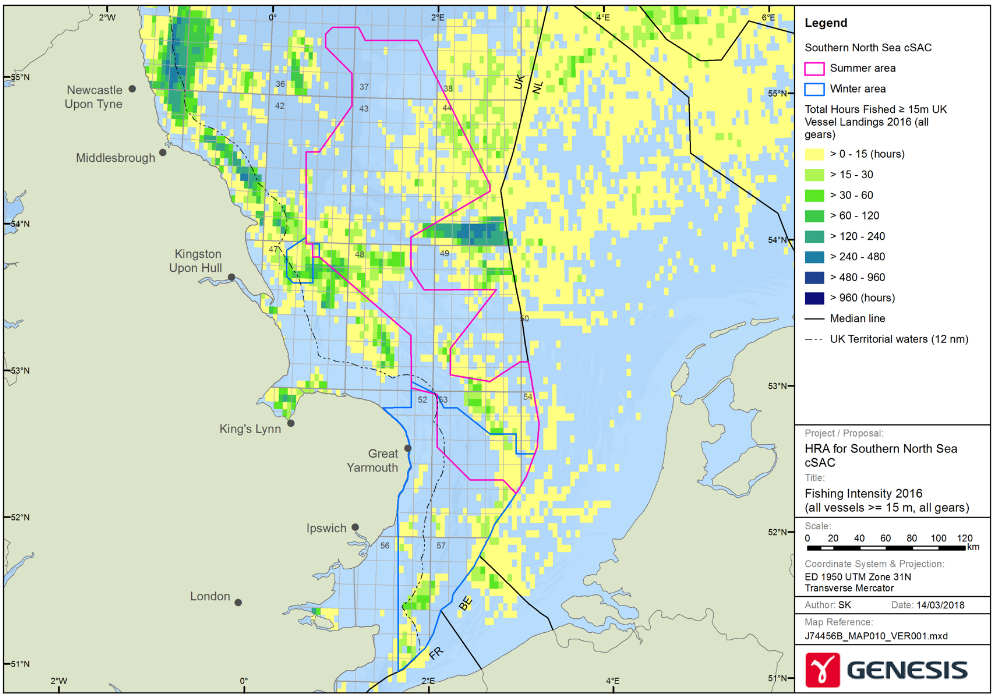


Figure 13: Fishing intensity across the SAC during 2014 by UK registered vessels.

10.64 There have been no studies undertaken to estimate the level of seabed impact within the Southern North Sea SAC and therefore it is not possible to quantify the extent of seabed disturbance caused by fishing activities within the site.

Renewable energy

10.65 No wind farm licensed areas occur within the boundaries of the North Norfolk Sandbanks and Saturn Reef SAC and no direct or indirect physical impacts on the SAC are predicted to occur from offshore wind turbines. However, up to six export cables from the proposed Hornsea 3 offshore wind farm are currently planned to cross the SAC from the Hornsea 3 offshore wind farm to the North Norfolk Coast (Figure 14) (DONG 2017).

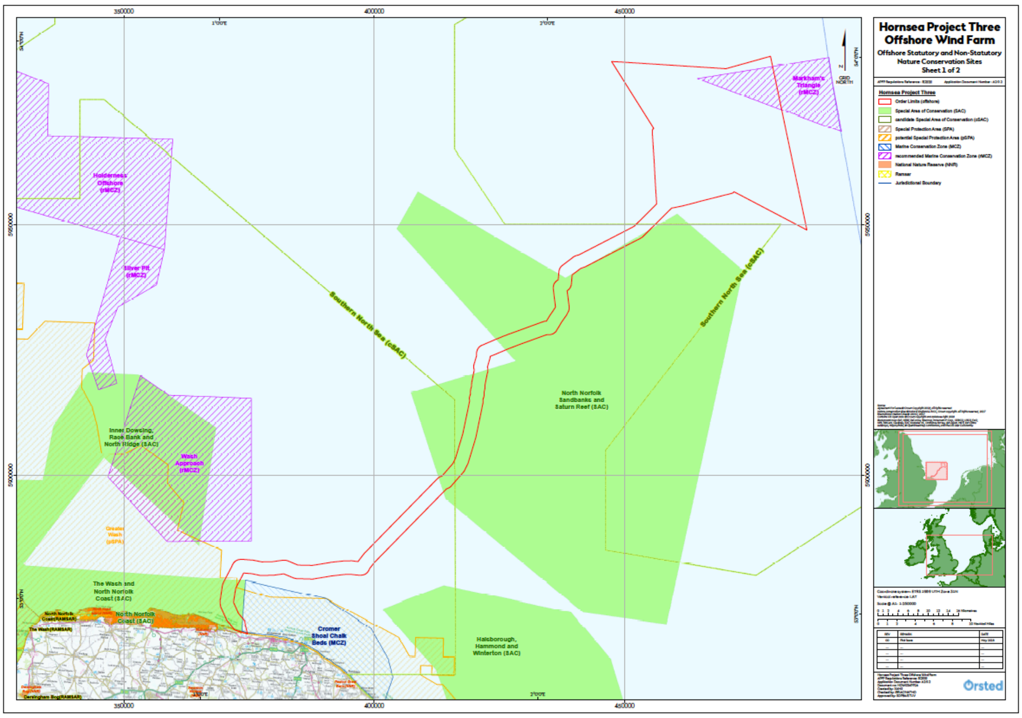


Figure 14: Proposed Hornsea 3 project and offshore nature conservation sites (Source Ørsted 2018b).

10.66 The total length of the export cable route associated with the proposed Hornsea 3 development is 145 km long and 1.5 km wide. The cables will be predominantly buried to a depth of 1 to 2 m, although up to 6% of the total cable route may require additional rock dumping to ensure burial (Ørsted 2020). In addition, where cables cross existing infrastructure, e.g. pipelines, rock will be required at each of the crossings. In total, within the SAC, an estimated 4,086,405 m^2 (4.1 km^2) of seabed may be physically disturbed by the trenching and burying of the cables and 418,440 m^2 (0.4 km^2) of seabed will be physically impacted by rock placed along the cable route for protection and crossings (DONG 2017, Ørsted 2020).

10.67 In total an estimated 0.1% of the seabed within the SAC may be physically disturbed and 0.01% may be physically lost by the laying of export cables across the SAC.

10.68 The estimated area of impact arising from offshore wind farms within the Southern North Sea SAC are presented in Table 40. The potential area of seabed within the SAC estimated to be permanently impacted by the physical presence of the turbines, associated infrastructure and scour protection is 8.12 km^2. A total of 94.66 km^2 of seabed may be temporarily impacted by cable trenching (BEIS 2020). However, the extent of physical impact caused by cable trenching by Hornsea Three and Norfolk Vanguard could not be located.

Table 40: Estimated area of impact from consented offshore wind farms within the Southern North Sea SAC (Source BEIS 2020).

Wind farm	Estimated area of physical impact (km^2)				
	Turbines and scour	Infrastructure	Cable protection	Total 'permanent' impact	Cable trenching
Galloper	0.98	0.00	0.20	0.29	3.90
Greater Gabbard	0.11	0.005	0.15	0.27	2.99
Dogger Bank A	0.45	0.02	0.74	1.33	14.73
Dogger Bank B	0.45	0.02	0.73	1.32	14.64
Dogger Bank C	0.00	0.00	0.08	0.08	1.53
Sophia	0.68	0.11	0.72	1.51	14.37
Hornsea One	0.25	0.05	0.27	0.57	7.10
Hornsea Two	0.32	0.06	0.63	1.02	12.62
Hornsea Three [1]	0	0	n/a	n/a	n/a
East Anglia One	0.13	0.03	0.37	0.52	7.32
East Anglia Three	0.33	0.11	0.77	1.21	15.46
Norfolk Vanguard	0	0	n/a	n/a	n/a
Total	3.7	0.405	4.66	8.12	94.66

1 – n/a not available. Information regarding the extent of cable protection or length of cable or area of impact within the Southern North Sea SAC could not located.

Aggregate extraction and dredging activity

10.69 Aggregate extraction areas 483 and 484 lie within the boundary of the North Norfolk Sandbanks and Saturn Reef SAC (Figure 15). Applications to undertake extraction at both sites were made in 2014 and consent given for area 484 in March 2015 and varied in June 2017 (currently discharging conditions from 2017 variation approval. Extraction area 483 obtained consent in December 2017 (MMO 2015b, MMO 2017c).

10.70 The area of each site within which extraction could be undertaken is 28.24 km^2 for site 483 and 17.2 km^2 for site 484; a combined total area of 45.4 km^2. Assuming the worst-case scenario is that the whole area of the two sites will be impacted, then 1.2% of the SAC could be physically impacted by aggregate extraction.

10.71 Consent was granted for both Areas to each extract up to a maximum of 9 million tonnes of material over the licence term of 15 years (i.e. an average of 600,000 tonnes/area/year) (Fugro Emu 2014).

10.72 Dredged material will be extracted using a trailer suction hopper dredger. Material will be screened and estimated 50 – 55% of the material may be returned back to the seabed due to being unsuitable for market requirements. The dredging of the material will cause a physical impact on the seabed and habitats.

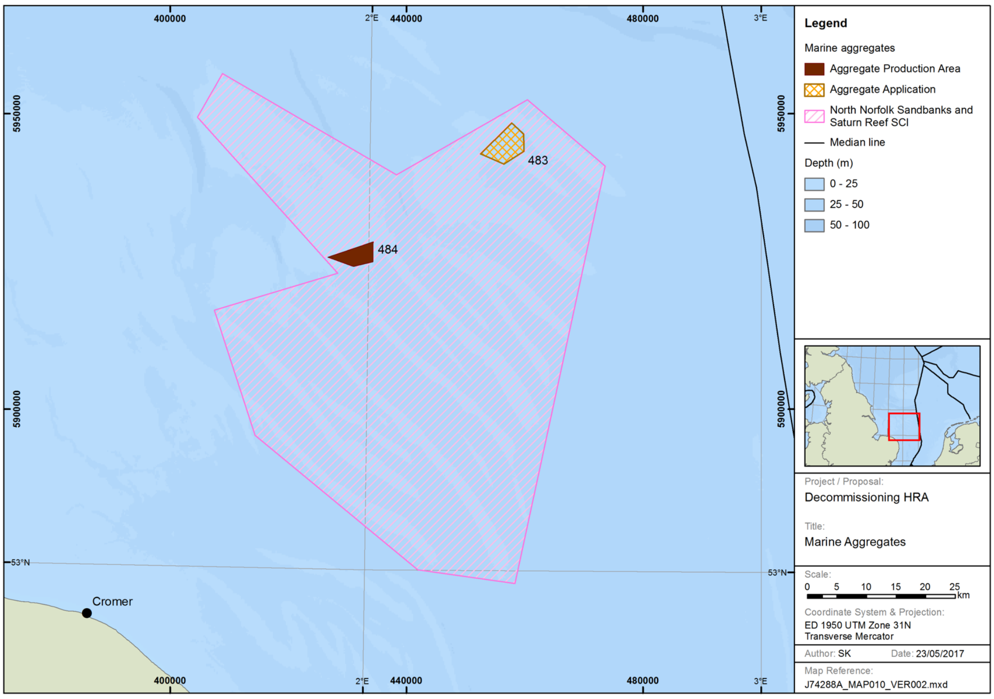


Figure 15: Aggregate extraction sites within the North Norfolk Sandbanks and Saturn Reef SAC.

10.73 An assessment undertaken by the applicant in support of their license application concluded that dredging activities at either site would not cause an adverse effect on the integrity of the SAC. Following an agreement to avoid an area of Sabellaria reef habitat, both the MMO and JNCC agreed with these conclusions for area 484, (Fugro Emu 2014, MMO 2015b).

10.74 Within the Southern North Sea SAC existing localised aggregate dredging occurs primarily in the southern half of the SAC, along the east coast (Figure 16). In 2017 there were 29 aggregate production areas and five Exploration and Option sites covering an area of 579.3 km^2 (Table 41). Five of the aggregate sites occur in the 'summer' area of SAC and the rest occur in the 'winter' area of the SAC, with some sites occurring in both the 'winter' and 'summer' areas (TCE 2019a).

10.75 The three-year average annual offtake of construction aggregate across the Humber, East Coast and Thames Estuary regions was 8.13 million tonnes (TCE 2019b).

Table 41: Aggregate extraction sites within the Southern North Sea SAC.

Aggregate Site	Area number	Area (km^2)
Humber 5	483	28.24
Humber 3	484	17.20
Longsand	510/2	6.21
Longsand	509/3	6.65
Shipwash	507/5	0.82
Shipwash	507/6	4.25
Shipwash	507/2	2.13
Shipwash	507/4	6.80
Shipwash	507/3	0.68
Shipwash	507/1	17.78
North Cross Sands	494	6.15
North Inner Gabbard	498	6.56
Southwold East	430	15.32
Off Great Yarmouth	254	11.71
TBC	511	26.63
Off Great Yarmouth	228	13.11
Off Great Yarmouth Extension	240	31.54
Yarmouth	401/2A	48.23
Yarmouth	401/2B	2.89
TBC	512	21.76
Norfolk	212	3.12
North Inner Gabbard	498	6.56
Southwold East	430	15.32
Longsand	510/1	6.65
TBC	513/2	8.61
TBC	513/1	5.91
Longsand	508	6.65
New 495	525	28.13
Thames D	524	77.45
North Falls East	501	52.25
Outer OTE	528/2	31.81
Cross Sands	242/361	9.32
Lowestoft Extension	1804	13.97
East Orford Ness	1809	38.86

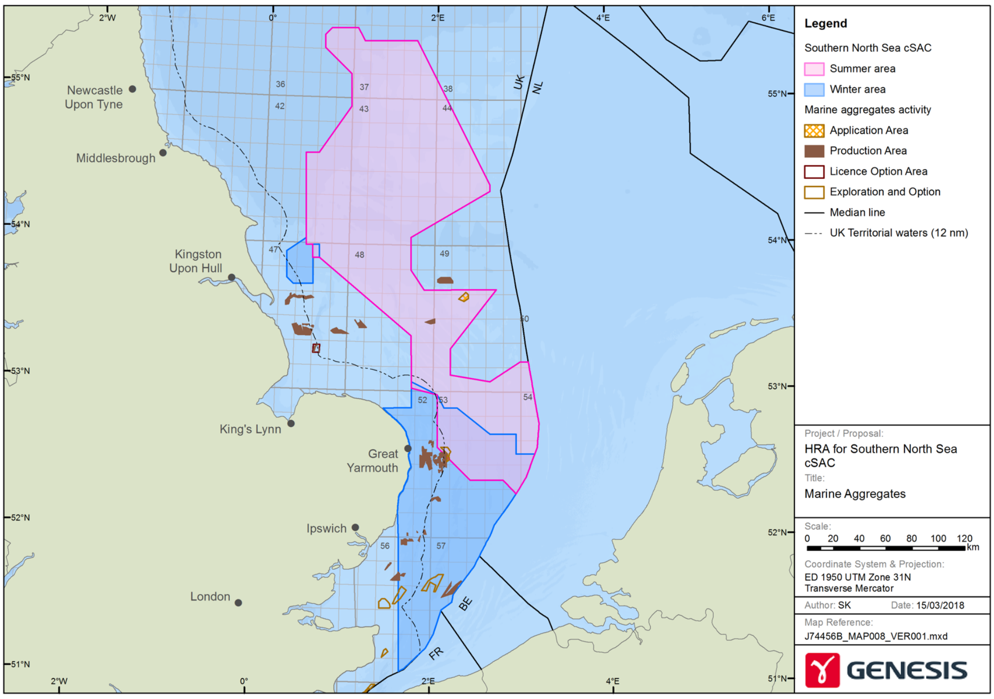


Figure 16: Existing marine aggregate activities in the Southern North Sea SAC.

11 LIKELY SIGNIFICANT EFFECTS TEST

11.1 Regulation 5 of the 2001 Regulations requires the Competent Authority to consider whether a development will have a likely significant effect on a European site[11], either alone or in combination with other plans or projects. A likely significant effect is, in this context, any effect that may be reasonably predicted as a consequence of a plan or project that may affect the Conservation Objectives of the features for which the site was designated, but excluding trivial or inconsequential effects. An Appropriate Assessment is required if a plan or project is likely to have a significant effect on a European site, either alone or in combination with other plans or projects. A judgement of likely significant effect in no way pre-supposes a judgement of adverse effect on site integrity.

11.2 This section addresses this first step of the HRA, for which BEIS has considered the potential impacts of decommissioning activities alone and in combination with other plans and projects on each of the interest features of the relevant national sites to determine whether there will be a likely significant effect.

North Norfolk Sandbanks and Saturn Reef SAC Likely Significant Effect

Sandbanks

11.3 Results from the assessment of potential impacts presented in Section 9 indicates that there is a risk of physical impacts or loss of habitat occurring that could cause a likely significant effect on sandbank features arising from:

- Accommodation work vessel stabilisation,
- Drill rig stabilisation and scour protection,
- Drill rig anchors,
- Heavy lift vessel anchors,
- Cutting jacket piles and cut and remove pipeline ends, tees and manifolds,
- Rock placement at cut pipeline ends and remove pipeline T-pieces,
- Well conductor removal,
- Drill rig spud cans,
- Free-span remediation,

11.4 BEIS considers that the proposed decommissioning, when considered alone and in-combination may have a likely significant effect on the North Norfolk Sandbanks and Saturn Reef SAC because:

[11] A European site is now referred to as a national site.

a. Physical impacts may occur to sandbank habitats through the use of heavy lift vessel/ drill rig anchors/chains, drill rig/AWV spud cans, cutting of jacket and subsea asset piles and pipelines and the removal of well conductors.

b. Physical loss of habitat may occur due to the placement of rock for accommodation vessel stabilisation, rig stabilisation and scour protection and the protection of the pipeline ends.

c. Physical loss of habitat from existing infrastructure that will remain *in situ*, e.g. pipelines.

Reefs

11.5 BEIS does not consider that there is potential for a likely significant effect on *Sabellaria* reef habitats from the proposed decommissioning activities. This is based on results from surveys undertaken that have not reported any *Sabellaria* reef habitat within the area predicted to be impacted (ConocoPhillips 2015a,b; Chrysaor 2020a). However, future decommissioning activities occurring elsewhere within the SAC, including those relating to activities associated with the future ten years of decommissioning, could affect *Sabellaria* reef habitat if discovered during site specific surveys.

Southern North Sea SAC Likely Significant Effect

Harbour porpoise

11.6 Results from the assessment of potential impacts presented in Section 9 indicates that there is a risk of physical injury or disturbance that could cause a likely significant effect on harbour porpoise arising from:

- Noise arising from vessel activity,
- Noise arising from cutting jacket piles and pipelines.

11.7 There is potential for a physical impact on the supporting habitats and processes. It is estimated that the total area of habitat within the that could be disturbed from decommissioning LDP2-5 is 0.0650 km^2 (Table 22) The impacts from seabed disturbance will be temporary with the habitat predicted to recover over a relatively short period of time.

11.8 There is potential for loss of habitat due to planned decommissioning activities. An estimated 0.0187 km^2 could be permanently affected (Table 23). The habitat impacted is widespread across the SAC and the area impacted is equivalent to 0.00005% of the SAC. The loss of 0.00005% of habitat is considered to be trivial and the effects, if any, will be inconsequential. Although there is potential for an in-combination impact arising from existing and future activities, the extent of any impact on habitat is so small that it will not contribute in any meaningful way to the potential in-combination impacts.

11.9 Consequently, it is concluded that the physical impacts and potential loss of habitat arising from the decommissioning LOGGS LDP2 to LDP5 will not cause a likely significant effect on the conservation objectives of the site.

11.10 BEIS considers that the proposed decommissioning, when considered alone and in-combination may have a likely significant effect on the Southern North Sea SAC because:

a) Sound arising from the proposed activities may cause injury or disturbance to harbour porpoise or their prey.

12 APPROPRIATE ASSESSMENT

12.1 An Appropriate Assessment is triggered when the competent authority, in this case the Secretary of State, determines that a plan or project is likely to have a significant effect on a national site. Guidance issued by the European Commission states that the purpose of an Appropriate Assessment is to determine whether adverse effects on the integrity of the site can be ruled out as a result of the plan or project, either alone or in-combination with other plans and projects, in view of the site's conservation objectives (EC 2019).

North Norfolk Sandbanks and Saturn Reef SAC

Sandbanks which are slightly covered by seawater all the time: Physical impact

12.2 A physical impact on the sandbanks may arise from decommissioning activities. The total estimated area of seabed disturbance within the SAC is 0.0799 km^2 (Table 22).

12.3 Sediment disturbance will occur during decommissioning. Seabed sediments in the Southern North Sea are subject to physical impacts from winter storms and strong tidal currents and are therefore in a dynamic environment where up to 30 cm of the surface sandy sediments occurring in less than 40 m of water are regularly impacted (ICES 2001). Studies undertaken at the Sean Gas Field, in water depths of about 20 m and in moderately sorted medium sand sediments demonstrated that resuspension of seabed material and the rate of erosion was closely correlated with seabed shear stresses and that at the Sean field wave induced resuspension of material occurred throughout the year and for over 50% of the time between January and March (Thompson *et al*. 2011). This dynamic environment causes continual exposure and reburial of pipelines.

12.4 Localised sediment plumes will occur during decommissioning. Although there is little information on the extent sediment plumes may occur from decommissioning activities, studies undertaken for cable and aggregate industries indicate that sediment plumes remain relatively localised with elevated sediment levels occurring largely within a few kilometres of the activities (e.g. Hill *et al.* 2011, BERR 2008). Once decommissioning activities have ceased, sediment levels will return to background levels within a few weeks (Hill *et al.* 2011).

12.5 Impacts will persist for varying times depending on the rate of local sediment movement. Measurements suggest this may be as short as only a few days in high energy environments such as the Bristol Channel and North Norfolk Banks but can be as long as several years for more stable deposits (Cooper *et al*. 2005, Hitchcock & Bell 2004, Kenny & Rees 1996). However, in larger areas of disturbance, e.g. areas of aggregate extraction, evidence from monitoring studies indicates that depressions in the seabed do not inhibit the movement of sediments, as they move into, through and out of the depressions and therefore there is no significant interruption to sediment movements (ICES 2016). Consequently, it is predicted that sandbanks will progressively recover and any physical impacts will be localised and temporary.

12.6 Following discussions with BEIS it has been agreed that in order to reduce the extent of seabed disturbed by decommissioning there will be no intrusive over-trawl surveys undertaken following decommissioning. Typically, the impacts from over-trawl surveys are relatively very large compared to the other impacts from decommissioning and the removal of the requirement to undertake intrusive over-trawl surveys significantly reduces the area of seabed disturbed by LOGGS LDP2 to 5.

12.7 Subtidal sandbanks are considered to be highly tolerant to physical disturbance with a high capability of recovery. Consequently, they are not considered to be highly sensitive to physical disturbance (Tillin *et al.* 2010, Tillin *et al*. 2019, Tillin and Tyler-Walters 2015)

12.8 Following cessation of activities benthic communities within the sandbank features will rapidly recolonise due to their mobile nature. Studies have shown that meiofaunal communities have partially recovered from sediment disturbance within a few tidal cycles and the ability of subtidal sandbank benthic communities to recover from sediment disturbance is high (Elliot *et al.*1998). However, the time taken for recovery to occur does vary depending on the level of disturbance, the type of community and seabed (Pidduck *et al*. 2017).

12.9 Studies along trenched and buried offshore wind farm export cables, e.g. Lynn and Inner Dowsing offshore wind farm, have shown that benthic communities, including *Sabellaria* re-colonised the disturbed seabed within a year of cable laying and that there were no differences in species composition from areas that had been impacted and those that had not (RPS 2019).

12.10 The area of physical impact on sandbank habitat arising from sediment disturbance will be very localised and occur in an area recognised as already having existing historical seabed disturbance. Any impacts on both the sandbank features or their communities will cease shortly after decommissioning activities have been completed.

12.11 The total area of Annex I sandbank habitat within the SAC is 3,603 km^2 and the total area impacted by the proposed decommissioning is approximately 0.0799 km^2 (Table 22). The potential physical impact to the feature is 0.002% of the total habitat within the site. The impact will be temporary with recovery of the sandbank habitat predicted to occur.

Sandbanks which are slightly covered by seawater all the time: Physical loss of habitat

12.12 Sandbanks are highly mobile, so the presence of solid structures in this environment can create an artificial habitat, localised scouring and sediment deposits and consequently a physical loss of habitat. Removal of the sandbank features may result in some localised loss of its ecological communities. The structure and diversity of sandbank communities are determined by environmental characteristics such as sediment particle size distribution, seabed slope and water depth. Any change in these environmental parameters (e.g. by removing or smothering part of the feature) could result in a loss of habitat and a possible shift in community organisation.

12.13 Physical loss of sandbank habitat will arise from the placement of rock used for stabilising the accommodation vessel, burying the ends of the pipelines and for rig stabilisation or scour protection. It is recognised that there is potential for future remediation of free-spans along exposed pipelines, although, it is not possible to determine the extent that this may occur. However, based on historical levels of rock dump along the existing pipelines it is likely that future deposits will be relatively localised. Any future remediation requiring rock dumping or other deposits will require an assessment to be undertaken under the Habitats Regulations.

12.14 The estimated area of seabed that could be permanently impacted by rock deposited during the decommissioning of the LOGGS LDP2 to LDP5 is 0.022 km^2 (Table 23). In addition, the leaving *in situ* of pipelines will cause an estimated area of 0.15 km^2 of seabed to be lost.

12.15 The total area of sandbank habitat within the North Norfolk Sandbanks and Saturn Reef SAC is 3,603 km^2. Consequently, approximately, as a worst-case, 0.1717 km^2 of sandbank habitat may be permanently impacted by rock deposits and existing exposed pipelines; equivalent to 0.0048% of the qualifying sandbank habitat within the SAC. However, it is likely to be significantly less than this as rock is not anticipated to be required for stabilisation at the majority of locations.

12.16 Rock placed onto a sandbank feature will change the habitat from a mobile sand feature to an immobile rock habitat. Overtime some of the rock may potentially bury or be partially buried by sand deposition although the extent that this occurs will depend on the local currents at each location and there is potential for re-exposure (Chrysaor 2020b).

12.17 The physical presence of rock or infrastructure within the SAC may cause an obstruction to the sandbanks and inhibit their natural mobility. The rate at which sandbanks are reported to move varies depending on their location. It has been estimated that at the rate that the Norfolk sandbanks move it could take in excess of 100 years for the sandbanks to move 100 m (Cooper *et al*. 2008). Although, movements of between 11 m and 15 m/year may occur (ABPmer 2005, Cooper *et al*. 2008). At these rates of movement, it is unlikely that any possible effect the physical presence of rock may potentially have on the mobility of the sandbank feature will be able to be detected.

12.18 Studies undertaken at Scroby Sands offshore wind farm, which is located on a shallow sandbank, indicated that although the physical presence of the turbines did cause an affect within 100 m of the turbines due to extensive scouring, there was no effect from the physical presence of the turbines on the sediment transport of the sandbank and therefore the overall morphology of the sandbank was being maintained (CEFAS 2006).

12.19 The movement of sandbanks within the SAC is caused by the re-deposition of sand in a north-easterly direction predominantly as bedload, although also by suspension (Colins *et al.* 1995, Cooper *et al.* 2008). The movement is caused by large scale hydrographic features such as Coriolis forces and tidal currents (Collins *et al*. 1995, ABPmer 2005). Additional material deposited from onshore erosion and residual currents around the banks maintain them. An estimated 400,000 m^3 of additional sand per year is deposited from cliff erosion along the Norfolk coast. Overtime this material is transported offshore onto the sandbanks (Cooper *et al.* 2008). North Sea mean current speeds are predominantly below 0.5 ms^{-1} but can be over 1 ms^{-1} during tidal flood (Collins *et al*. 1995).

12.20 In order to cause the physical loss of a sandbank that would affect the maintenance of the sandbank feature, an impact would need to affect the transportation of sand; the movement of which is primarily caused by tidal currents and Coriolis forces.

12.21 Data from ten years of surveys undertaken along two gas pipelines demonstrate the variability in the rate of burial. At the NW Bell ZX to Callisto ZM pipeline, the pipeline and associated rock and mattresses were completely buried over a ten year period, whereas along the Callisto ZM to Ganymede ZD pipeline the pipeline and associated rock and mattresses were only partially buried over this time (Chrysaor 2020b).

12.22 Pipeline surveys undertaken since 1994 along 31 km of VDP1 pipelines indicate that pipelines located on sandy sediments bury or remain buried if trenched and buried at installation over such sediment type. Pipelines which were trenched without burial or were surface laid appear to remain stable when located on gravelly sands (covered by deposits and subject to sand ripple migration) unless they were buried at installation (ConocoPhillips 2016). The pipeline surveys showed the migration of sand mega ripples over pipelines, regardless of pipeline orientation. Figure 17 shows the progressive movement of a sand mega-ripple, moving right to left, over a buried pipeline over three survey periods undertaken between 2000 and 2012.

12.23 A further study undertaken by Spirit Energy (formerly Centrica) compared the changes in the positions of sandwaves within the North Norfolk Sandbanks and Saturn Reef SAC from the time a 4" umbilical was trenched and buried in 1993 and 2017. The results indicated that there had been no noticeable difference in the position of the sandwaves from the time the umbilical had been laid and 2017 (Figure 18) (Centrica 2017).

12.24 Similarly, the Ensign to Audrey A (WD) pipelines (PL2838 and PL2839) were trenched and buried in 2010, with the seabed pre-swept prior to their installation. Surveys undertaken in 2018 indicate that sandwaves have re-established along the pipeline since they were laid, with some sandwave movement in a north-westerly direction over the eight year period (Figure 19) (Spirit Energy 2020).

12.25 The results from the studies indicate that following the installation of pipelines and umbilicals, sandwaves reform over the pipelines and that they continue to move over the pipelines and across the protected site.

12.26 There is likely to be some variability in this natural process as a result of a range of factors including changes in wind and weather, wave, tides, surges and sediments which are likely to influence sand migration. This appears to be reflected in a natural variability in exposure between survey periods which means the percentage of pipelines buried or exposed is subject to change between survey periods. Sand mega ripples continue to migrate across the site and over time regardless of the presence of pipelines. Pipelines do not appear to impede this sand migration and it means that pipelines which are exposed at one point in time can be buried at another point in time in a continuously process of sand movement. This feature also migrates at the surface over buried pipelines, resulting in variability in burial depth profiles, though pipelines which are substantially buried, remain buried.

12.27 Sand migration as a result of mega-ripples appears to be impeded at a small scale in the immediate vicinity of gas platforms/ pipeline risers. Scour and accretion is evident at some platform/ pipeline riser base locations. (ConocoPhillips 2015c). However mega-ripples appear to quickly reform away from platforms and platform risers, re-establishing the continuity of the feature. As the platforms and pipeline risers are to be removed and pipelines cut in proximity to the platform it is likely that the sand features will progressively re-establish over former platform locations. The Viking A complex (Viking AC, AD, AP, AR and FD) was largely removed in 1996, leaving only the Viking AR platform in place. Subsequent surveys undertaken in 2016 found no evidence of scour at any of the historical platform locations, with only minor depressions at the Platform AD and AF locations (Chrysaor 2020b). Mega-ripples are smaller scale features compared to sandbanks and the presence of oil and gas assets which were mostly installed in the 1970s appears to have had no impact on the sandbanks over that period and gas platforms have a very minor impact on the migration of sand mega ripples.

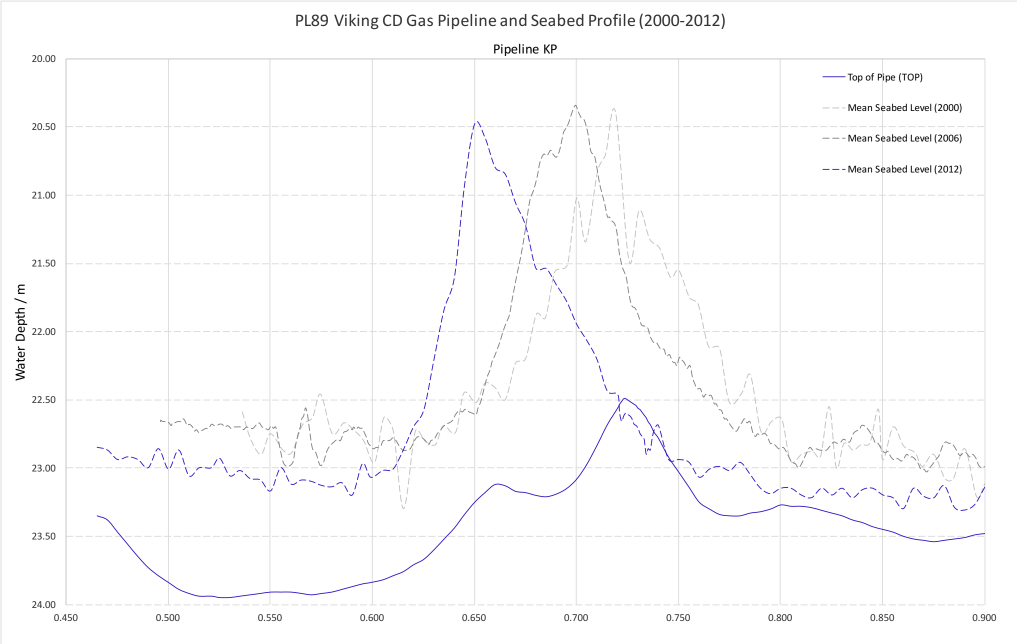


Figure 17: Viking CD gas pipeline burial depths and mean seabed profile between 2000 and 2012.

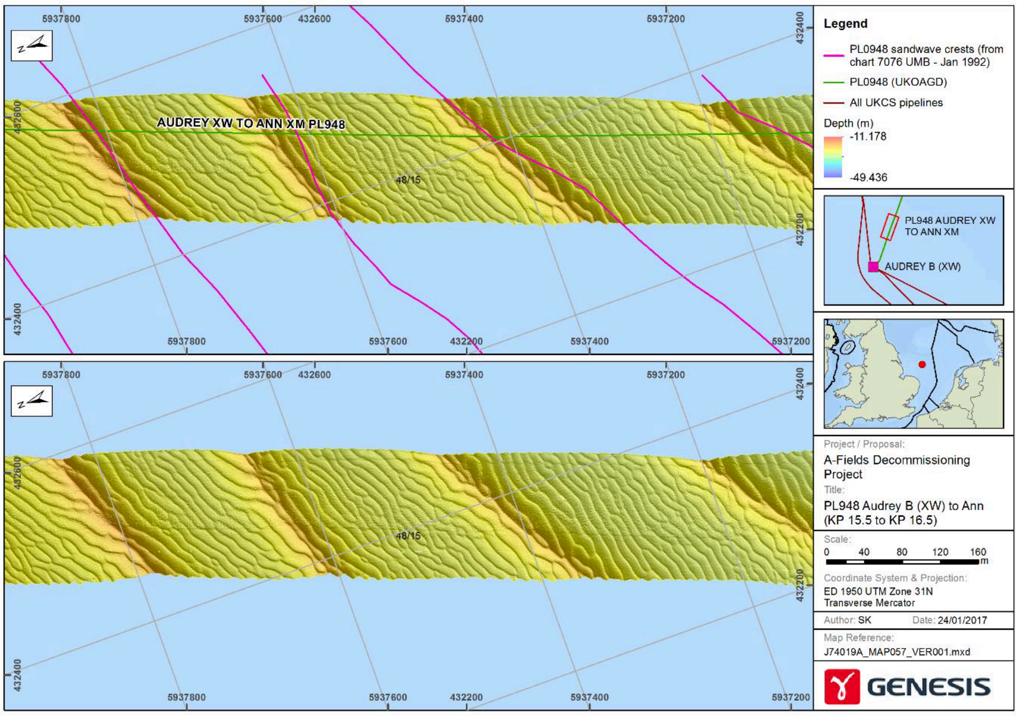


Figure 18: Location of sandwaves over a buried umbilical (Audrey to Ann) in 1993 and 2017.

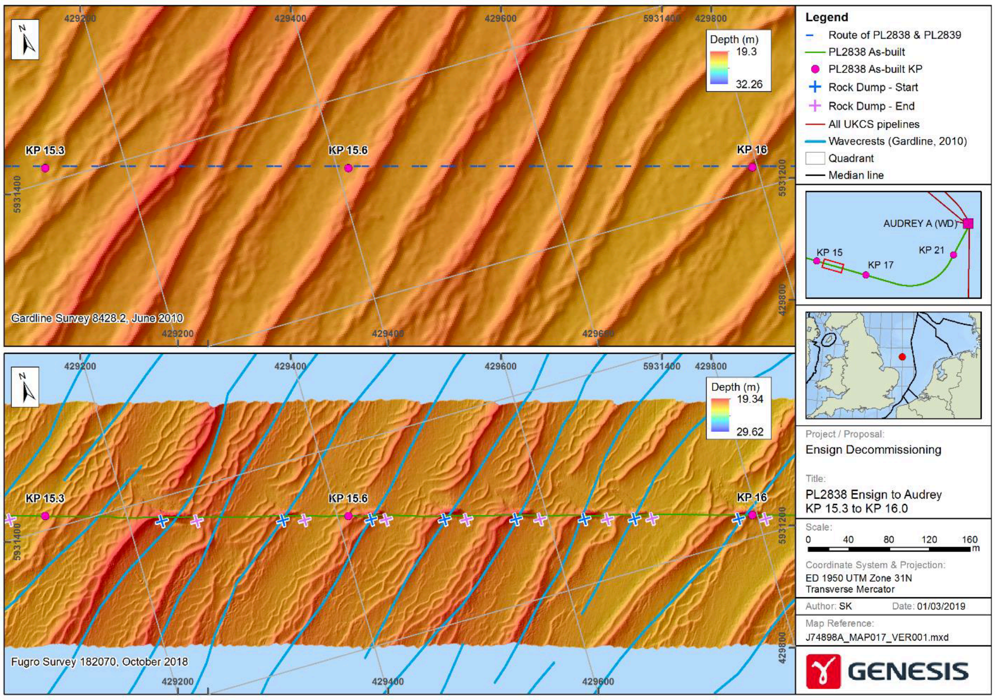


Figure 19: Sandwaves along Ensign PL2838 and PL2839 in 2010 and 2018.

12.28 Evidence from offshore wind farms indicate that the physical presence of wind turbines do not affect the sediment transport over a sandbank feature. The relatively very small scale of obstruction caused by oil and gas infrastructure is not predicted to affect the larger scale tidal currents or Coriolis forces that maintain the sandbank feature. Therefore, the sandbank features will maintain their morphological equilibrium which is determined by environmental factors whilst it is evident that they are migrating over time.

12.29 There is already a physical loss of habitat from the existing infrastructure, much of which has been in place prior to the site being designated the impacts from which are therefore part of the baseline environment; the LOGGS complex started operating in 1988. Following the removal of all installations there will be depressions in the seabed where the piles and conductors have been cut. However, overtime the habitat will recover and will reduce the area of habitat currently lost by the physical presence of the existing installations.

12.30 Leaving pipelines *in situ*, without any further remediation will not increase the area of habitat already impacted prior to the site becoming designated. The total area of sandbank estimated to be impacted by exposed pipeline is 0.15 km^2. This equates to 0.004% of the qualifying sandbank habitat within the SAC. It is recognised that this potential impact has been largely present prior to site designation.

12.31 Pipeline route inspections undertaken along four pipelines crossing the Swarte Bank have indicated that the physical presence of pipelines do not cause any discernible effects on the sandbanks features, with surface features, such as mega-ripples, being visually identical along the pipeline corridors as those away from the pipelines. (ConocoPhillips 2015a). Therefore, the physical presence of pipelines below the seabed do not visually appear to impact the features of a sandbank.

12.32 Studies undertaken at the Viking Alpha complex have shown that overtime scour at platforms disappears (Chrysaor 2020b). Consequently, the proposed removal of installations during decommissioning will, reduce the extent of scouring caused by the physical presence of platforms and other infrastructure within the SAC.

12.33 Although, no additional equipment is being placed on the seabed, the rock that may be used for stabilising the accommodation work vessel, the well decommissioning drill rig and for burying the pipeline ends may also cause localised scour. The extent of scour is dependent on the local conditions but is reported to be typically ten times the diameter of the obstacle (OSPAR 2006). Studies undertaken at offshore wind farms indicate scour depths vary both across locations and within the same locations, with deeper scouring typically occurring in areas of shallower waters and stronger currents. However, the extent and depth of scour at each location can change overtime depending on the prevailing tidal and wave conditions (HR Wallingford 2008, ABPmer 2010). Studies undertaken at Scroby Sands indicated no significant effects on sandbanks from scour beyond 100 m (CEFAS 2006). It is therefore predicted that impacts from scour will be relatively localised at each location and not affect natural processes beyond a microscale.

Conclusion

12.34 The potential impacts from the proposed decommissioning associated with LOGGS LDP2 to LDP5 activities within the North Norfolk Sandbanks and Saturn Reef SAC will cause a localised area of physical impact to the SAC. The area at potential risk of being impacted is relatively small compared to the extent of habitat within the SAC.

12.35 The features at risk of being impacted are widespread and not sensitive to physical disturbance and evidence from existing studies indicate that any physical impact is temporary, with the habitat and benthic communities recovering once decommissioning activities are completed.

12.36 The potential impacts from the proposed decommissioning activities associated with the LOGGS LDP2 to LDP5 within the North Norfolk Sandbanks and Saturn Reef SAC will cause a loss of habitat within the SAC. However, the extent of potential habitat loss is estimated to be relatively small compared to the extent of habitat within the SAC and it is predicted that less than 0.0048% of the site may be impacted. Overtime it is predicted that a proportion of the rock placed on the seabed will be buried and not cause an ongoing long-term loss of seabed habitat. The physical presence of structures on sandbanks have been shown to not cause morphological impacts on sandbanks over anything but a localised area (CEFAS 2006). Existing pipelines could impact on the SAC. However, they are not predicted to affect sandbank features, with surface features being uninterrupted by their presence and leaving them *in situ* is not predicted to increase the current extent of possible habitat loss or physical impact to the site. The communities and typical species across the SAC are predicted to remain the same with recovery occurring in areas of disturbance shortly after activities cease. There will be a reduction in the area impacted by the existing infrastructure when it is removed during decommissioning.

12.37 Based on the best available information BEIS is satisfied that the planned decommissioning activities relating to LOGGS LDP2 to LDP5 will not have an adverse effect upon the integrity of the North Norfolk Sandbanks and Saturn Reef SAC.

All Chrysaor Decommissioning Programmes

12.38 Chrysaor have been and will continue to undertake decommissioning activities at existing installations and associated infrastructure. Each asset will, prior to decommissioning, be subject to a detailed decommissioning programme that includes an environmental appraisal.

12.39 The estimated area of physical impact to the seabed arising from previous decommissioning programmes (LDP1, VDP1, VDP2 and VDP3) is 36.29 km^2, of which 36.1 km^2 was from over-trawl surveys (Table 24). BEIS policy has evolved on debris clearance in national sites protected for seabed features since the environmental appraisals supporting LDP1 and VDP1-3 were prepared. Where physical decommissioning has occurred in such sites, debris identification, recovery and verification of clear seabed will be done by non-intrusive means.

12.40 The estimated area of physical impact arising from the current proposed LOGGS decommissioning programme (LDP2 to 5) is 0.0799 km^2 (Table 22).

12.41 Future decommissioning in the North Norfolk Sandbanks and Saturn Reef SAC is predicted to physically impact an area of 131.08 km^2 (Chrysaor 2020a).

12.42 The combined area of potential seabed physically impacted by Chrysaor decommissioning is estimated to be 167.45 km^2 [12]. However, this includes the potential for future over-trawl surveys which are unlikely to occur to the extent predicted, based on the approach taken for LOGGS LDP2 to 5. The worst-case scenario is that 4.6% of

[12] Estimate based on LDP2-5 impacting 0.0799 km^2, LDP1 and VDP1-3 impacting 36.29 km^2 and future decommissioning impacting 131.08 km^2.

the seabed within the SAC could be physically impacted over a ten year period due to decommissioning activities.

12.43 As previously discussed, the impacts from seabed disturbance within the SAC will be temporary with the habitat and associated benthic communities recovering within one to two years. The temporary impact will be spread over a period of at least ten years and therefore the actual physical impact at any one point in time will be lower.

12.44 The estimated area of habitat lost due to contingency rock required for stabilisation and actual buryial of pipeline ends, plus the existing exposed pipelines from previous decommissioning programmes (LDP1, VDP1, VDP2 and VDP3) is estimated to be 0.1596 km^2 (Table 25).

12.45 The estimated area of habitat loss within the SAC from current LOGGS LDP2 to 5 decommissioning programme is 0.1717 km^2 (Table 23).

12.46 The estimated area of habitat loss from future decommissioning is predicted to be 0.259 km^2 (Chrysaor 2020a).

12.47 The overall area of habitat lost within the SAC from Chrysaor decommissioning activities is estimated to be 0.5903 km^2; 0.02% of the SAC.

12.48 The maintenance of sandbank features and consequently their communities is controlled by tidal currents and Coriolis effects. These are large scale natural forces that will not be affected by very small physical changes caused by rock placed on the seabed. The hard substrate will provide habitats for benthic communities associated with hard substrates. These will remain at the localised areas of rock and not affect the wider sandbank communities.

12.49 There is a theoretical loss of habitat from the existence of pipelines within the SAC. However, the majority of pipelines are buried within the site and will not cause a physical effect on the sandbank features. Further assessment at the time of decommissioning will confirm the status of the lines and whether remedial action to protect the lines and other sea users is required.

12.50 There is no information on the potential for Annex I *Sabellaria* reef habitat to occur within the area of future decommissioning activities and therefore no assessment on the potential impacts on this qualifying feature is possible.

Conclusion

12.51 The potential impacts from the proposed decommissioning activities associated with Chrysaor decommissioning activities within the North Norfolk Sandbanks and Saturn Reef SAC over a ten year period will cause a loss of habitat within the SAC. However, the extent of potential habitat loss is estimated to be relatively small compared to the extent of habitat within the SAC and it is predicted that less than 0.02% of the site may be impacted. However, due to the precautionary assumptions made on the need for stabilisation material required, it is likely that the actual increase in habitat loss will be less than this. Furthermore, there will be a small reduction of permanent impacts caused by the removal of the infrastructure once they are removed.

12.52 Seabed features and communities disturbed by the decommissioning activities will recover over time and the impacts will be temporary.

12.53 Existing pipelines are not predicted to effect sandbank features, with surface features being uninterrupted by their presence and leaving them *in situ* is not predicted to increase the current extent of possible habitat loss or physical impact to the site.

12.54 Based on the best available information BEIS is satisfied that the planned decommissioning activities relating to Chrysaor's decommissioning activities over a ten year period within the SAC will not have an adverse effect upon the integrity of the North Norfolk Sandbanks and Saturn Reef SAC.

Southern North Sea SAC

Harbour porpoise

12.55 The primary source of noise predicted to impact on harbour porpoise arises from vessels associated with the proposed decommissioning activities.

12.56 There are no published studies indicating that there is potential for either permanent threshold shift (PTS) or temporary threshold shift (TTS) from vessel noise in harbour porpoise. The level of sound arising from vessels is relatively low (<190 dB re 1 µPa @ 1 m) and is a continuous sound source (i.e. non-pulsed) and the risk of PTS or TTS occurring is considered to be very low. The main frequencies produced by vessels are below the main hearing frequencies for harbour porpoise. However, vessel noise is audible to harbour porpoise and has the potential to cause behavioural impacts, with localised displacement, a reduction in vocalisation and masking effects (Nowacek *et al.* 2007, Pirotta *et al.* 2015).

12.57 If, based on the current estimates, there is an avoidance or a behavioural response out to 0.4 km from a vessel, then an area of 0.5 km^2 may be impacted around each vessel. Should this occur, the area of habitat temporarily unavailable to harbour porpoise, or within which they will be disturbed, will be 0.001% of the SAC as a whole or 0.002% of the 'summer' area. In the event that eight vessels are operating simultaneously (Chyrsaor 2020a), the worst-case scenario is that an area of 4 km^2 may be affected, equivalent to 0.01% of the SAC as a whole or 0.01% of the 'summer' area.

12.58 Recorded densities of harbour porpoise across the SAC vary from between 0.19 ind./km^2 at East Anglia One offshore wind farm and 2.87 ind./km^2 at Hornsea

Zone 3 (EAOWL 2012, SMart Wind 2017). Peak densities, based on modelling, of harbour porpoise within the SAC are 3 ind./km^2 (Heinänen and Skov 2015). Therefore, based on the peak modelled densities, up to 12 harbour porpoise may be disturbed or displaced from the areas used by vessels during decommissioning. This is 0.003% of the North Sea Management Unit harbour porpoise population.

12.59 Although there is potential for relatively localised behavioural response arising from vessel noise which could cause an increase in energetic costs to individual harbour porpoise, the duration of any behavioural effects arising from decommissioning vessels are predicted to be relatively short (Dyndo *et al.* 2015). Studies undertaken on bottlenose dolphins indicate that although there is a reduction in vocalisation due to the presence of vessels, the dolphins remain in the area and resume activities as the vessels move away (Pirotta *et al.* 2015). Similar behaviour is predicted to occur with harbour porpoise within the SAC and any behavioural impact caused by vessel activities will be localised and temporary.

12.60 Fish are not known to be particularly sensitive to vessel noise and although there is potential for a very localised area of displacement away from vessel within the SAC, the extent of any impact is predicted to be very localised and will not affect the ability of harbour porpoise to feed within the designated site.

12.61 In the event that fish do relocate away from the decommissioning activities, they will return once the sound has stopped. Harbour porpoise will be able to find prey elsewhere within the SAC during the relatively short period of time that the activities are occurring within any one area. They will return once activities stop.

12.62 There is potential for a localised, temporary effect on the supporting habitats and their prey from the removal of installations and associated infrastructure. The estimated extent of impact from LDP2-5 on the seabed within the SAC is 0.0650 km^2 (Table 22). Physically impacted seabed is predicted to recover over a period of time depending on the local environment. Any disturbance to the seabed habitat that could affect either harbour porpoise or their prey within the SAC will be temporary. Within the SAC harbour porpoise occur widely and therefore any individuals displaced by the relatively localised short-term impacts from decommissioning activities will be able to relocate to suitable habitats elsewhere within the SAC.

Conclusion

12.63 The potential impacts from the proposed decommissioning activities within the Southern North Sea SAC may cause localised temporary disturbance to harbour porpoise. The extent of potential area of disturbance is estimated to be relatively small compared to the overall area of the SAC and it is predicted that less than 0.03% of the site may be temporarily affected by noise arising from decommissioning activities. The number of individuals estimated to be impacted is 0.03% of the North Sea Management Unit population. Any impacts will be temporary and localised.

12.64 The disturbance to habitats and their prey species will be equally localised and temporary and impacted porpoises will locate to other suitable sites areas within the SAC.

12.65 Based on the best available information BEIS is satisfied that the planned decommissioning activities will not have an adverse effect upon the integrity of the Southern North Sea SAC alone or in-combination.

13 In-combination impacts

13.1 BEIS recognises that there is extensive existing oil and gas related infrastructure within the southern North Sea, the majority of which has been present prior to sites being designated as SACs. Impacts on qualifying features from existing infrastructure have been present prior to the sites being designated and are considered part of the baseline environment.

13.2 Decommissioning of existing oil and gas infrastructure has occurred in the past and will occur in the future. All planned decommissioning projects require the submission of a decommissioning programme and an environmental appraisal. Each programme will also require an assessment to be made under the Habitat regulations if there is potential for a likely significant effect on a designated site.

13.3 Where no decommissioning programmes have been submitted the assessment of potential scale of impacts arising from decommissioning is based on assumptions derived from existing decommissioning activities undertaken within the area. It is important to note that the scale of the potential impacts are estimates based on the currently best available information and assumptions based on previous decommissioning experience; they are however, estimated impacts. Further assessment will be required at the time of each decommissioning project. Presuming that future decommissioning will be undertaken using similar methods as those to be used for LOGGS LDP2 to 5, then similar scales of impact for each activity are predicted to occur.

In-combination impacts on North Norfolk Sandbanks and Saturn Reef SAC

13.4 The known infrastructure within the North Norfolk Sandbanks and Saturn Reef SAC is presented in Table 42 and the estimated extent of physical disturbance that could arise from past, current and future decommissioning within the SAC is presented in Table 43. The estimated loss of habitat from existing infrastructure and decommissioning is presented in Table 44.

13.5 No *Sabellaria* reef habitat has been found within the proposed LOGGS LDP2 to 5 area of activities and therefore no in-combination impact will arise.

13.6 The lack of site specific information and the ephemeral nature of *Sabellaria spinulosa* makes it not possible to assess the extent of future impacts on this qualifying feature. However, site surveys undertaken at the time of decommissioning will, if present, identify areas of *Sabellaria* reef that could be impacted by specific decommissioning projects and these will be subject to assessment under the Habitats regulations at the time decommissioning programmes are submitted.

13.7 There will be a physical impact on the sandbank features and their communities from decommissioning activities. It is estimated that the total area physically impacted, excluding over-trawl surveys, will be 1.65 km^2 (Table 43). Evidence from existing studies indicate that any physical impacts will be temporary with both the sandbank features and associated communities recovering within a relatively short period of time.

13.8 The policy position on over-trawlability surveys in sites protected for seabed features has evolved. Previously submitted environmental appraisals included over-trawl surveys which may impact a total area of 67.3 km^2 (Table 42). These have been, or will be, undertaken over a number of years and, compared with the 1,312 km^2 of beam trawling occurring within the SAC each year, it is predicted that even if all over-trawl surveys were to be undertaken in a single year they would increase the overall impact within the SAC by no more than 0.5% per year. Following any survey, the impacts will cease and the seabed and the biological communities will recover. The impacts from the over-trawl surveys are therefore temporary. However, over-trawl surveys will not be required for all future decommissioning activities with none, for example being undertaken for the LOGGS LDP2 to LDP5 decommissioning programmes.

13.9 There is potential for a physical loss of habitat of up to 0.2556 km^2 due to rock placement (Table 44). The significant majority of this relates to impacts from contingency stabilisation of accommodation vessels and drill rigs. In the event that they are not used then the estimated area of impact from rock-placement is significantly reduced.

13.10 Existing pipeline infrastructure is largely buried and will not cause a physical impact on the seabed. However, exposed sections of pipeline could have a localised effect estimated to cover 1.0797 km^2. Existing rock and other known deposits impact over an area of 0.1204 km^2. In total an estimated area of habitat that could be lost from existing infrastructure, deposits and decommissioning is 1.4557 km^2.

13.11 The leaving *in situ* of existing lines is not considered to impact on the integrity of the site as they are predicted to remain largely buried by sandbanks or mobile sediments and will require minimal additional remediation. The extent of existing rock dump along all the pipelines within the SAC is currently unknown. Site specific surveys at the time of decommissioning pipelines will determine the extent of any existing or additional rock dump that may be required to ensure the pipelines remain safe for other sea users. In the event that remediation is required in the future, then this will be subject to further assessment.

13.12 The physical loss of habitat will be localised and not predicted to affect the tidal currents or Coriolis effects that maintain the structure of the sandbanks. There will be localised changes in the biological communities in areas where the substrate has changed but these will not affect the overall community structure within the SAC.

13.13 The physical loss of habitat due to decommissioning across the SAC will not affect the integrity of the site.

13.14 The physical presence of buried pipelines will not affect the structure and function of the Annex I sandbank habitat and not impact on the integrity of the site.

Table 42: Known oil and gas infrastructure within the North Norfolk Sandbanks and Saturn Reef SAC.

Field / Decommissioning programme	No. of platforms	No. of subsea installations	No. of subsea infrastructures	No. of wells	No. of pipeline cut ends	Length of pipeline and Umbilicals (km)	No. of piles	No. of conductors	Area of over-trawl survey (km^2)	Free-spans rock (m^2)
LOGGS LDP 2 to 5	14	0	4	59	16	129.4	72	110	0.0	538.7
LDP1 and VDP1	8	0	2	29	10	54.7	54	31	17.2	431.1
VDP2 and VDP3	8	2	3	30	18	103.2	56	33	18.9	400
Anglia	1	0	2	6	2	24	3	6	5.59	970
Ann and Alison	0	1	2	3	3	74.5	4	3	10.42	20
Audrey & Annabel	2	0	3	18	8	72.0	20	18	11.27	0
Ensign	1	0	0	3	4	34.4	4	3	3.82	0
Leman BH	1	0	0	0	0	0	4	0	0	0
Victoria	0	1	2	1	4	4.45	4	1	0	0
Other Fields	41	n/a	n/a	n/a	n/a	214.27	n/a	n/a	n/a	n/a

n/a – not available

Table 43: Estimated in-combination physical impact from decommissioning all existing oil and gas infrastructure within the NNSSR SAC.

Activity	VDP1 and LDP1	VDP2 and VDP3	LOGGS LDP2 to 5	Anglia	A-Fields	Victoria	Ensign	Leman BH	Remaining fields	Total
Physical impact (habitat disturbance)										
Accommodation works vessel – spud cans -1	0.0630	0.0394	0.0013	*0.0001*	0	0	0	0	*0.0049*	*0.1087*
Platform removal – Cutting of piles [2]	0.0087	0.0096	0.0096	*0.0100*	0.023	0.0027	0.004	<0.0001	*0.0379*	*0.0959*
Heavy lift vessel anchors [3]	0.012	0.0180	0	0.0200	0.24	0	0.161	0.400	*0.0570*	*0.908*
Removal of subsea infrastructure (excluding pipelines) [4]	-	0.0037	0.0025	0.0060	0.001	0.0248	0	0	*unknown*	*0.038*
Cutting and removal of pipeline ends [5]			0.0013	0.003	0.105	0.0052	0.007	0	*0.0064*	*0.1279*
Well abandonment – spud cans [6]	0.047	0.0029	0.0253	0.001	0.001	0.0001	0.0006	0	*0.0483*	*0.1262*
Well abandonment –anchors and chains [7]	0.0192	0.0120	-	*0.001*	0.004	0	0.002	0	*0.1968*	*0.2388*
Removal of conductors [8]	0.0001	0.0001	0.0002	-	0.0001	0	0.0001	0	*unknown*	*0.0006*
Over-trawl [9]	17.2	18.9	0	5.59	25.65	0	0	0	*42.84*	*110.18*
Estimated total physical impact (km^2) = 111.82										

Italics represent figures that have been calculated based on the assumptions listed below. Other, non-italic, figures have been obtained from the relevant decommissioning plans.

1. Assumes area of impact from spud cans of 120 m^2 at each installation (Chrysaor 2020a).
2. Assumes area of impact from cutting piles of 154 m^2 and an average of six piles at each installation (ConocoPhillips 2018a, BEIS 2019, Chrysaor 2020a).
3. Assumes 8 anchors and chains impacting 750 m of seabed and worst-case scenario of two movements at each installation, i.e. 1,500 m^2 (ConocoPhillips 2018a).
4. The number of subsea structures are unknown.
5. Assumed to be same area as rock placement across pipeline ends of 22 m^2 (Chrysaor 2020a). 29 pipelines not accounted for in decommissioning plans all presumed to be wholly within SAC, i.e. two cut ends for each pipelines.
6. Assumes drill rig spud can for well abandonment of 589 m^2 (Chrysaor 2020a) and two rig movements at each installation (BEIS 2019).
7. Assumes anchor and chain impacts of 2,400 m^2 at each installation (Chrysaor 2020a) and two rig movements at each installation (BEIS 2019).
8. The number of wells to be decommissioned and therefore the number of conductors to be removed is unknown.
9. Assumes over-trawl surveys will occur along a 200 m corridor for the entire length of pipelines and a 500 m radius around each installation.

Table 44: Estimated in-combination habitat loss from existing infrastructure and decommissioning all existing oil and gas infrastructure within the NNSSR SAC.

Activity	VDP1 and LDP1	VDP2 and VDP3	LOGGS LDP2 to 5	Anglia	A-Fields	Victoria	Ensign	Leman BH	41 Remaining fields	Total
Loss of habitat										
Accommodation works vessel – rock stabilisation [1]	0.0510	0.0432	0.0138	0.002	0	0	0	0	*0.0902*	*0.2002*
Rock at pipeline ends [2]	0.0002	0.0004	0.0002	*0.0001*	0	0	0	0	*0.0079*	*0.0088*
Jack-up well abandonment rock stabilisation [3]	0.0032	0.0020	0.0072	0.002	0	0	0	0	*0.0302*	*0.0446*
Free-spans [4]	0.0002	0.0004	0.0005	0.0009	0	0	-	0	*unknown*	*0.002*
Exposed existing pipelines [5]	0.0498	0.2001	0.1500	*0.0218*	0	0.0006	0	0	*0.6570*	*1.0797*
Existing rock [6]	-	-	-	-	0.007	0	0.001	-	0.0714	*0.0794*
Existing installations [7]	-	-	-	-	-	-	-	-	0.0410	*0.0410*
Total loss of habitat (km^2) = 1.4557										

Italics represent figures that have been calculated based on the assumptions listed below. Other, non-italic, figures have been obtained from the relevant decommissioning plans.

1 - Assumes area of impact from rock placement required for AWV stabilisation of 1,100 m^2 at each installation (Chrysaor 2020a) and includes re-distribution of rock for rig stabilisation

2 - Assumed to be 22 m^2 at each end of pipeline (Chrysaor 2020a).

3 - Assumed to be 400 m^2 (ConocoPhillips 2017) and two rig movements at each location (BEIS 2019).

4 - The requirement of future rock dump along existing pipelines is unknown.

5 - Estimated based on 9.1% of pipelines being exposed and impacting 10 m corridor (Chrysaor 2020b).

6 – blank cells are either because the existing rock is already accounted for in exposed pipeline assessment or the amount is unknown

7 – Figure is an estimate based on jacket size of existing installations and not footprint from installation legs (See Para. 10.11).

13.15 There is potential for an in-combination impact with current aggregate extraction in areas 483 and 484 (Figure 15). Assuming that aggregate extraction occurs across the whole of each site, a total of 45.4 km^2 of the SAC will be physically impacted and habitat lost. Subject to conditions the extraction of aggregates at 483 and 484 will not cause an adverse effect on the integrity of the site (MMO 2015b).

13.16 There is potential for an in-combination impact with the proposed export cable for the Hornsea 3 offshore wind farm. It is estimated that a total area of 4.1 km^2 of sandbank habitat within the SAC will be physically impacted by activities associated with the trenching and burying of the cables. An additional 0.4 km^2 of sandbank features will be physically lost due to the placement of cable protection along the surface of the seabed.

13.17 Other activities being undertaken within the SAC that could cause an in-combination impact include fishing. Fishing intensity within the SAC is estimated to impact on 1,312 km^2 of seabed each year. This annual impact on the seabed is significantly greater than that predicted to be caused by all the oil and gas decommissioning over-trawl surveys that may be undertaken within the SAC (based on previously submitted environmental assessments supporting decommissioning programmes). The predicted level of over-trawl surveys is likely to be within the annual range of current fishing activity within the SAC and are not predicted to contribute to an in-combination impact that would cause a likely significant or adverse effect.

13.18 The overall area of seabed estimated to be physically impacted within the SAC from existing or planned activities is 1,428 km^2, of which the estimated area of seabed disturbance of 0.0799 km^2 by proposed decommissioning of LOGGS LDP2 LDP5, contributes 0.005% of the total area of seabed disturbed (Table 45 and Table 22).

13.19 The overall area of seabed estimated to be physically lost within the SAC from existing or planned activities is 47.00 km^2, of which the proposed decommissioning of LOGGS LDP1 to LDP5 contributes 0.1717 km^2; 0.08% of the total (Table 45 and Table 23).

Table 45: Total estimated in-combination impacts within North Norfolk Sandbanks and Saturn Reef SAC

Activity	Total area of physical impact (km^2)	Total area of seabed physically lost (km^2)
Aggregate Extraction	-	45.4
Beam Trawling (annual)	1,312	-
Renewables	4.1	0.4
Existing gas pipelines and umbilicals	-	1.0797
Existing rock and other deposits (2011 to 2016)	-	0.0794
Existing installations	-	0.0410
Past, current and future decommissioning	111.83	0.2556
Total	**1,428**	**47.00**
% of NNSSR SAC	39.63	1.30

13.20 The physical impact to the seabed is a temporary impact and it is predicted that the seabed will recover following cessation of the activities that cause the physical impacts to the seabed. The proportion of the in-combination impact that is attributable to the proposed decommissioning activities is relatively very small and once decommissioning is completed, no further on-going impacts are likely to occur. Consequently, there will not be an on-going in-combination adverse effect from physical impacts arising from the proposed LOGGS LDP2 to LDP5 decommissioning.

13.21 The proposed LOGGS LDP2 to LDP5 activities may cause the loss of 0.005% of the SAC. However, this is largely due to the leaving of the existing pipelines *in situ*, which are predominantly buried and therefore do not cause a physical loss of habitat. The loss of habitat is predicted to be permanent but is a very small proportion of the total Annex 1 habitat within the site. Furthermore, the physical presence will not cause significant changes to the hydrodynamic regime that maintains the sandbank features as these are influenced by large scale Coriolis forces and tidal currents (Collins *et al*. 1995, ABPmer 2005) and these will not be significantly affected by the relatively small scale physical presence of oil and gas infrastructure and associated deposits, much of which is buried below the seabed.

13.22 No *Sabellaria* reef habitat have been located during surveys for the LOGGS LDP2 to LDP5 decommissioning programmes. Consequently, no in-combination impact on *Sabellaria* reef habitats will arise with current or future activities. It is not known whether *Sabellaria* reef habitat will be found during future decommissioning programmes. These will be subject to their own assessments at the time decommissioning programmes are submitted.

Conclusion

13.23 The potential impacts from the proposed decommissioning activities within the North Norfolk Sandbanks and Saturn Reef SAC in-combination with other plans or projects, including existing infrastructure, will cause physical impacts and a loss of habitat within the SAC. However, the extent of potential habitat loss and physical impact is estimated to be relatively small compared to the extent of habitat within the SAC and the level of impact caused by other activities currently being undertaken within the SAC.

13.24 Evidence from surveys shows that any physical impacts to the sandbank features and their communities will be temporary and the habitat will recover once the impact has ceased. Permanent impacts will cause a loss of habitat but the impacts will be localised and not affect the hydrography such that it will affect the maintenance of the sandbank features.

13.25 Based on the best available information BEIS is satisfied that the planned decommissioning activities will not have an adverse effect upon the integrity of the North Norfolk Sandbanks and Saturn Reef SAC in-combination with other plans or projects.

In-combination impacts on Southern North Sea SAC

Impacts from noise on harbour porpoise

13.26 Shipping has been on-going in the southern North Sea for many hundreds of years and the area is important for shipping, with relatively high numbers of vessels occurring within it. Based on vessel track lines, in 2013 a total of 93,291 vessels were recorded transiting across the SAC; an average of 256 vessels per day (MMO 2016).

13.27 The oil and gas industry has used, and will continue to use, vessels in support of the vast majority of offshore activity, from initial exploration through to final decommissioning. Vessels are extensively used during construction and maintenance, with supply vessels supporting operating platforms and safety vessels permanently present in development areas. A total of 19,976 vessels associated with oil and gas industry were recorded crossing the SAC in 2013 (MMO 2016); an average of 55 vessels per day. Oil and gas related vessel traffic accounts for 21.4% of all vessel traffic within the site.

13.28 Vessel movements are the largest contributor to anthropogenic ocean noise and in deeper water are the dominant noise source in the lower frequencies, between 50-300 Hz (Ulrick 1967). Measurements undertaken in the Southern North Sea indicate that shipping noise is the dominant anthropogenic noise in the region predominantly in the frequency range of between 40 and 200 Hz (de Haan *et al.* 2007). In general, vessels that use dynamic positioning thrusters tend to generate higher levels of underwater sound. The individual noise output produced by a vessel is dependent upon a number of factors including the speed of the vessel, age, load, maintenance and oceanographic conditions.

13.29 The additional use of up to eight vessels during decommissioning contributes a very small proportion of the total vessel activity within the SAC. The extensive vessel activity, including that associated with the oil and gas industry, within and adjacent to the SAC over many years has not had a measurable negative effect on the current conservation status of harbour porpoise within the site.

13.30 BEIS recognises that there are other activities within the Southern North Sea SAC that could cause an in-combination impact, e.g. offshore renewable, fishing, dredging and geophysical surveys. Impacts from these activities include noise from pile-driving, the clearance of unexploded ordnance and seismic airguns. The relatively very small area of potential impact arising from the proposed decommissioning activities will not contribute substantially to the overall impacts within the SAC and will not cause an in-combination impact that will have an adverse effect on site integrity

Conclusion

13.31 Levels of oil and gas vessel activity within the SAC associated with decommissioning activities are not predicted to be significantly greater than current levels of shipping within the SAC and therefore levels of potential disturbance are also not predicted to significantly increase. As decommissioning progresses in future years, the number of vessels associated with the oil and gas industry will reduce. It is therefore concluded that the in-combination impacts from vessel noise or seabed disturbance will not have an adverse effect upon the integrity of the Southern North Sea SAC alone or in-combination.

14 APPROPRIATE ASSESSMENT - CONCLUSIONS

14.1 BEIS has undertaken a Habitats Regulations Assessment in respect of the Conservation Objectives of relevant national sites to determine whether the proposed Decommissioning programmes for LOGGS LDP2 to LDP5 either alone or in combination with other plans and projects will have an adverse effect upon the integrity of the relevant sites. In this case the North Norfolk Sandbanks and Saturn Reef SAC and the Southern North Sea SAC.

14.2 Based on the potential work programme and predicted scale of impacts, along with evidence from existing studies of the likely potential effects on the qualifying features, it is concluded that the planned activities will not cause a likely significant effect on any qualifying features connected with the designated site either alone or in-combination with other plans or projects. It will therefore not have an adverse effect on the integrity of any relevant designated site.

14.3 Having concluded that there will be no likely significant effect and no adverse effect on the integrity of any site no further assessment is required.

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16 Appendix A – Gas Pipelines in NNSSR SAC.

Source: UKoilandgas 2018.

Pipeline No.	Name	Trenched	Length in NNSSR SAC (km)
PL1635	Bure West to Thames 8” gas line	N	1.928
PL1690	NW Bell ZX to Callisto ZM 8” gas line	N	0.078
PL2355	Wenlock gas export Spool Piece	N	0.060
PL2355	Wenlock Gas pipeline	N	28.621
PL2066	Annabel to Audrey A 10” gas export	N	13.247
PL1091	Callisto ZM to Ganymede ZD 12” gas line	N	14.132
PL1095	Victor JM to Victor JD 12” gas line	N	5.151
PL91	Viking BD to Viking ED 12” gas line	N	11.895
PL92	Viking BD to Viking GD 12” gas line	N	5.139
PL2107	Saturn 14” gas export line	N	26.661
PL994	Galleon PN to Clipper PM 12/14” gas line	N	1.051
PL1093	Ganymede ZD to LOGGS PR 18” gas line	N	19.129
PL1610	Corvette A to Leman A 20” gas line	N	23.668
PL496	Audrey WD to LOGGS PP 20” gas line	N	16.521
PL253	Esmond to Bacton 24” gas export Line	N	24.431
PL1705	NW Bell to Bess E 6” Gas Production Pipeline	Y	6.399
PL371	Bure O Wellhead to Thames 8” gas line	Y	0.253
PL575	Audrey WM to Audrey WD 8” gas line	Y	0.430
PL954	Anglia YD to Anglia YM 8” gas line	Y	2.104
PL456/PL457	Vanguard QD to LOGGS PP 10” gas line	Y	7.496
PL460/PL461	South Valiant TD to LOGGS PP 10” gas line	Y	10.625
PL470/PL471	North Valiant SP to LOGGS PP 10” gas line	Y	4.304
PL1767	Vixen VM to Viking BD 12” gas line	Y	8.474
PL1962	Viscount VO to Vampire OD 12” gas line	Y	11.307
PL462/PL463	Vulcan UR to Vulcan RD 12” gas line	Y	3.679
PL624	Former Camelot gas export line	Y	7.123
PL854	LOGGS PP to Anglia YD 12” gas line	Y	23.523
PL89	Viking BD to Viking CD 12” gas line	Y	3.899
PL90	Viking BD to Viking DD 12” gas line	Y	4.108
PL93	Viking BD to Viking HD 12” gas line	Y	5.549
PL947	Ann XM to LOGGS PR 12” gas line	Y	30.181
PL1692	Vampire OD to LOGGS PR 12” gas line	Y	9.191
PL1694	Europa EZ to PL1091 TEE 12” gas line	Y	4.539
PL364	Leman G to Leman F 14” gas line	Y	2.708
PL723	Audrey XW to Audrey WD 14” gas line	Y	4.317

Pipeline No.	Name	Trenched	Length in NNSSR SAC (km)
PL1571	Viking KD to Viking BD 16” gas line	Y	13.436
PL1572	Viking LD to PL1571 TEE 16” gas line	Y	0.047
PL211	Victor JD to Viking BD 16” gas line	Y	13.451
PL458/PL459	Vulcan RD to LOGGS PP 18” gas line	Y	16.055
PL102	Leman E to Leman BP 20” gas line	Y	3.019
PL106	Leman 49/27 BP to 49/27 AP 20” gas internal field line	Y	3.141
PL107	Leman 49/27 CP TP 49/27 AP 20” gas internal field line	Y	3.411
PL108	Leman 49/27 EP TP 49/27 AP 20” gas internal field line	Y	1.671
PL110	Leman 49/27 FP 49/27 BT 20” gas internal field line	Y	2.050
PL206	Leman 49/27 H to 49/27 AC 20” gas internal field line	Y	5.929
PL363	Leman F to Leman AK 20” gas line	Y	4.776
PL100	Leman D to Leman BT 24” gas line	Y	8.011
PL251	Leman 49/27 G to 49/27 BT 24” gas internal field line	Y	6.257
PL370	Bacton to Thames 24” gas export	Y	33.982
PL632	Clipper PT to Bacton 24” gas line	Y	24.817
PL88	Viking AR to Viking BP 24” gas line	Y	10.964
PL98	Leman BP to Leman BT 24” gas line	Y	0.623
PL99	Leman CP to Leman BT 24” gas line	Y	2.091
PL27	Viking AR to Theddlethorpe 28” gas line	Y	24.516
PL101	Leman BT (Perenco) to Leman BT (Shell) 30” gas line	Y	7.771
PL109	Leman 49/27 BT to 49/27 DP 30” gas internal field line	Y	4.847
PL22	Indefatigable JOINT 49/23 AT to 49/27 BT 30” gas line	Y	21.541
PL23	Leman 49/27 AP to Bacton A1 30” gas line	Y	10.842
PL24	Leman BT to Bacton A2 30” gas line	Y	8.250
PL25	Leman AP to Bacton 30” gas line	Y	9.129
PL29	Leman 49/26-BT to Bacton 30” gas line	Y	9.999
PL311	Sean PP to Bacton 30” gas line	Y	5.544
PL97	Leman BT to Leman AP 30” gas line	Y	3.501
PL454	LOGGS PP to Theddlethorpe 36” gas line	Y	26.546
PL2810	12” Gas Pipeline from Clipper South Victor to LOGGS	Y	15.156
-	Viking Bravo to Victoria subsea well	Y	3.371
PL3027	8” Gas Leman 53/02-14A to Leman 27A	Y	8.771
PL2838	Ensign NPAI to Audrey WD gas export	Y	21.910
PL2841	Ensign Subsea Well 48/14-ED to Ensign NPAI	Y	1.837
PL2643	Viking to LOGGS gas export pipeline	Y	27.290

17 Appendix B – Gas Pipelines in Southern North Sea SAC.

Source: UKoilandgas 2018.

Pipeline No.	Name	Trenched	Length in SNS SAC
-	Cutter to Carrack	Y	5.35
-	Annabel Wells 1 & 2 to Annabel Manifold	Y	0.13
PL020	Hewett Southern Export A-Line to Bacton	Y	4.78
PL021	Hewett Northern Export B-Line to Bacton	Y	5.04
PL083	52/5a to 48/29ftp gas export	Y	4.01
PL084	48/29b to 48/29ftp gas export	Y	3.40
PL085	48/29c to 48/29ftp gas export	Y	10.42
PL086	48/30-8 and 10 to 48/29c gas export	Y	5.84
PL087	48/30-9 to 48/29ftp gas export	Y	6.20
PL100	Leman D to Leman BT	Y	8.01
PL101	Leman BT (Perenco) to Leman BT (Shell)	Y	7.77
PL102	Leman E to Leman BP	Y	3.03
PL1053/PL1054	Davy to Inde-AT	Y	15.68
PL106	Leman 49/27 BP to 49/27 AP	Y	3.14
PL107	Leman 49/27 CP TP 49/27 AP	Y	3.41
PL108	Leman 49/27 EP TP 49/27 AP	Y	1.67
PL109	Leman 49/27 BT to 49/27 DP	Y	4.87
PL1093	Ganymede ZD to LOGGS PR gas line	Y	18.91
PL110	Leman 49/27 FP 49/27 BT	Y	2.06
PL1169	Barque PL to Clipper PM	Y	15.43
PL1171	Newsham to West Sole	Y	5.76
PL1173	48/29-9 to 48/29c gas export	Y	1.59
PL1177	48/30-14 to 48/29c gas export	Y	5.85
PL1220/PL1221	Tyne to Trent	Y	55.80
PL1220X	Tyne to Trent	Y	0.02
PL1222	Schooner to Murdoch gas line	Y	0.34
PL1339	Bacton to Zeebruge	Y	156.07
PL1436	Murdoch MD to Boulton BM gas line	Y	11.36
PL145	West Sole to Easington 24in gas line	N	11.55
PL150	Rough 47/3b Import/Export	N	13.02
PL151	Rough 47/8a Export	N	2.19
PL1561	Galleon PG to Clipper PM Gas	Y	8.77
PL1570	Shearwater to Bacton (SEAL)	N	209.93
PL1571	Viking KD to Viking BD gas line	Y	13.43
PL1572	Viking LD to PL1571 Tee	Y	0.05

Pipeline No.	Name	Trenched	Length in SNS SAC
PL1610	Corvette A to Leman A	Y	5.69
PL1612	Ketch to Murdoch gas line	Y	0.28
PL1630	48/30-16 to Della PLEM gas export	Y	0.24
PL1637	Thurne to Thames RA gas export	Y	0.29
PL1684	Neptune to Cleeton pipeline	Y	6.91
PL1692	Vampire OD to LOGGS PR gas line	N	9.23
PL1707	Mercury to Neptune	Y	13.08
PL1708	Neptune to Mercury	Y	13.13
PL1724	Skiff to Clipper PM	Y	10.51
PL1767	Vixen VM to Viking BD gas line	Y	8.47
PL1871	North Davy to Davy	Y	10.28
PL1875	Hoton Pipeline	Y	11.82
PL1922	Hawksley EM to Murdoch MD gas line	Y	21.55
PL1923	Murdoch K KM to Murdoch MD gas line	Y	0.24
PL1924	Boulton H HM to Murdoch MD gas line	Y	0.15
PL1928	Whittle to Cleeton	Y	14.87
PL1929	Wollaston to Whittle	Y	3.24
PL1932	M5 to Minerva	Y	4.65
PL1933	M1 to Minerva	Y	3.54
PL1934	Minerva to Cleeton gas export	Y	13.27
PL1937	Apollo to Minerva	Y	6.34
PL1962	Viscount VO to Vampire OD gas line	Y	11.31
PL2047	Arthur to Thames	Y	28.61
PL2047JP1	Arthur P1 to Arthur Manifold	Y	0.05
PL2047JP2	Arthur Well 2 to Arthur Manifold	Y	3.21
PL2047JP3	Arthur Well 3 to Arthur Manifold	Y	0.05
PL206	Leman 49/27 H to 49/27 AC	Y	5.97
PL2066	Annabel to Audrey A	Y	17.82
PL2071	Langeled Pipeline	Y	58.21
PL2080	Horne And Wren Export Pipeline	Y	19.86
PL2105	JFE Production	Y	6.73
PL2107	Saturn ND to LOGGS PR	Y	39.33
PL2109	Murno MH to Hawksley EM	Y	4.94
PL211	Victor JD to Viking BD gas line	Y	3.95
PL2137	Hunter Export to Murdoch K	Y	1.16
PL2160	Garrow to Kilmar export spool	Y	22.20
PL2160	Garrow export spool	Y	0.04
PL2162	Kilmar to Kilmar gas export spool	Y	0.05

Pipeline No.	Name	Trenched	Length in SNS SAC
PL2162	Kilmar to Trent gas export spool	Y	0.05
PL2162	Kilmar gas export	Y	21.14
PL22	Indefatigable Joint 49/23 At to 49/27 BT	Y	6.32
PL2225	BBL Balgzand to Bacton	Y	122.03
PL2234	Tethys to Saturn Tee	Y	3.76
PL2236	Mimas to Saturn	Y	9.82
PL2284	Cavendish export pipeline	Y	47.17
PL23	Leman 49/27 AP to Bacton A1	Y	35.78
PL2344	Davy Host to Davy East Gas	Y	5.71
PL2355	Wenlock gas pipeline	Y	16.33
PL2355	Wenlock gas export spool piece	Y	0.06
PL24	Leman BT to Bacton A2	Y	64.87
PL2430	12in Prod. Kelvin to Murdoch	Y	12.43
PL2441	Davy A to Tristan NW	Y	14.89
PL2491	53/4d-11 to Thames AR gas export	Y	10.45
PL2491	Wissey Gas Production	Y	10.45
PL25	Leman AP to Bacton	Y	29.35
PL2501	Johnston J5 Export	Y	0.03
PL251	Leman 49/27 G to 49/27 BT	Y	6.27
PL2526	Lx1 Well to Viking Bravo	Y	3.79
PL2528	Rita to Hunter Export	Y	14.09
PL253	Esmond to Bacton	Y	134.31
PL255	Esmond to Forbes	Y	11.37
PL258	Esmond to Gordon	Y	34.74
PL2595	Ceres to Mercury Export	Y	3.26
PL2597	Eris to Mercury Export	Y	3.26
PL26	Easington to Rough 47/3b	Y	14.16
PL261	Esmond to Forbes	Y	11.37
PL2612	Babbage Export	Y	27.88
PL264	Esmond to Gordon BHP	Y	34.74
PL2641	Seven Seas - Newsham gas export	Y	7.99
PL2643	Viking to LOGGS gas export	Y	27.36
PL27	Viking AR to Theddlethorpe gas line	Y	41.61
PL28	West Sole to Easington 16in gas line	N	15.03
PL2810	Clipper South to LOGGS Gas Pipeline	Y	15.15
PL2838	Ensign NPAI to Audrey WD gas export	Y	21.91
PL2841	Ensign Production Pipeline	Y	1.84
PL2894	Katy to Kelvin gas export pipeline	Y	11.94

Pipeline No.	Name	Trenched	Length in SNS SAC
PL29	Leman 49/26-BT to Bacton	Y	33.99
PL2917	York production pipeline	Y	15.02
PL3005	Hunter to Murdoch K Export Pl3005	Y	1.08
PL3027	8in Gas Leman 53/02-14a to Leman 27a	Y	9.18
PL3027A	Leman SW Spoolpiece	Y	0.09
PL3086	Cygnus A to Cygnus B Gas Pipeline	Y	7.28
PL3088	Cygnus to ETS Gas Pipeline	Y	50.11
PL311	Sean PP to Bacton	Y	82.50
PL363	Leman F to Leman AK	Y	4.82
PL364	Leman G to Leman F	Y	2.74
PL370	Bacton to Thames	Y	33.02
PL372	Yare to Thames	Y	4.12
PL446	48/30-10 to 48/30-8 gas export	Y	0.01
PL447	Cleeton CP to Dimlington	Y	40.22
PL448	Cleeton CP to Ravenspurn A	Y	20.68
PL450	Ravenspurn B Spur	Y	0.07
PL451	Ravenspurn C Spur	Y	0.07
PL454	LOGGS PP to Theddlethorpe gas line	Y	19.15
PL456/PL457	Vanguard QD to LOGGS PP gas line	Y	7.49
PL458/PL459	Vulcan RD to LOGGS PP gas line	Y	16.05
PL460/PL461	South Valiant TD to LOGGS PP gas line	Y	10.62
PL462/PL463	Vulcan UR to Vulcan RD gas line	Y	3.68
PL470/PL471	North Valiant SP to LOGGS	Y	4.30
PL496	Audrey WD to LOGGS PP gas line	Y	16.52
PL575	Audrey WM to Audrey WD	Y	0.43
PL584	48/30-11 to 48/29a-P gas export	Y	9.18
PL624	Camelot CA gas export to Leman 27a	Y	14.70
PL632	Clipper PT to Bacton	Y	9.58
PL633	Barque PB to Clipper PT	Y	24.43
PL669	Ravenspurn North Export Line	Y	25.51
PL670	Ravenspurn North St-2 Infield	Y	5.94
PL674	Welland to Thames	Y	15.20
PL676	Welland 3 to Welland	Y	7.69
PL677	Welland 4 to Welland	Y	5.52
PL678	Welland 2 to Welland	Y	3.91
PL723	Audrey XW to Audrey WD gas line	Y	4.32
PL729/PL730	Ravenspurn North ST3 to RNCP	Y	13.70
PL854	LOGGS PP to Anglia YD gas line	N	17.60

Pipeline No.	Name	Trenched	Length in SNS SAC
PL876	Lancelot to Bacton	N	1.53
PL878	53/2-B to Pl-624 Tee	Y	1.25
PL88	Viking AR to Viking BP gas line	Y	10.96
PL89	Viking BD to Viking CD gas line	Y	3.00
PL90	Viking BD to Viking DD gas line	Y	3.41
PL91	Viking BD to Viking ED gas line	Y	11.89
PL92	Viking BD to Viking GD gas line	Y	5.14
PL929	Theddlethorpe to Murdoch Md	Y	78.21
PL93	Viking BD to Viking HD gas line	Y	5.55
PL931	Orwell to Thames RA	Y	23.82
PL935	Murdoch MD to Caister CM gas line	Y	0.23
PL937	Hyde to West Sole Bravo	Y	11.50
PL94	West Sole WB to West Sole WC	Y	4.52
PL947	Ann XM to LOGGS PR	Y	39.56
PL95	West Sole E to West Sole B	Y	1.50
PL97	Leman BT to Leman AP	Y	3.50
PL98	Leman BP to Leman BT	Y	0.62
PL989	Johnston Export	Y	9.34
PL99	Leman CP to Leman BT	Y	2.09
PL994	Galleon PN to Clipper PM	Y	12.28

18 Appendix C – Surface Installations in NNSSR SAC.

Source: UKoilandgas 2018.

Installation		
Andrea 48/15B – Lighted Buoy	Leman BD (Perenco)	LOGGS Riser
Anglia A	Leman BH	North Valiant 1
Anglia YD	Leman BP (Perenco)	North Valiant 2
Audrey A (WD)	Leman BP (Shell)	South Valiant
Audrey B (XW)	Leman BT (Perenco)	Vampire
Audrey 1 WD	Leman BT (Shell)	Vanguard
Audrey XW 2	Leman CD (Perenco)	Victor Juliet Drilling
Buoy H: KFB 07/2002	Leman CD (Shell)	Viking A Riser
Clipper South	Leman CP (Perenco)	Viking B Accommodation
Ensign	Leman CP (Shell)	Viking B Compression
Ensign Victor	Leman D	Viking B Drilling
Europa	Leman DD	Viking B Production
Galleon PN	Leman DP	Viking C Drilling
Ganymede ZD	Leman E	Viking D Drilling
Indefatigable Banks: KFB	Leman ED	Viking ED
Jupiter	Leman EP	Viking G Drilling
Leman AC	Leman F	Viking H Drilling
Leman AD	Leman FD	Viking K Drilling
Leman AD1	Leman FP	Viking L Drilling
Leman AD2	Leman G (Perenco)	Viscount
Leman AK	Leman G (Shell)	Vulcan 1
Leman AP (Perenco)	Leman H	Vulcan 2
Leman AP (Shell)	Leman J	Wenlock NUI
Leman AQ	LOGGS Accommodation	
Leman AX	LOGGS Compression	
Leman BD (Shell)	LOGGS Production	

Those greyed out have been decommissioned and removed

19 Appendix D – Surface Installations in Southern North Sea SAC

Source: UKoilandgas 2018.

Installation		
Audrey 1 WD	Leman AD	North Valiant 2
Audrey A (WD)	Leman AD1	Ravenspurn North CC
Audrey B (XW)	Leman AD2	Ravenspurn North CCW
Audrey XW 2	Leman AK	Ravenspurn North ST2
Babbage	Leman AP (Perenco)	Ravenspurn North ST3
Barque PB	Leman AP (Shell)	Ravenspurn South A
Barque PL	Leman AQ	Ravenspurn South B
Boulton	Leman AX	Ravenspurn South C
Camelot CA	Leman BD (Perenco)	Rough AD
Camelot CB	Leman BD (Shell)	Rough AP
Cavendish	Leman BH	Rough BD
Cleeton CC	Leman BP (Perenco)	Rough BP
Cleeton PQ	Leman BP (Shell)	Rough CD
Cleeton WLTR	Leman BT (Perenco)	Skiff
Clipper PC	Leman BT (Shell)	South Valiant
Clipper PH	Leman CD (Perenco)	Tethys 49/11b
Clipper PM	Leman CD (Shell)	Trent
Clipper PR	Leman CP (Perenco)	Tyne
Clipper PT	Leman CP (Shell)	Vampire
Clipper PW	Leman D	Vanguard
Clipper South	Leman DD	Viking Alpha Riser
Cutter	Leman DP	Viking B Accommodation
Cygnus A (APU)	Leman E	Viking B Compression
Cygnus A (AQU)	Leman ED	Viking B Drilling
Cygnus A (AWHP)	Leman Ep	Viking B Production
Cygnus B (BWHP)	Leman F	Viking E Drilling
Davy A	Leman FD	Viking G Drilling
Ensign	Leman FP	Viking H Drilling
Ensign Platform	Leman G (Perenco)	Viking K Drilling
Frigate Extension	Leman G (Shell)	Viking L Drilling
Galleon PG	Leman H	Viscount
Galleon PN	Leman J	Vulcan 1
Garrow NUI	LOGGS Accommodation	Vulcan 2
Hewett 48/29a-FTP	LOGGS Compression	Welland
Hewett 48/29a-P	LOGGS Production	Wenlock NUI
Hewett48/29a-Q	LOGGS Riser	West Sole A
Hewett 48/29c	Mimas MN	West Sole A
Hewett 52/5a	Mimas 48/9a	West Sole B
Horne And Wren Platform	Minerva	West Sole C
Hoton	Munro MH	West Sole PP
Hyde	Murdoch Accommodation	West Sole SP
Kelvin TM 44/23a	Murdoch Compression	York
Kilmar NUI	Murdoch Drilling	
Leman AC	Neptune	
Leman AC (Shell)	North Valiant 1	

Those greyed out have been decommissioned and removed