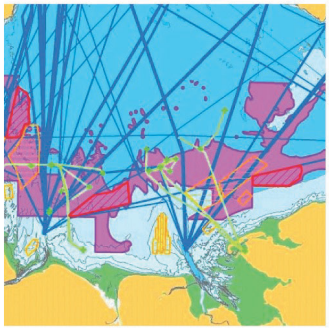
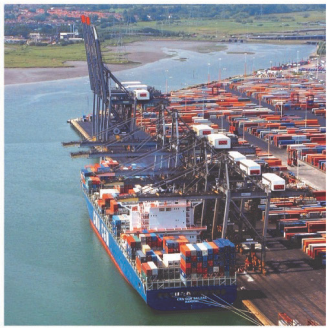
EDF Energy

Hunterston B Seaweed Removal

Environmental Appraisal

June 2017



Innovative Thinking - Sustainable Solutions

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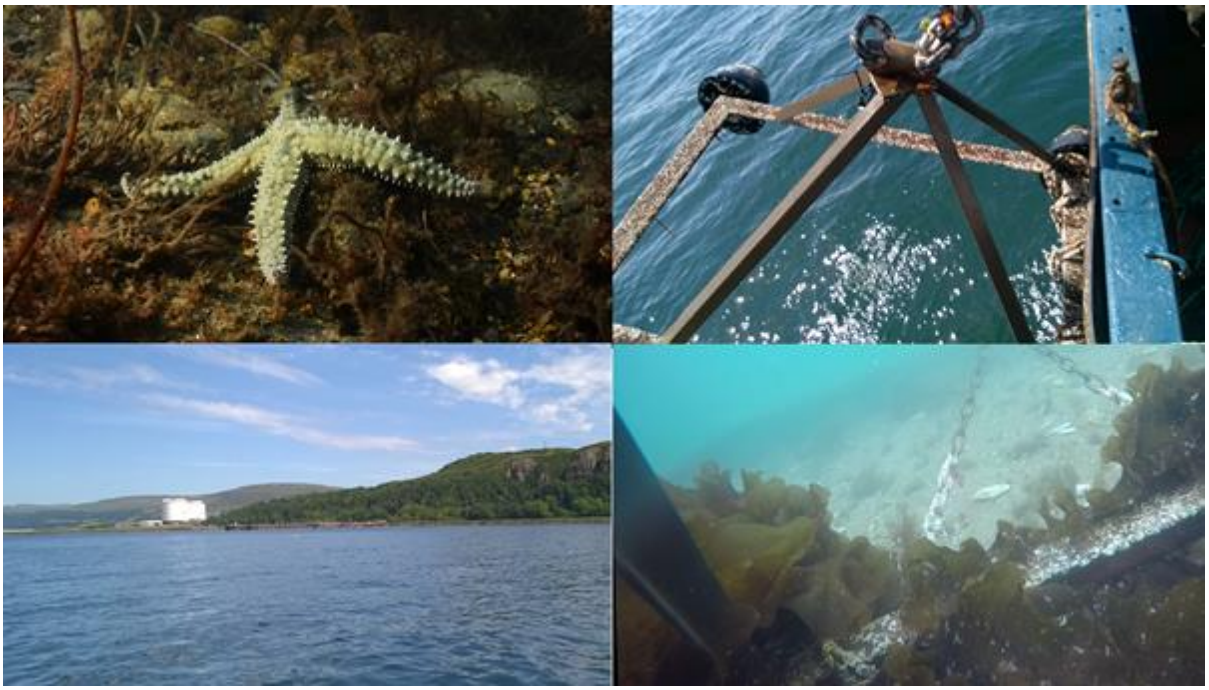

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Notice

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1 Introduction

ABPmer has been commissioned by Hunterston B Power Station, owned and operated by EDF Energy, to undertake an environmental appraisal of the potential marine environmental effects of seaweed clearance from the vicinity of its cooling water intake. This information will support a marine licence application for seaweed clearance that will be submitted to Marine Scotland as part of the marine licensing process.

Hunterston B Power Station utilises the sea as a source of cooling water for plant systems. The cooling water enters the station by passing through a coarse screen located at the cooling water intake. On a number of occasions, the station has experienced high levels of seaweed ingress onto the cooling water intake screens. The high levels of impingement have reduced water flow through the screens requiring the station to reduce energy generation. The station undertook a limited programme of seaweed clearance in 2016 from within the vicinity of the cooling water intake with the approval of Marine Scotland. This is considered to have led to a subsequent reduction in seaweed impingement. The station therefore proposes to undertake similar works in 2017.

A teleconference between EDF Hunterston, ABPmer and Marine Scotland on 19 May 2017 confirmed that the works did not require a formal environmental impact assessment (EIA), but that an environmental appraisal would be required to support the marine licence application. In addition, consideration would need to be given to potential impacts on Natura 2000 sites, national nature conservation marine protected areas (MPAs) and achievement of Water Framework Directive (WFD) objectives.

A voluntary environmental appraisal has therefore been prepared to provide the relevant information on potential environmental issues in support of the marine licence application.

The environmental appraisal has been structured as follows:

Section 2: **Project Description** presents details of the proposed works;

Section 3: **Consenting Framework** outlines the consenting framework against which the proposed works have been assessed;

Section 4: **Environmental Appraisal** reviews the potential effects of the proposed works on environmental receptors;

Section 5: **Habitats Regulations Appraisal (HRA) Screening Assessment** reviews the potential effects of the proposed works on designated features of European/Ramsar sites;

Section 6: **Mitigation and Monitoring Plan** highlights measures to reduce/avoid potential environmental impacts and plans to monitor the environment; and

Section 7: **Conclusions** presents a summary of the conclusions of the environmental appraisal.

2 Project Description

Hunterston B Power Station utilises the sea as a source of cooling water for plant systems. The cooling water enters the station by passing through a coarse screen located at the cooling water intake (see Figure 1 and Image 1). The design intent of the coarse screen is to minimise marine debris from entering the cooling water system.

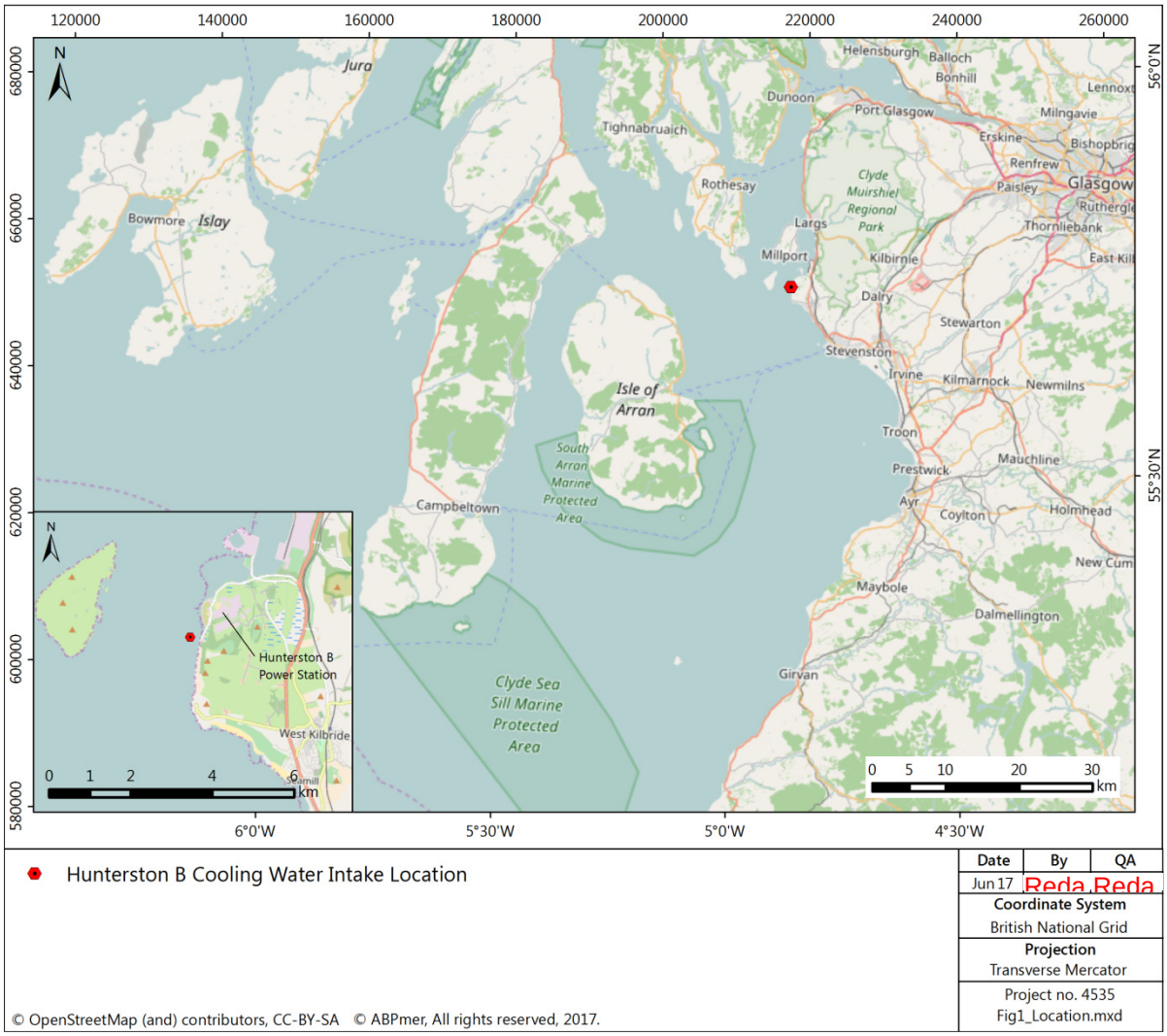


Figure 1. Location of Hunterston B Power Station and cooling water intake within the Clyde

Operational experience has shown that strong winds from the south to southwest coincident with a low tide promotes seaweed from leaving the sea floor and gathering on the coarse screen. If the coarse screen is inundated with large volumes of seaweed, the cooling water flow is reduced which challenges the operability of the plant. To mitigate, a preliminary study was undertaken in 2016 which involved assessing and reducing the seaweed growth local to the cooling water intake (see Figure 2 for 2016 seaweed reduction area). Permission for the activity was obtained from Marine Scotland. The study indicated that by reducing the local seaweed growth the amount of seaweed gathering on the coarse screen following storm conditions was significantly reduced.

Source: EDF Energy

Image 1. Hunterston B cooling water intake jetty

Hunterston B Power Station now wishes to obtain a marine licence to permit further removal of seaweed within a proposed seaweed reduction area (Figure 2), delineated by the coordinates provided in Table 1. The proposed seaweed reduction area covers a reduced spatial extent (0.64 km^2) compared to the 2016 seaweed reduction area (1.3 km^2), based on the findings of a drop-down camera survey in May 2017 (see Appendix A for details of the survey). The removal technique will consist of using a standard fishing net supplemented with a mobile chain mat were practicable, deployed from a suitable commercial fishing vessel.

Table 1. Co-ordinates of proposed seaweed reduction area

Proposed Seaweed Reduction Area Point (See Figure 2)	Co-ordinates (WGS84)	
	Latitude	Longitude
A	55°43’3794N	04°54’3132W
B	55°43’4454N	04°54’6530W
C	55°42’4260N	04°54’6918W
D	55°42’4380N	04°54’3798W

The fishing net is a standard nephrops trawl 460 meshes in circumference made with 80 mm braided netting. This is mounted on 24 m of standard 250 mm rock hoppers rigged to have minimum bottom contact to reduce the disturbance of the seabed and associated marine life. The net will have an approximate weight in the water of 400 kg. The deployment of the net involves a pair of No. 5 Bison trawl doors producing an opening net of approximately 12 to 15 m. The mobile chain mat is made of 12 m of 16 mm chain mounted in a U-shape onto a 100 mm pipe with 450 mm wheels. The mobile mat is designed to reduce ground contact and disturbance to a minimum (Image 2).

Seaweed collected during the activity will be stored on the vessel and contained within 1 tonne rubble style sacks or an open bunded 1,000 litre pallet tank. The contained seaweed would then be craned ashore and disposed of using an approved method.

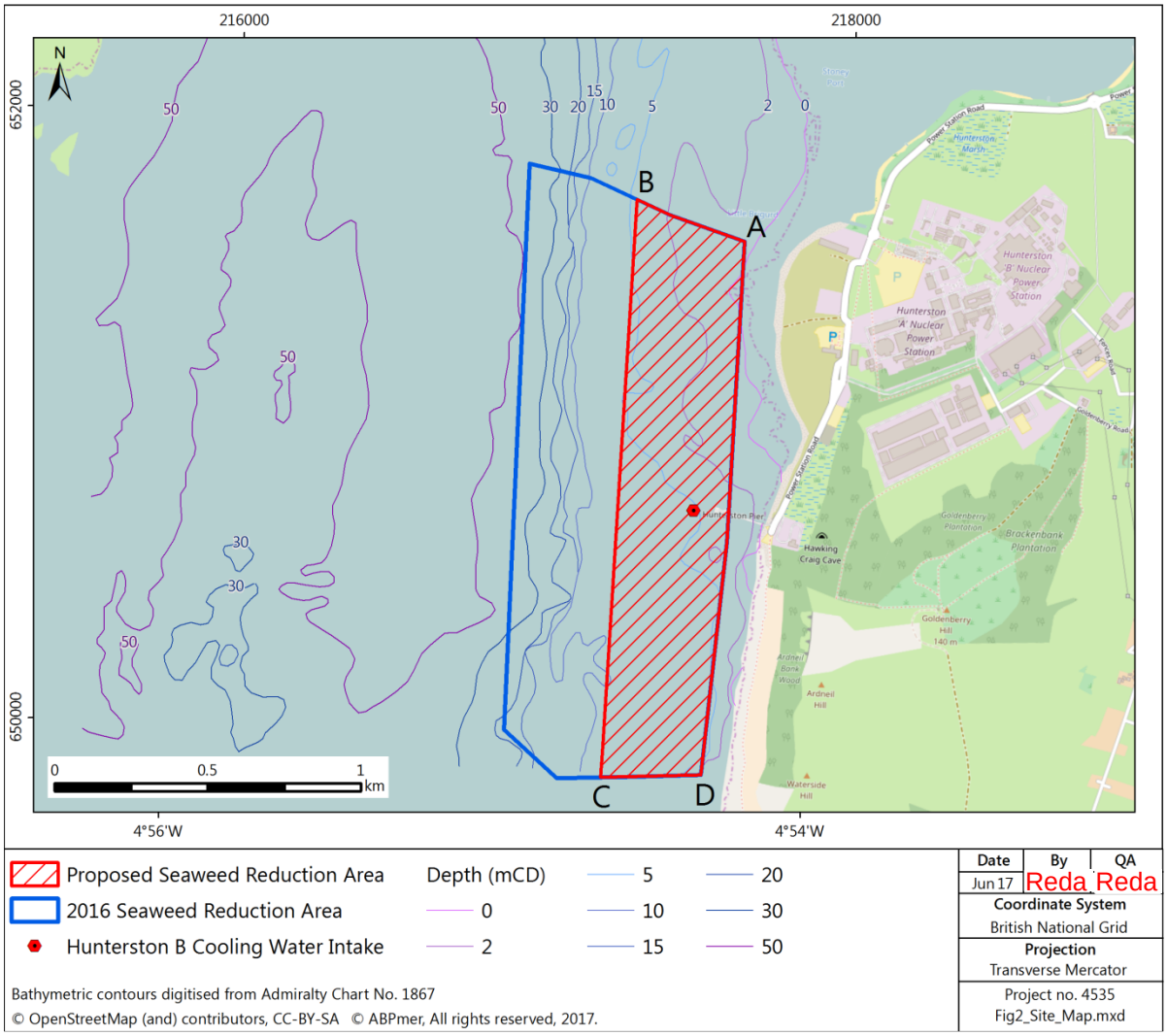


Figure 2. Proposed (and 2016) seaweed reduction area and depth contours

Source: EDF Energy

Image 2. Modified nephrops trawl (left) and mobile chain mat (right)

Hunterston B Power Station is seeking a one year marine licence for seaweed removal within the proposed seaweed reduction area, based on three discrete seaweed removal campaigns. These campaigns would be expected to take place in July/August 2017 to remove the current accumulation of seaweed, September/October 2017 in advance of the winter storms and April/May 2018 to provide

post-winter clearance. Subject to weather conditions, the working pattern for each campaign will involve up to approximately ten 12-hour working days.

Based on a drop-down camera survey in May 2017, the main species of seaweed present within the proposed seaweed reduction area is the kelp *Saccharina latissima* (formerly *Laminaria saccharina*). This is also the main type of seaweed that collects on the cooling water intake screens (Hunterston B Power Station, *pers. comm.*). Hunterston B Power Station is seeking a marine licence to remove up to a maximum of 50 tonnes wet weight of seaweed during each campaign from within the proposed seaweed reduction area, primarily comprising *S. latissima*. Therefore, this equates to a maximum of 150 tonnes wet weight of seaweed removed during the licence period.

A visual survey of the proposed seaweed reduction area would be undertaken using a drop-down camera to identify the distribution and density of seaweed before each campaign. The survey completed in May 2017 (see Appendix A) will be used to inform the first campaign. Daily monitoring of the amounts of seaweed entering the cooling water intake will also be undertaken to assess the effectiveness of the proposed works.

3 Consenting Framework

The following sections outline the consenting framework against which the proposed works have been assessed.

3.1 Marine Licence under the Marine (Scotland) Act 2010

Under the Marine (Scotland) Act 2010, Scottish Ministers are responsible for the marine licensing system and enforcement in the Scottish inshore region from 0-12 nautical miles (nm). The licensing regime allows regulation of the deposit and removal of substances and objects in the seas around Scotland. Activities must take place in accordance with licence conditions. The removal of wild seaweed constitutes 'a removal of substances/objects from the seabed' and thus requires a marine licence.

In considering an application for a marine licence, the Marine Scotland Licensing Operations Team (MS-LOT) will, as part of the process, take into account Government policy statements and guidance including the Marine Policy Statement (HM Government, 2011) and Scotland's National Marine Plan (The Scottish Government, 2015). As part of the determination process, Marine Scotland will also take account of and give consideration to the need for the following:

- Environmental Impact Assessment (EIA);
- Habitats Regulations Appraisal (HRA);
- Water Framework Directive (WFD) Assessment; and
- Marine Protected Area (MPA) Assessment.

The following sections summarise each of the above and considers whether they are likely to be required to support the marine licence application for the proposed works.

3.1.1 Environmental Impact Assessment

The Environmental Impact Assessment Directive (2011/92/EU) sets out the procedure that must be followed before approval is granted for a range of plans and projects, defined in Annexes I and II of the Directive. Annex I projects are considered to have significant effects on the environment and EIA is mandatory. The potential for significant effects on the environment as a result of Annex II projects, and thus whether an EIA is required, however, is at the discretion of the Competent Authority, in this case Marine Scotland, having regard to criteria set out in Annex III of the Directive.

Wild seaweed removal is not identified under either Annex I or Annex II of the Directive. Therefore, a formal EIA is not required. Marine Scotland has requested that an environmental appraisal is prepared to support the marine licence application (teleconference on 19 May 2017). The topics to be covered by the environmental appraisal have been indicated to include:

- Project description;
- Physical processes;
- Water and sediment quality;
- Nature conservation and aquatic ecology;
  - Benthic habitats and species;
  - Nature conservation designated sites; and
- Mitigation and monitoring plan.

3.1.2 Habitats Regulations Appraisal (HRA)

Where a project is located close to, or within, an area designated or proposed under the Birds[1] and/or Habitats Directives[2] (European sites) and/or the Ramsar Convention[3] (Ramsar sites), the requirements of the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations) apply. In essence, this requires the lead Competent Authority, in this case Marine Scotland, to determine whether the proposed works are likely to have a significant effect on a European/Ramsar site and, if so, to undertake an Appropriate Assessment (AA) of the implications of the proposals in the light of the site's conservation objectives.

The nearest European/Ramsar site to the scheme is the Renfrewshire Heights Special Protection Area (SPA), located approximately 12 km northeast from Hunterston. However, this site is designated for terrestrial features (Scottish Natural Heritage (SNH), 2007). The nearest marine related site is the Inner Clyde SPA and Ramsar site, located more than 25 km to the northeast of the proposed works, while the Inner Hebrides and the Minches Special Area of Conservation (SAC) is over 40 km to the west. An HRA screening assessment is presented in Section 5.

3.1.3 Water Framework Directive

The Water Framework Directive (WFD) (2000/60/EEC) establishes a framework for the management and protection of Europe's water resources. It is implemented in Scotland through the Water Environment Water Services (Scotland) Act 2003 and the Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activity Regulations (CAR). The overall objective of the WFD is to achieve "good ecological and good chemical status" in all inland and coastal waters. The initial deadline to meet this objective was 2015; however, in cases where it was not possible to do so due to disproportionate expense, natural conditions or technical feasibility, the deadline to achieve "good ecological and good chemical status" is extended to 2027.

The proposed works are located within the Largs Channel (Fairlie Roads) coastal water body. It is necessary to consider whether the proposed works might compromise achievement of WFD objectives for this and/or adjacent water bodies. A WFD compliance assessment is presented in Appendix B.

3.1.4 Nature Conservation Marine Protected Areas

The Marine (Scotland) Act 2010 provides for the designation of nature conservation Marine Protected Areas (MPAs) in Scottish inshore waters (within 12 nm of the territorial baseline) to protect features (habitats and species) considered to be of national importance. Thirty nature conservation MPAs were designated in 2014 covering both Scottish inshore and offshore waters. Under Section 83 of the Act, when considering granting a marine licence, Marine Scotland has to take account of potential impacts to MPA features.

The proposed works are over 10 km from the nearest nature conservation MPA. The South Arran MPA, at approximately 16 km to the southwest of Hunterston, is designated due to a diversity of habitats and species including maerl beds, kelp and seagrass (SNH, 2014). The Southannan Sands Site of Special Scientific Interest (SSSI) is located approximately 0.5 km north and east of the proposed works. This is a nationally designated site due to intertidal sandflat habitat (SNH, 2013). Nature conservation designations are discussed in Section 4.3.

1 Council Directive 79/409/EEC on the Conservation of Wild Birds.
2 Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna.
3 Ramsar Convention on Wetlands – Conservation on Wetlands of International Importance, especially on Waterfowl Habitat.

4 Environmental Receptors

There is limited potential for environmental effects to arise from the seaweed removal activity at Hunterston B given the scale and nature of the proposed works. This section considers any potential effects in the context of the following receptors:

- Physical processes;
- Water and sediment quality;
- Nature conservation and aquatic ecology;
  - Benthic habitat and species; and
  - Nature conservation designated sites.

4.1 Physical Processes

Hunterston B Power Station is located at the southern end of the Inner Firth of Clyde. Water level data at Hunterston, based on levels at Millport (approximately 3.5 km northwest of Hunterston), is described on the United Kingdom Hydrographic Office (UKHO) Admiralty Chart 'Firth of Clyde Hunterston Channel and Rothesay Sound' (Chart No. 1867). These data are reproduced in Table 2 and show a spring and neap tidal range of 2.9 m and 1.8 m, respectively.

Table 2. Water level data at Millport (northwest of Hunterston)

Tidal Level	Chart Datum (CD) (m)	Ordnance Datum (Newlyn) (ODN) (m)
Mean High Water Springs (MHWS)	3.4	1.78
Mean High Water Neaps (MHWN)	2.8	1.18
Mean Low Water Springs (MLWS)	0.5	-1.12
Mean Low Water Neaps (MLWN)	1.0	-0.62
Mean Sea Level (MSL)	1.9	0.28

Source: UKHO Chart No. 1867

The Inner Firth of Clyde is characterised by relatively weak currents that are moderated by the wind. This area is relatively shallow, with some deeper channels in excess of 50 m. Tidal flows tend to be low, generally below 0.9 knots (~0.46 m/s). However, marginally faster flow rates are observed through restricted channels such as those around the Isle of Bute and Great Cumbrae. Tidal flows at Hunterston are described in the UKHO Chart No. 1867, with two tidal diamonds in close proximity (both in the Hunterston Channel). Tidal diamond A (55°44'6N, 04°54'0W) is situated approximately 2.0 km north, while tidal diamond B (55°43'7N, 04°55'6W) is approximately 1.5 km west of Hunterston and immediately adjacent to the proposed seaweed reduction area. Over a tidal cycle, the tidal excursion in waters off Hunterston is around 10 km, based on the tidal information presented in the UKHO Chart No. 1867.

Tidal diamonds A and B exhibit an approximate north-easterly flow during the flooding tide and an approximate south-westerly flow during the ebbing tide, following the orientation of the Hunterston Channel. For tidal diamond A, peak flow in both spring and neap tides occurs three hours after high water with flow velocities of 1.4 and 0.9 knots (0.72 and 0.46 m/s), respectively. The maximum current velocities of flooding tides occur five hours before high water, with flows of 1.1 knots (0.57 m/s) during spring tides and 0.7 knots (0.36 m/s) during neap tides. Flow speeds for tidal diamond B are notably lower compared to tidal diamond A, with peak flows during spring and neap tides of 0.7 and 0.4 knots (0.36 and 0.21 m/s) occurring five hours after high water.

Table 3. Significant wave height (m) distribution by direction from a location southwest of Little Cumbrae

Significant Wave Height (m)	Directional Sector Proportion (%)								
	N	NE	E	SE	S	SW	W	NW	Total
0 to 1	4	3	6	9	27	12	13	16	89
1 to 2	0	0	0	1	4	2	2	1	10
2 to 3	0	0	0	0	0	0	0	0	1
3 to 4	0	0	0	0	0	0	0	0	0
4 to 5	0	0	0	0	0	0	0	0	0
Total	4	3	6	10	32	14	16	16	100

Source: SEASTATES

SEASTATES[4] is ABPmer's metocean information service which contains a hindcast of hourly wave conditions for the period 1979 to 2015 inclusive (ABPmer, 2013a). Data have been extracted in the vicinity of Hunterston, specifically from a location southwest of Little Cumbrae (55°40'4N, 04°56'13W), and analysed to determine the distribution of wave height by direction as shown in Table 3 and Image 3. The data indicates that waves predominantly originate from a southerly direction (32%), with notable contributions from the southwest, west and northwest (46% combined). However, it should be noted that Little Cumbrae provides a degree of shelter from wave action originating from the west and northwest to the coastline adjacent to Hunterston B, largely restricting potential effects to waves from the south and southwest.

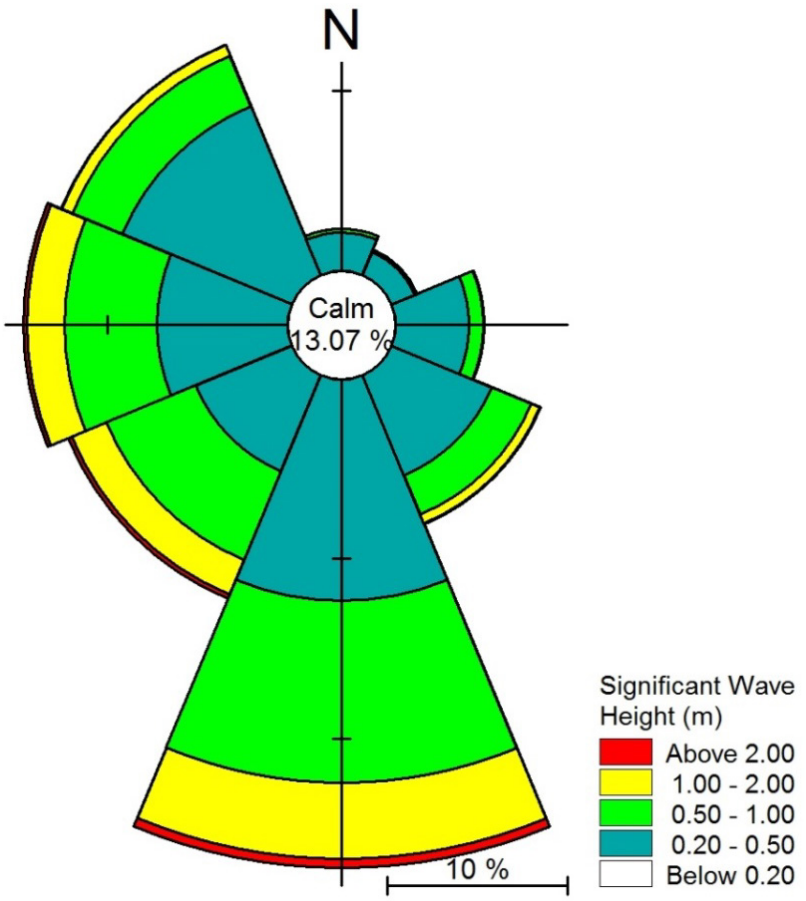


Image 3. Significant wave height (m) distribution by direction from a location southwest of Little Cumbrae (produced using SEASTATES data)

[4] ABPmer SEASTATES: www.seastates.net (Accessed June 2017).

The coastline at Hunterston B Power Station is west facing and, therefore, wave action from the south would impact littoral habitats/sediments through refraction towards the coast while wave action from a southwest direction could directly impact the coastline at Hunterston. It is these wave conditions, combined with low water tidal states, which are considered to push seaweed towards the Hunterston B cooling water intake.

The removal of seaweed, predominantly *S. latissima,* from the proposed seaweed reduction area has the potential to increase wave energy reaching the adjacent shoreline as seaweed such as kelps can attenuate wave activity. This, in turn, could lead to changes in the morphology of the intertidal area as a result of increased wave energy acting on the shoreline. The extent of wave dampening is strongly influenced by the morphology, and drag co-efficient, and density of the dominant kelp species; thus, the magnitude of protection provided varies with species, and therefore may also vary with location (Gaylord et al. 2007).

The proposed seaweed reduction area is located in a relatively sheltered area of the Inner Clyde, although extreme wave heights of greater than 2 m do occasionally occur. The abundance and density of *S. latissima* varies seasonally, with higher biomass present in summer and lower biomass present in winter and early spring as a result of removal by natural storm events in autumn and winter. The wave attenuating effects of *S. latissima* will thus be lower during the winter when more extreme and more frequent storm events will occur. It is thus considered that naturally occurring *S. latissima* will play a relatively limited role in wave attenuation in this area of the Inner Clyde.

The proposed seaweed reduction area does not extend all the way to the shoreline. Following seaweed clearance activity, a strip of seaweed will remain on the shoreward side of the reduction area which will continue to play a role in wave dampening. Much of the shoreline adjacent to the seaweed reduction area comprises rocky shore and boulders/cobbles. Such shorelines will be relatively insensitive to changes in morphology in response to minor changes in wave energy. The impact of seaweed removal on the morphology of these shorelines is assessed as **negligible**. The shoreline adjacent to the northern part of the seaweed reduction area is more mixed, comprising boulders/ cobbles, gravel and some sand. While the morphology of this shoreline could be slightly more sensitive to changes in wave energy, given the minor nature of the changes in wave energy reaching this shoreline, the impact of seaweed removal on the morphology of this shoreline is assessed as **minor**.

4.2 Water and Sediment Quality

The proposed works are located within the Largs Channel (Fairlie Roads) coastal water body (ID: 200026), while the Seamill and Ardrossan coastal water body (ID: 200024) is located immediately to the south of the proposed seaweed reduction area. In 2015, both coastal water bodies were classified as achieving good overall status[5]. The WFD compliance assessment, presented in Appendix B, concludes that the proposed works at Hunterston are not likely to have a permanent (i.e. non-temporary) effect on the status of WFD parameters that are significant at water body level. The proposed works are therefore not predicted to cause either deterioration to the current status of the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from achieving future WFD objectives. The proposed seaweed reduction activity could lead to small quantities of sediment being raised into suspension through contact with the seabed, although any disturbance will be temporary and sediment will quickly disperse. Given the nature and small scale of the proposed works, water and sediment quality will not be affected and **no impact pathway has been identified**.

[5] Scotland water body classification results (2015): http://www.sepa.org.uk/environment/water/classification/classification-results (Accessed June 2017).

4.3 Nature Conservation and Aquatic Ecology

4.3.1 Benthic Habitats and Species

A number of reviews of the benthic ecology of the Clyde Sea area have been undertaken (e.g. Connor et al. 1998; Wilding et al. 2005). More local reviews of marine habitats in the vicinity of Hunterston B Power Station have also been prepared by Gardline Environmental Ltd (2007) and Cowie (2007). The main habitats and associated species of interest for the appraisal are the subtidal kelp habitats that will be affected by the proposed works and adjacent intertidal areas that could be exposed to indirect impacts as a result of subtidal seaweed removal.

Intertidal Habitats

There is a variety of intertidal habitats in the vicinity of Hunterston B Power Station, ranging from sandflats in more sheltered areas through to boulder and rocky shores in more exposed areas (see Figure 3).

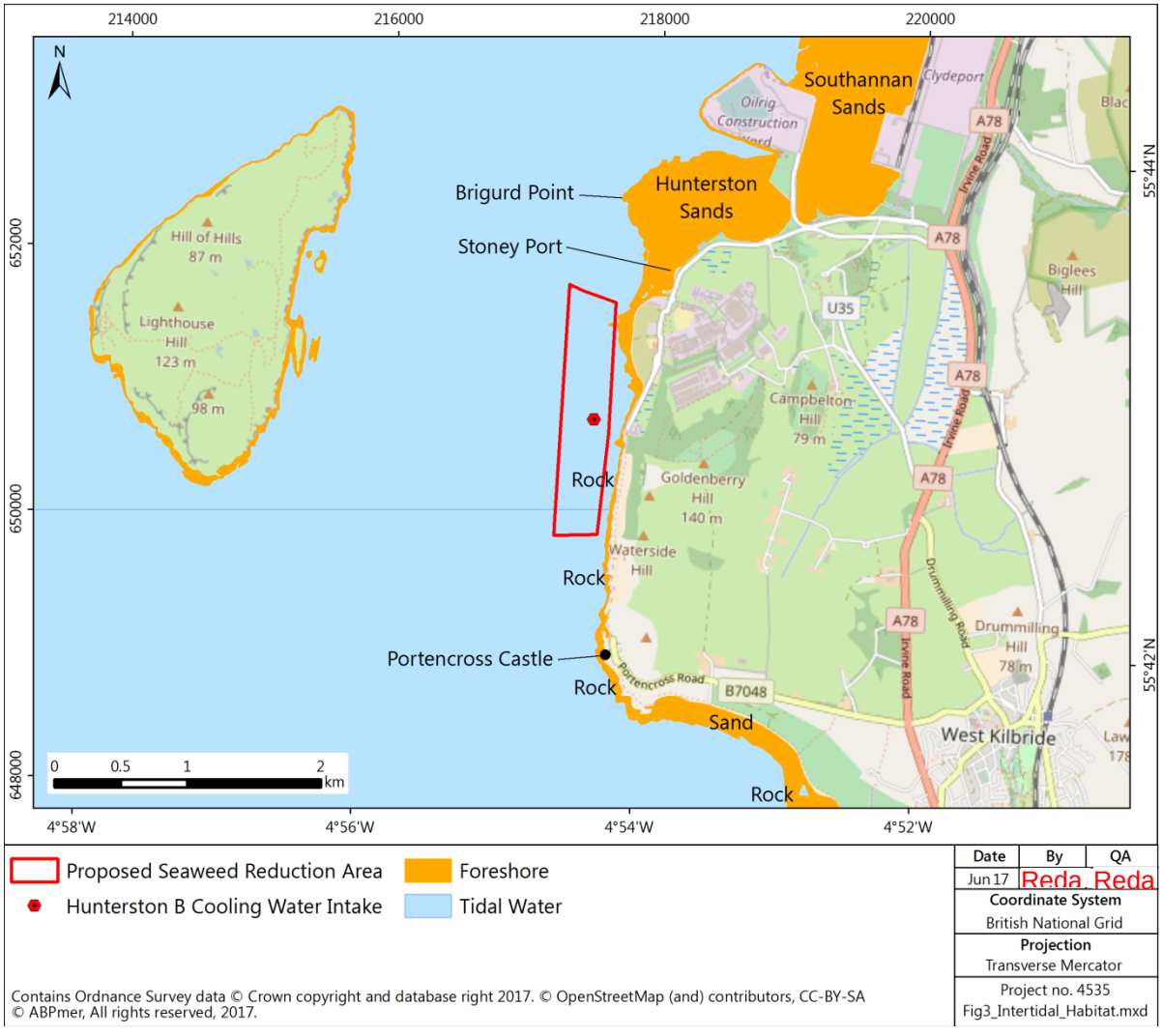


Figure 3. Intertidal habitat in the vicinity of the proposed seaweed reduction area

Hunterston Sands, which lies approximately 2 km northeast of the Hunterston B cooling water intake, is a sandy shore supporting dense lugworm beds (Cowie, 2007). It comprises the biotopes LGS.S.AP.P and LGS.S.Lan (Connor et al. 1998). DHI Ecological Consultancy (2005) reported dense stands of *Zostera noltii* covering approximately 40 hectares (ha) of Hunterston Sands and Southannan Sands.

The area around Brigurd Point (approximately 1.5 km to the north of the Hunterston B cooling water intake) is more exposed than Hunterston Sands. In the upper to mid eulittoral zone there is a mixed habitat matrix of boulders, cobbles, pebbles and sand. The area is characterised by *Semibalanus balanoides* on the boulders and stones together with small clumps of *Mytilis edulis* (Cowie, 2007). Limpets (*Patella vulgata*) are present on larger boulders together with small fucoids (*Fucus vesiculosus*). At the extreme low water level, the substrate is characterised by boulders, cobbles and sand supporting a diverse seaweed community (*F. serratus*, *F. vesiculosus* and encrusting coralline algae) together with encrusting bryozoans and sponges (Gardline Environmental Ltd, 2007). The area has been classified as biotope ELR.Bpat (Connor et al. 1998).

Stoney Port, approximately 1 km to the north of the Hunterston B cooling water intake, is characterised by a complex mosaic of habitats including boulders, cobbles and sand with a larger area of sand towards extreme low water springs. The mid to lower shore is dominated by dense algal cover including *F. vesiculosus* and *Ascophyllum nodosum* and a variety of littorinids (Cowie, 2007).

The coastline adjacent to the cooling water intake jetty (see Image 1) and southwards towards Portencross Castle is more exposed with upper and mid-eulittoral zones comprising steep red sandstone outcrops and boulders. In the lower eulittoral/sublittoral fringe, algae attached to boulders and cobbles form a mosaic with barnacles, littorinids, encrusting bryozoans, sponges and sepulid worms (Gardline Environmental Ltd, 2007).

Subtidal Habitats

There is limited information on the subtidal habitats in the vicinity of Hunterston B Power Station. The European Marine Observation and Data Network (EMODnet)[6] habitat map classifies the proposed seaweed reduction area as muddy sand/sandy mud with sediments becoming muddier moving offshore (Figure 4), including the following biotopes:

- A3.1: Atlantic and Mediterranean high energy infralittoral rock;
- A5.33: Infralittoral sandy mud; and
- A5.35: Circalittoral sandy mud.

[6] European Marine Observation and Data Network (EMODnet): http://emodnet.eu (Accessed June 2017).

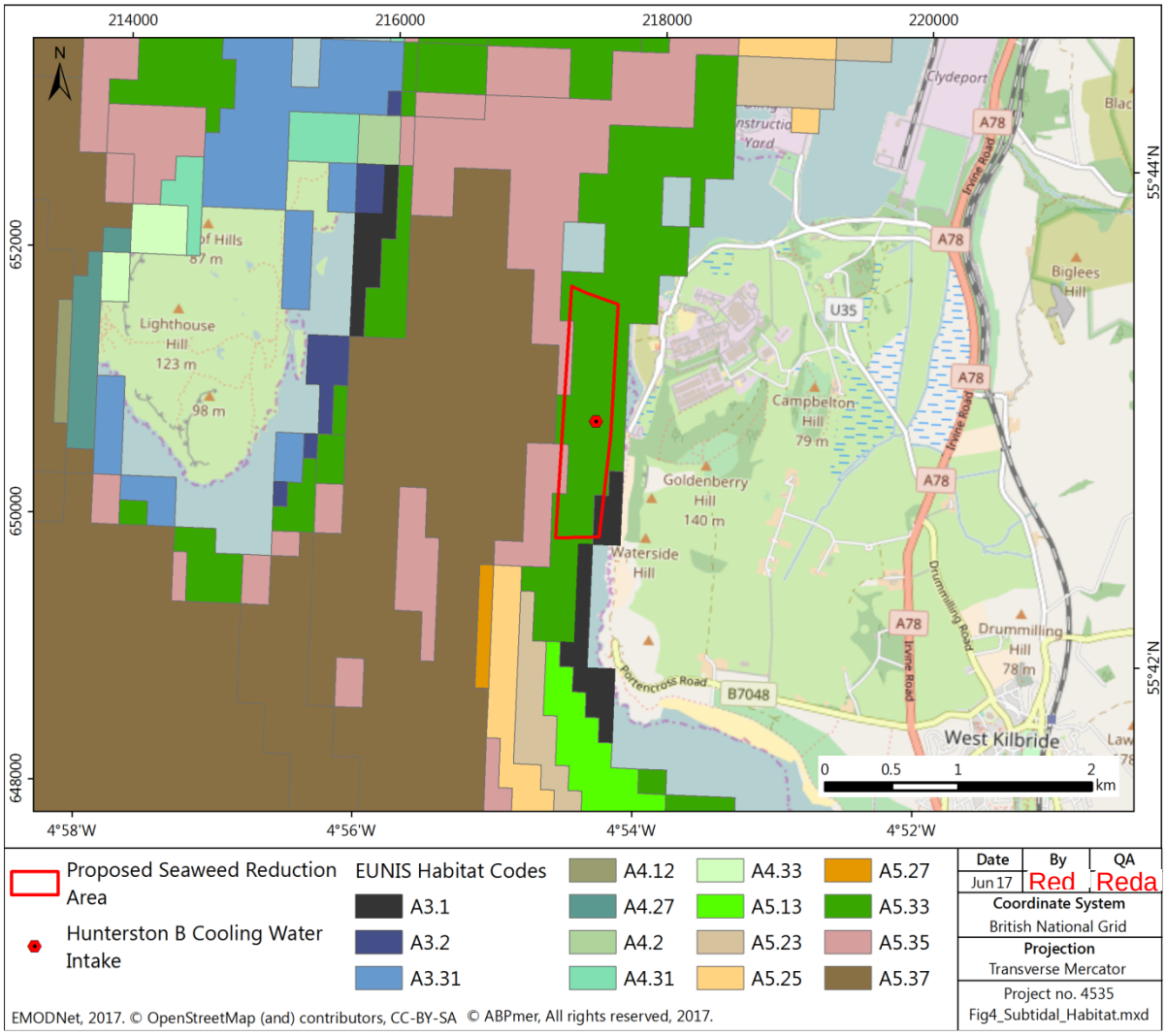


Figure 4. EMODnet habitat map in the vicinity of the proposed seaweed reduction area

The EMODnet habitat map (Figure 4) is supported by the findings of a drop-down camera survey conducted in May 2017 which covered the subtidal area approximately 2 km to the north and 2 km to the south of the Hunterston B cooling water intake (see Appendix A for full details). The main biotopes recorded during the drop-down survey included (see also Figure 5):

- IR.LIR.K.Lsac.Ldig (A3.3131): *Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock;
- SS.SSa.IMuSa (A5.24): Infralittoral muddy sand;
- SS.SMu.ISaMu (A5.33): Infralittoral sandy mud;
- SS.SMp.KSwS.LsacR (A5.521): *Laminaria saccharina* and red seaweeds on infralittoral sediments; and
- SS.SMp.KSwSS.LsacR.S (A5.5213): *Laminaria saccharina* and filamentous red algae on infralittoral sand.

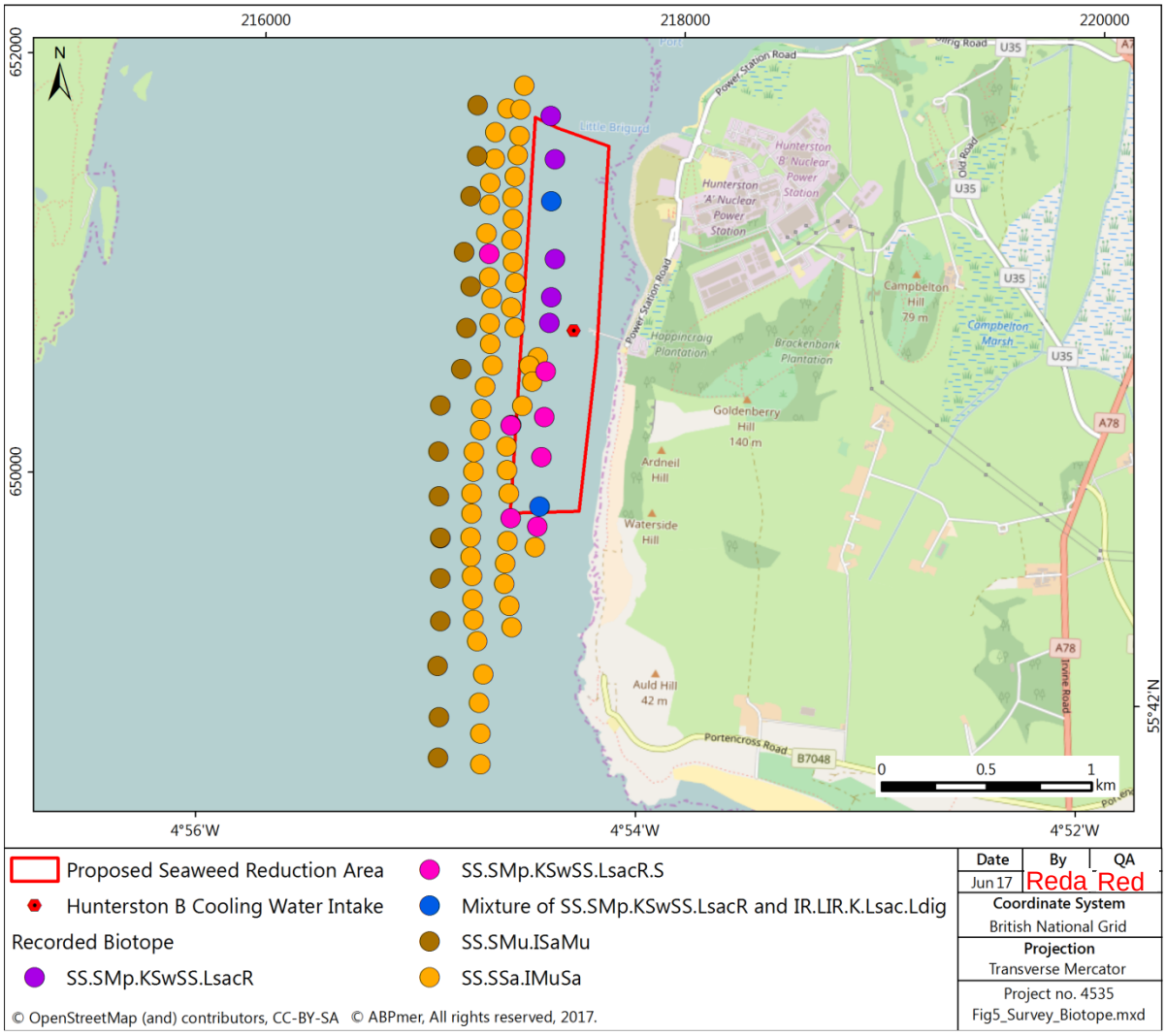


Figure 5. Biotopes recorded during drop-down camera survey (May 2017) in the vicinity of the proposed seaweed reduction area

Kelp

Kelps tend to occur from extreme mean low water springs (MLWS) down to the limit of photic depth (up to 30 m in clear waters; Smale et al. 2013). Dense areas of kelp (*S. latissima*) were recorded at a number of locations in the proposed seaweed reduction area, particularly shallower areas to the north of the cooling water intake. The relative density and distribution of kelp species recorded during the 2017 drop-down camera survey is presented in Figure 6 using the Marine Nature Conservation Review (MNCR) SACFOR scale[7]:

- Super-abundant (S);
- Abundant (A);
- Common (C);
- Frequent (F);
- Occasional (O);
- Rare (R); and
- Less than rare (L).

[7] SACFOR scale: http://jncc.defra.gov.uk/page-2684 (Accessed June 2017).

The main kelp species encountered was *S. latissima*. Occasional *Laminaria digitata* were also present. No kelp was observed below 10 m chart datum (CD), suggesting that light is limiting growth beyond this depth. Furthermore, seaweed abundance to the south of the Hunterston B cooling water intake was notably reduced compared to the area north of the intake. It is possible that this is due to the seaweed removal activity undertaken in 2016.

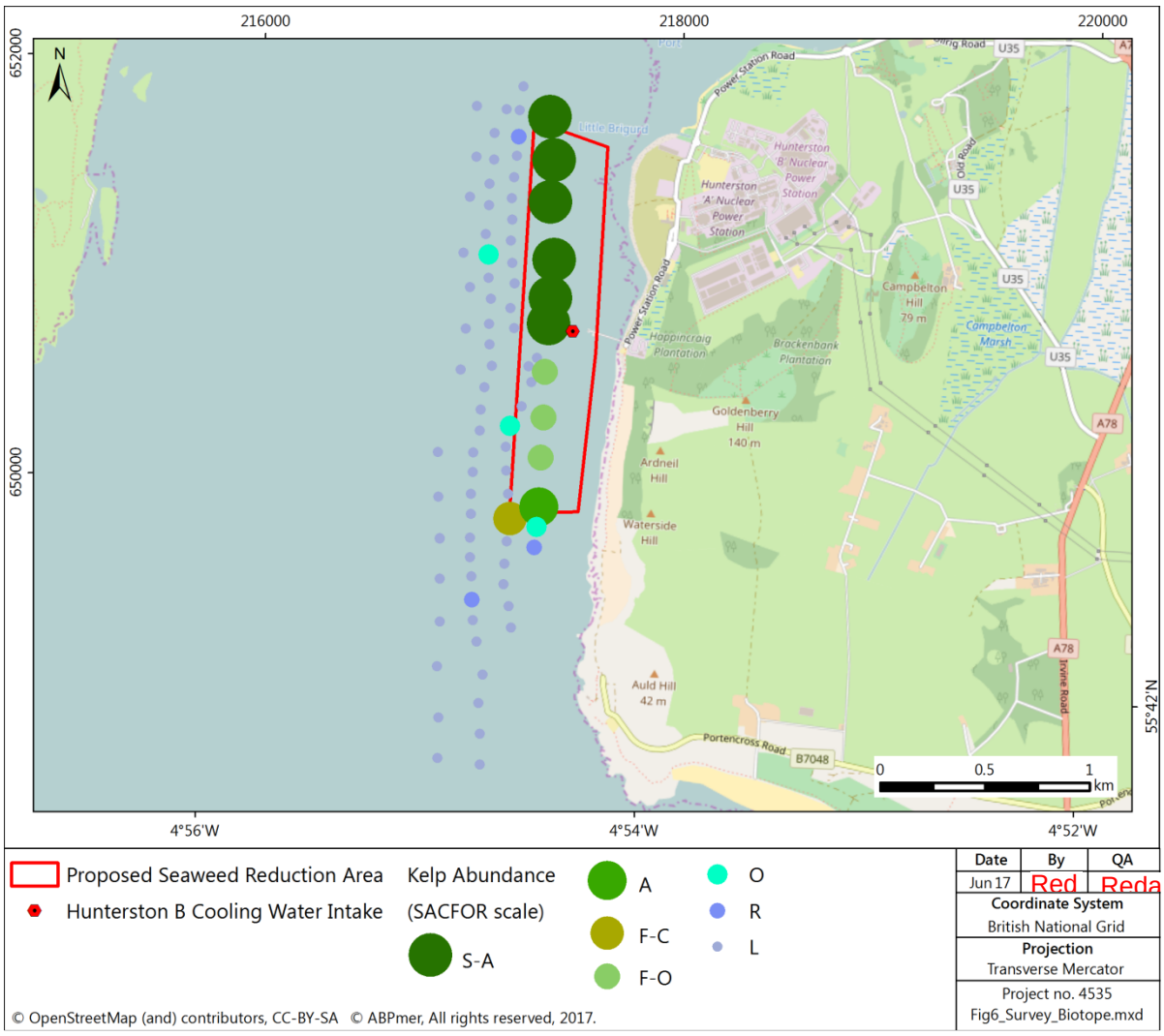


Figure 6. Seaweed abundance within the proposed seaweed reduction area based on SACFOR scale

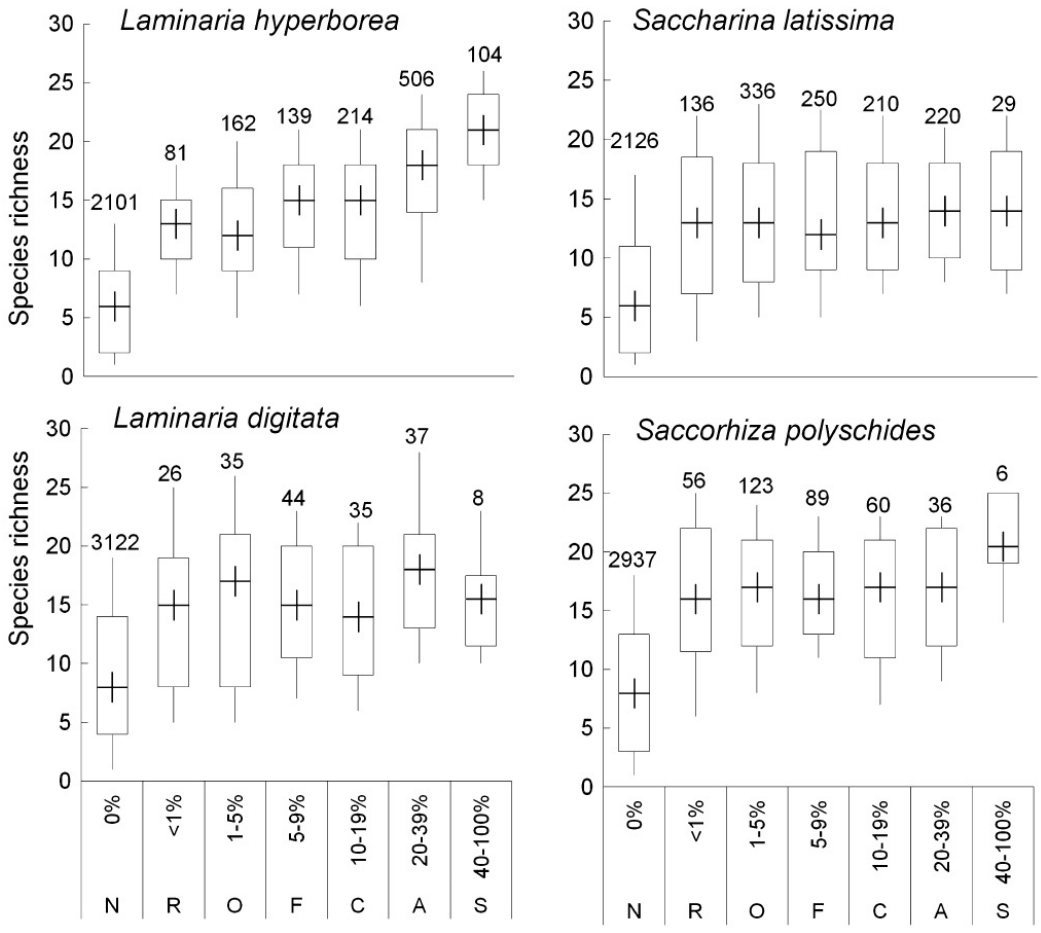
Maximum standing crop biomass of over 10 kg/m^2 wet weight has been recorded for *S. latissima* (Krumhansl and Scheibling, 2011). In order to estimate total seaweed biomass within the proposed seaweed reduction area (0.64 km^2), based on the findings of the Ma7 2017 drop-down camera survey, it is assumed that 50% of the site (to the north of the Hunterston B cooling water intake) is abundant to super-abundant (1-3 kg/m^2 wet weight) and 50% of the site (to the south of the Hunterston B cooling water intake) is occasional to frequent (0.2-0.5 kg/m^2 wet weight). Using these values, it is estimates that total seaweed biomass within the proposed seaweed reduction area ranges between 384 and 1,120 tonnes wet weight (Table 4).

Table 4. Seaweed biomass within the proposed seaweed reduction area

SACFOR Scale	Proportion of Area (%)	Area (km^2)	Seaweed Biomass	
			(kg/m^2)	(Tonnes)
Super-abundant (S) – Abundant (A)	50	0.32	1 – 3	320 – 960
Frequent (F) – Occasional (O)	50	0.32	0.2 – 0.5	64 – 160
Total	100	0.64	-	384 – 1,120

Within the wider Clyde Sea, Wilding et al. (2005) noted that *S. latissima* was widespread with records of extensive beds around Arran and Cumbrae as well as in many of the sea lochs within the Clyde system. *Saccharina latissima* is also widespread throughout Scottish waters (Marine Life Information Network (MarLIN) website)[8].

Kelps such as *S. latissima* play an important role in coastal marine ecosystems. In particular, they contribute high levels of primary production. For example, Graham et al. (2016) indicated that primary production within *S. latissima* beds can exceed 1,000 g C m^2/year, with much of this production entering the carbon cycle as detritus or dissolved organic matter. Kelp species also support notable biodiversity, with higher levels of biodiversity observed in kelp beds than equivalent comparable areas (see Image 4; Smale et al. 2013).



Source: Smale et al. (2013)

Image 4. Kelp species abundance and local species richness using the SACFOR scale

[8] Sugar kelp (*Saccharina latissima*): http://www.marlin.ac.uk/species/detail/1375 (Accessed June 2017).

Kelp beds have also been identified as providing important nursery and feeding functions for certain fish and shellfish species. For example, Smale et al. (2013) indicated that kelp forest habitats are vital for the European lobster (*Homarus gammarus*) where it preys on a variety of molluscs and crustaceans. May (2015) identified kelp forests as important for juvenile lobster and juvenile crab (*Cancer pagurus*) around the Isle of Man. Kelp forests also serve as a nursery for many fish species, including Atlantic Cod (*Gadus morhua*) and pollack (*Pollachius pollachius*) (Smale et al. 2013). They are also feeding grounds for fish species such as ballan wrasse (*Labrus bergylta*) and Goldsinny wrasse (*Ctenolabrus rupestris*), which prey on kelp associated invertebrates (Norderhaug et al. 2005), as well as attracting commercially important species such as European sea bass (*Dicentrarchus labrax*), pollack (*P. pollachius*) and conger eels (*Conger conger*) (Smale et al. 2013). In turn, elevated fish densities in kelp forests attract large piscivores, such as large fish, seals and otters.

Maerl

There are no known maerl beds in the vicinity of Hunterston B Power Station (Cowie, 2007) and none were detected during the drop-down camera survey in May 2017 (see Appendix A). The nearest maerl beds are understood to be located in the area of the Tan between Great and Little Cumbrae (Gardline Environmental Ltd, 2007).

Assessment of Potential Impacts

The following impacts to benthic habitats and species have been assessed:

- Direct loss of/damage to kelp habitat within the proposed seaweed reduction area;
- Direct damage to other habitats within the proposed seaweed reduction area;
- Indirect damage to intertidal habitats as a result of changes in wave activity;
- Indirect damage to wider marine ecosystem as a result of removal of primary production;
- Introduction of non-native species; and
- Impact of kelp removal on juvenile and adult fish and shellfish, including commercially important species.

Direct loss of/damage to kelp habitat within the proposed seaweed reduction area

The activity will remove kelp from an area of up to 0.64 km^2, targeted towards those areas of densest kelp cover based on the findings of a drop-down camera survey in May 2017. The activity will remove some but not all of the kelp from the areas within which the activity occurs. Immediately following the removal, the habitat will support less kelp/less dense kelp than prior to the activity, but the habitat type will not change. Rather some of the ecological functioning of the area could be reduced. Smale et al. (2013) noted that the biodiversity of *S. latissima* beds did not change significantly across the SACFOR scale (see Image 4), suggesting that some aspects of ecological functioning may not be significantly impaired.

Saccharina latissima is likely to regrow rapidly in the targeted areas. This regrowth may offset some of the lost function of the affected habitat. Given the relatively small area over which activity may occur in relation to the overall scale of the resource within the Clyde Sea, the limited impact on ecological structure/functioning and the scope for rapid recovery, the impact on kelp habitat is therefore assessed as **minor**.

Direct damage to other habitats within the proposed seaweed reduction area

No maerl has been identified within the proposed seaweed reduction area based on the May 2017 drop-down camera survey (see also Appendix A). The main biotopes present within the proposed

seaweed reduction area, other than kelp habitat, comprise infralittoral muddy sand (A5.24) and infralittoral sandy mud (A5.33). The removal of *S. latissima* using an otter trawl and/or chain mat will cause some minor disturbance to surface seabed sediments as a result of the physical interaction between the gears and the seabed. The macrofauna and near-surface infauna of subtidal stable muddy sands, sandy muds and muds are susceptible to physical disturbance from bottom fishing gears (i.e. beam trawls, scallop dredges, otter trawls, seine netting, hydraulic suction dredges) (Hall et al. 2008; Kaiser et al. 2002; 2006; Johnson, 2002; Thrush and Dayton, 2002). In general, use of fishing gears that penetrate the substratum to a greater extent (i.e. beam trawls, scallop dredges and demersal trawls) will potentially damage these habitats to a greater degree than activities using lighter gear (i.e. light demersal trawls and seines) (Hall et al. 2008). However, the gears to be used within the proposed seaweed reduction area have been designed to avoid penetration into the seabed, although the gears (particularly the otter trawl doors) could create surface tracks on the softer sedimentary habitats. It is noted that the gears will be less damaging to the sea bed than standard otter trawls or scallop dredges (ABPmer, 2013b).

The abiotic component of sandy mud and muddy sand habitats is considered to have 'High' resistance to the surface abrasion as this pressure is unlikely to alter the habitat type, although there may be some surficial sediment disturbance and the displacement of stones. Recovery is considered to be 'Very High' and the habitat feature is therefore considered to be 'Not Sensitive' to a single event that leads to surface abrasion. Surface disturbance may alter the surface topography of these habitat types, re-suspend sediment and alter sediment characteristics. However, resistance to this pressure is assessed as 'Medium' as the habitat still remains and alterations are confined to surficial layers. In general, any tracks or pits resulting from surface damage would be infilled within six months or sooner by natural hydrodynamic processes and recovery is therefore judged to be 'Very High'. The sensitivity of the abiotic habitat is therefore categorised as 'Low' (ABPmer, 2013b).

Shallow disturbance may lead to injury and mortality of characterising species. Biological recovery is linked to the recovery of the abiotic habitat, which is likely to be rapid in areas where sediments are relatively mobile and will be aided by water transport or active migration of adults. Burrowing polychaetes are considered to be relatively protected from shallow disturbance while species exposed in surface sediments were considered to have lower resistance. Bivalve characterising species are considered to have 'Medium' resistance to this pressure. The high recovery rates of species that characterise these biotopes mean that overall sensitivity was considered to be 'Not Sensitive-Low' (ABPmer, 2013b).

Given the relatively small area affected by the removal activity and the low sensitivity of habitats and associated features to seabed abrasion, the impact on infralittoral muddy sand and infralittoral sandy mud habitats is assessed as **negligible**.

Indirect damage to intertidal habitats as a result of changes in wave activity

As described in Section 4.1, the largest waves within the study area are from the south and southwest with very small waves from other directions (less than 1 m). Removal of kelp from the shallow sublittoral zone could increase wave propagation onto adjacent shorelines. However, the shoreline adjacent to the proposed seaweed reduction area comprises sandstone outcrops, boulders and cobbles together with patches of sand at Stoney Port. These shorelines will be relatively insensitive to changes in wave propagation. Furthermore, the abundance of *S. latissima* is seasonal with peak biomass in summer and lowest biomass in winter (when the frequency and magnitude of storms and wave action are likely to be greatest). On this basis, the impact of kelp removal on the morphology and ecology of the shoreline adjacent to the proposed seaweed reduction area is assessed as **negligible** (for those areas of harder shoreline) to **minor** (for sandy areas of shoreline).

Indirect damage to wider marine ecosystem as a result of removal of primary production

Between June 2015 (following a site event due to seaweed) and December 2015, 231 tonnes of material was collected and subsequently removed from the trash baskets of the Hunterston B cooling water intake (Hunterston B Power Station, *pers. comm.*). The trash baskets are large meshed containers that collect material such as seaweed that has passed through the coarse screens (it should be noted that this figure also includes jellyfish). Up to 150 tonnes wet weight will be removed from within the proposed seaweed reduction area over the one year marine licence (three campaigns at 50 tonnes wet weight each). Assuming approximately 89% of the wet weight is water and 28% of the resulting dry weight is carbon (Gevaert et al. 2001), the activity represents a removal of approximately 4.6 tonnes of carbon from the Clyde system.

Assuming that the volume of kelp removed from the cooling water intake screens reduces as a result of the activity, the overall amount of carbon removed from the Clyde Sea may not increase substantially from the current baseline. Given the small area proposed, this removal of carbon is considered to be **negligible** in the context of the Clyde Sea as a whole.

Introduction of non-native species

The removal of kelp within the proposed seaweed reduction area may create colonising space for the recruitment of non-native species. The proposed seaweed reduction area is 0.64 km^2 and is naturally disturbed by wave activity during storms on a regular basis. The additional disturbance caused by seaweed removal is considered to be minor. The activity will primarily remove kelp and will cause very little impact to the seabed. On this basis, the increased risk of colonisation by non-native species as a result of the seaweed removal activity is assessed to be very low and the impact is assessed as **negligible**.

The use of a vessel to remove seaweed could pose a risk of introduction of non-native species through discharge of ballast water or biofouling of the vessel's hull. Hunterston B Power Station is committed to using a local fishing vessel to undertake the removal activity. The risk of transfer of non-native species is therefore assessed as **negligible**.

Impact of kelp removal on juvenile and adult fish and shellfish

It is likely that the kelp beds within the proposed seaweed reduction area are of functional value to juvenile cod and pollack and to juvenile lobster and crab. They may also be important feeding areas for adult lobster and a range of fish species. Therefore, removal of kelp within the proposed seaweed reduction area could reduce the functional value of the area for juvenile and adult fish and shellfish. The spatial extent of the proposed seaweed reduction area is small relative to the overall extent of kelp resources in the Clyde Sea. The proposed activity will remove some but not all of the kelp and some residual function as a nursery/feeding area will remain following the activity, while some regrowth of kelp will occur between each campaign. In addition, the proposed seaweed reduction area does not extend all the way to the shoreline. A strip of seaweed will remain on the shoreward side of the reduction area which will also continue to function as a nursery/feeding area.

Given the relatively small area over which seaweed removal may occur in relation to the overall scale of the resource within the Clyde Sea, the limited impact on ecological structure/functioning within proposed seaweed reduction area and the scope for rapid recovery, the impact on fish nursery and feeding function is assessed as **minor**.

4.3.2 Nature Conservation Designated Sites

This section reviews the effects of the proposed works on nature conservation receptors, i.e. designated habitats and species. The proposed works do not directly overlap with any nationally (Figure 7) or internationally (Figure 8) designated nature conservation sites. Table 5 presents a summary of all coastal and marine related designated sites within approximately 40 km of the proposed works and outlines their respective qualifying features.

Table 5. Coastal and marine related nature conservation designated sites within approximately 40 km of the proposed seaweed reduction area

Site Name	Features*	Approx. Distance from Proposed Seaweed Reduction Area (km)
Southannan Sands SSSI	Sandflats (Intertidal marine habitats and saline lagoons: Sandflats)	0.5
Kames Bay SSSI	Sandflats (Habitat: Coastland)	3
Ballochmartin Bay SSSI	Sandflats (Habitat: Coastland)	5
South Arran MPA	Burrowed mud; Kelp and seaweed communities on sublittoral sediment; Maerl beds; Maerl or coarse shell gravel with burrowing sea cucumbers; Seagrass beds; Shallow tide-swept coarse sands with burrowing bivalves; Ocean quahog aggregations	16
Inner Clyde SPA and Ramsar	Non-breeding birds: Redshank (*Tringa totanus*)	28
Inner Clyde SSSI	Saltmarsh; Non-breeding birds: Cormorant (*Phalacrocorax carbo*); Eider (*Somateria mollissima*); Goldeneye (*Bucephala clangula*); Oystercatcher (*Haematopus ostralegus*); Red-breasted merganser (*Mergus serrator*); Red-throated diver (*Gavia stellata*); Redshank (*Tringa totanus*)	28
Sound of Gigha dSPA	Non-breeding birds: Eider (*Somateria mollissima*), Great northern diver (*Gavia immer*), Red-breasted merganser (*Mergus serrator*)	37
Inner Hebrides and the Minches SAC	Harbour porpoise (*Phocoena phocoena*)	42

* Features based on information provided by SNH Sitelink: http://gateway.snh.gov.uk/sitelink/index.jsp (Accessed June 2017).

The nearest designated area to the proposed seaweed reduction area is the Southannan Sands SSSI, located approximately 0.5 km to the north of the proposed seaweed reduction area. This site is designated for intertidal sandflat and nationally rare dwarf eelgrass (*Zostera noltei*). The objectives for site management are 'to maintain the extent of the intertidal sandflat habitat by ensuring protection from damaging impacts, in particular any future coast development'. The main impacts are considered to be associated with direct habitat loss and interference with physical processes (SNH, 2013).

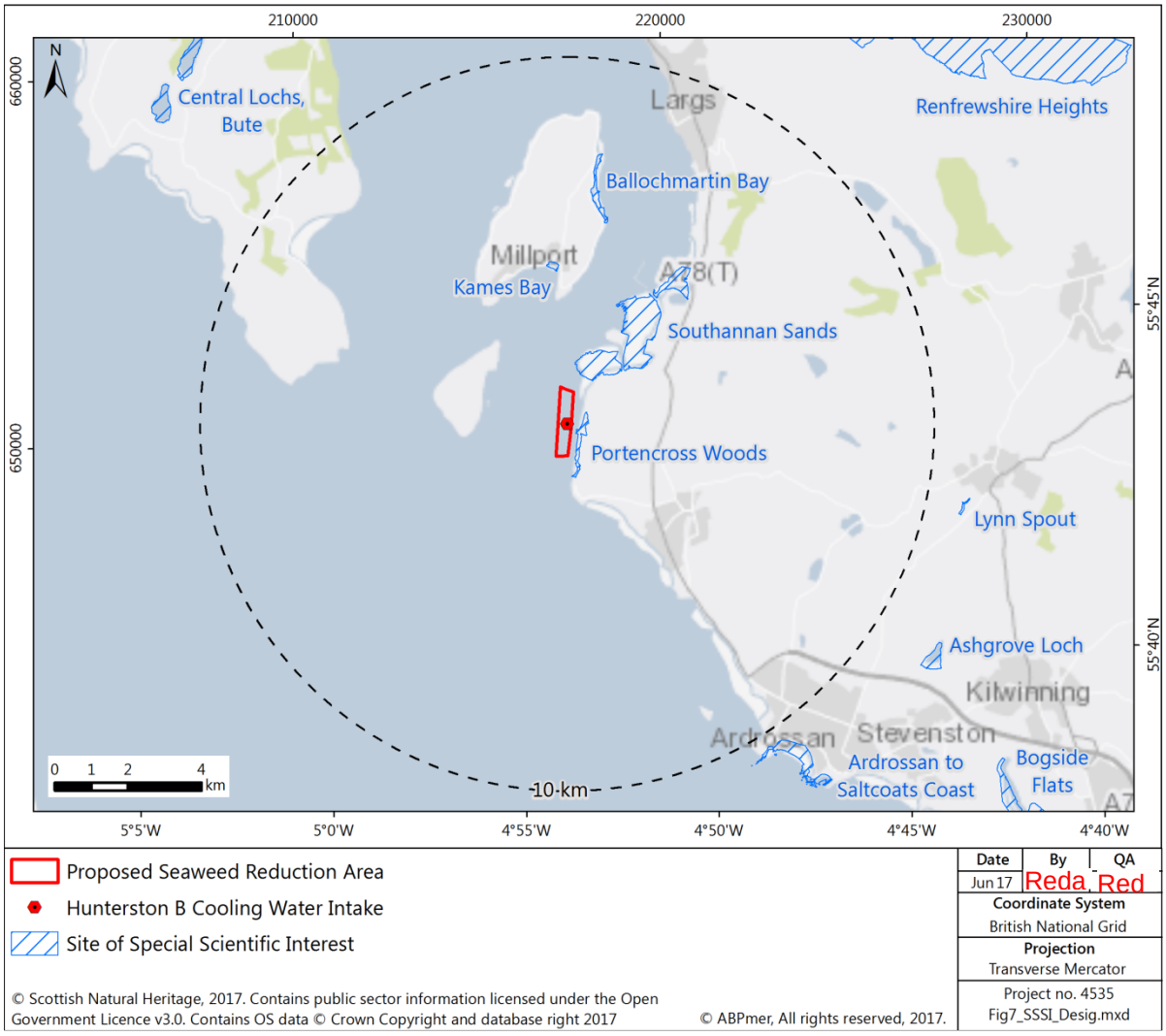


Figure 7. National nature conservation designations in the vicinity of the proposed seaweed reduction area

This assessment considers the potential effects on physical processes, water and sediment quality and benthic habitats and species which have been previously assessed for the proposed works (Section 4.1 to 4.3). Specifically, the potential for effects on intertidal areas is considered to be limited to changes in wave activity as detailed in Section 4.3.1. All effects have been assessed as negligible or minor and consequently no significant pathways for effects on Southannan Sands SSSI are identified. No effects are therefore anticipated on Southannan Sands SSSI intertidal features, or the other intertidal SSSIs in the wider area (e.g. Kames Bay and Ballochmartin Bay). Considering the small scale seaweed removal proposed, any effects from the proposed works are likely to be highly localised. The nearest marine related European/Ramsar Site is the Inner Clyde SPA and Ramsar located more than 25 km to the northeast of the proposed works. European and Ramsar sites are considered further within the HRA screening provided in Section 5. Overall, due to the distance of all designated sites from the proposed works, no significant pathways for direct or indirect effects are identified and consequently impacts on nature conservation are assessed as **negligible** or at worst **minor** and not significant.

Under the UK Biodiversity Action Plan (UK BAP), a range of priority habitats were identified as being the most threatened and requiring conservation action. Marine UK BAP priority habitats identified in the vicinity of the proposed seaweed reduction area include coastal saltmarsh, seagrass beds, subtidal

sands and gravels, maerl beds and intertidal mudflats[9]. Local Biodiversity Action Plans (LBAPs) aim to conserve biodiversity through local partnerships, taking into account both national and local priorities. The Ayrshire LBAP includes the marine environment adjacent to Hunterston B Power Station, with a primary objective to maintain and enhance the range of sublittoral sand and gravel communities off the Ayrshire coast[10]. As a result of devolution, and new country-level and international drivers and requirements, much of the work previously carried out by the UK BAP is now focussed at a country-level rather than a UK-level. As required under Section 2(4) of the Nature Conservation (Scotland) Act 2004, Scottish Priority Marine Features (PMFs) in the vicinity of the proposed seaweed reduction area include kelp and seaweed communities on subtidal sediment, kelp beds and seagrass beds. There will be no effect on any of the aforementioned habitat types, with the exception of kelp which has been assessed as **minor** in Section 4.3.1.

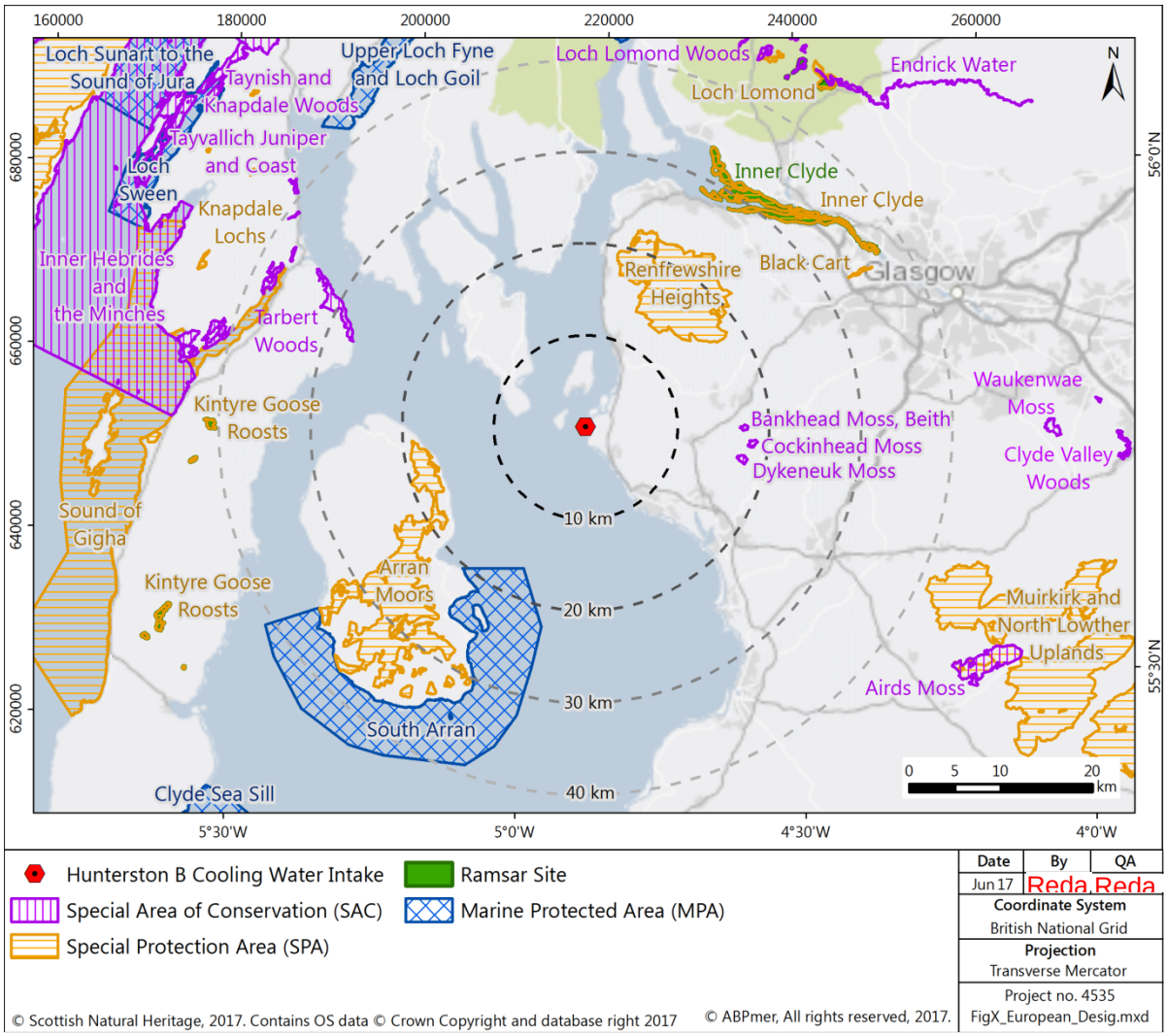


Figure 8. International nature conservation designations in the vicinity of the proposed seaweed reduction area

9 UK Biodiversity Action Plan (BAP) priority habitats: http://jncc.defra.gov.uk/page-5706 (Accessed June 2017).

10 Ayrshire Local Biodiversity Action Plan (LBAP): https://www.south-ayrshire.gov.uk/documents/lbap1.pdf (Accessed June 2017).

4.4 Cumulative and In-Combination Effects

There are no projects or plans known to be taking place in the vicinity of the proposed seaweed reduction area. In particular, there are no known seaweed harvesting proposals in the Clyde, with the nearest suitable areas located on the west coast of Mull of Kintyre. The potential effects that can be attributed to the proposed works are small scale, localised and considered to be minor at worst for receptors (see Sections 4.1 to 4.3). Therefore, the proposed works are **not predicted to result in any significant adverse cumulative/in-combination effects**.

5 HRA Screening Assessment

5.1 Introduction

This section represents a Habitats Regulations Appraisal (HRA) screening assessment for the proposed works. HRA screening is a requirement under The Conservation of Habitats and Species Regulations 2010 (SI 2010 No. 490) (the 'Habitats Regulations') to determine whether European designated sites are likely to be significantly affected by the proposed works either alone or in combination with other plans and projects. If significant effects are likely, there will be a need for an Appropriate Assessment (AA) to be carried out. The screening, any AA and any subsequent assessment is known as the HRA process. European Commission guidance sets out an approach to undertaking AA as part of a four-stage process (Stages A – D; Oxford Brookes, 2001):

- **Stage A**: Screening' to determine the need for an AA;
- **Stage B**: AA and the 'integrity test';
- **Stage C**: Assessment of alternative solutions; and
- **Stage D**: Assessment where adverse effects remain.

The screening assessment (Stage A) is based on Likely Significant Effects (LSE), alone or in combination with other plans or projects. If there are no LSE identified for all the European designated sites, it is considered Stages B, C and D will not be required.

This screening assessment is based on the following four steps (Oxford Brookes, 2001):

- **Step 1**: Determining whether the project or plan is directly connected with or necessary for the management of the site;
- **Step 2**: Describing the project (or plan);
- **Step 3**: Identifying the potential effects on European sites (site characterisation) ; and
- **Step 4**: Assessing the significance of any effects on European sites.

The proposed works is not directly connected with or necessary for the conservation management of any European sites (Step 1). It is therefore appropriate to proceed to Step 2 of the screening process.

5.2 Project Description (Step 2)

Information on the need for the proposed works and project description are provided within Section 2. This assessment considers that the only viable alternative to the proposed works is the 'do nothing' scenario. However, the proposed works are designed to mitigate the risk of extreme seaweed ingress at the Hunterston B cooling water intake. As identified in Section 4.4, no other plans or project have been identified that would have a significant effect and therefore need to be considered further within this assessment.

5.3 Site Characterisation (Step 3)

The importance of the area is recognised through a number of statutory designations in the wider area. This assessment considers the potential wide ranging foraging area of designated features. The following marine or coastal European/Ramsar designated sites are therefore considered that are located within approximately 40 km of the proposed works:

- Sound of Gigha draft SPA (dSPA);
- Inner Clyde Ramsar site;
- Inner Clyde SPA; and
- Inner Hebrides and the Minches SAC.

As detailed in Section 4.3.2, the site does not overlap with any designated sites and therefore potential effects are associated with indirect effects only. Other sites such as the Renfrewshire Heights and Arran Moors SPAs are also in the wider area but are purely terrestrial sites and have therefore not been considered within this assessment. Details of the existing supporting features of the marine or coastal designated sites are outlined in Table 5. All the European/Ramsar sites identified within 40 km are designated due to birds and harbour porpoise. The primary effects of the proposed works are therefore considered to be associated with loss and/or damage to foraging habitat and species. Section 6 also details mitigation and monitoring plans that are incorporated into the proposed works to minimise effects.

5.4 Assessment of Significance (Step 4)

An assessment of potential effects on physical processes, water and sediment quality and benthic habitats and species has been undertaken in Sections 4.1 to 4.3. All effects are assessed as negligible. Considering the small scale seaweed removal proposed, any effects are likely to be highly localised and no significant effects have been identified. No pathways are therefore identified that have the potential to indirectly effect birds or harbour porpoise within European/Ramsar sites. The proposed works are therefore not considered to have the potential to effects birds associated with The Sound of Gigha dSPA or the Inner Clyde Ramsar site and SPA. Similarly, there would be no indirect effects on harbour porpoise associated with the Inner Hebrides and the Minches SAC.

Overall, considering the proximity of the designated sites from the proposed seaweed reduction area, no pathways are identified that could change the current baseline of European/Ramsar sites in the wider area. The nearest European/Ramsar sites are located over 20 km from Hunterston and any effects associated with the proposed works will be highly localised. The proposed works are therefore not considered to have the potential to effect the integrity of any site conservation objectives. In light of the assessment presented, any effects - whether direct or indirect, permanent or temporary - to interest features are considered to be **negligible** and there is **not considered to be a LSE** on any habitat features or species features associated with the designated sites.

6 Mitigation and Monitoring Plan

To review the distribution and density of seaweed within the proposed seaweed reduction area, a **drop-down camera survey** will be conducted before each campaign. The results of the survey will be reviewed by EDF Energy to ensure the activity is focused on appropriate sections within the proposed seaweed reduction area to remove target species. The methodology would follow the same procedure employed to characterise the proposed seaweed reduction area in May 2017 (see Appendix A), thus also supporting longer-term monitoring of the site.

All seaweed removed from within the proposed seaweed reduction area will be **disposed to land**, as opposed to disposal at sea. This mitigation measure avoids potential adverse impact pathways between the disposed material and other marine habitats. Furthermore, as highlighted in Section 4.3.1, the removal of 150 tonnes of seaweed (wet weight) represents a removal of approximately 4.6 tonnes of carbon from the Clyde system. Assuming that the volume of kelp removed from the cooling water intake screens reduces as a result of the activity, the overall amount of carbon removed from the Clyde Sea may not increase substantially from the current baseline, considered to be negligible in the context of the Clyde Sea as a whole.

The ultimate aim of the proposed works is to mitigate the potential extreme ingress of seaweed at the Hunterston B cooling water intake. Therefore, suitable monitoring of the **amounts of seaweed entering the cooling water intake** will also be undertaken to assess the effectiveness of the activity with a view to reducing the seaweed reduction area over time.

7 Conclusions

Hunterston B Power Station is seeking a one year marine licence to remove up to a maximum of 150 tonnes (wet weight) of seaweed, primarily comprising *Saccharina latissima*, from within a proposed seaweed reduction area in the vicinity of its cooling water intake. The proposed works would involve three separate campaigns during the licence period, each removing up to a maximum of 50 tonnes wet weight of seaweed.

The potential effects that can be attributed to the proposed works are localised and, with the application of mitigation measures, are considered to be minor, negligible or insignificant for all receptors both alone and cumulatively/in-combination with other projects. A summary of how the scheme is compliant with the respective legislative requirements is provided below:

- **Environmental Impact Assessment/Appraisal**: The scale of the proposed works is such that an EIA is not considered necessary. This was agreed with Marine Scotland during a teleconference on 19 May 2017. This is supported by the review of potential impact pathways provided in Section 4 of this environmental appraisal;
- **Habitats Regulations Appraisal**: The proposed works will not have a LSE on any features that are identified within any European/Ramsar sites, either individually or in combination with other plans or projects. An HRA screening assessment is presented in Section 5; and
- **Water Framework Directive**: The scale and nature of the proposed works are very small in scale and unlikely to cause a deterioration or failure of the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies to meet future WFD objectives. A WFD compliance assessment has been prepared in order to comply with the requirements of the WFD and is provided in Appendix B.

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9 Abbreviations/Acronyms

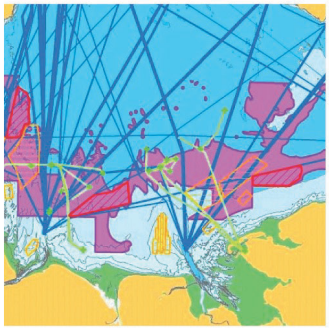
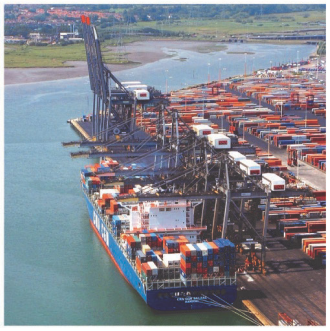
AA	Appropriate Assessment
BAP	Biodiversity Action Plan
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011
CD	Chart Datum
dSPA	Draft Special Protection Area
EIA	Environmental Impact Assessment
EMODnet	European Marine Observation and Data Network
HRA	Habitats Regulations Appraisal
LBAP	Local Biodiversity Action Plan
LSE	Likely Significant Effect
MarLIN	Marine Life Information Network
MHWN	Mean High Water Neaps
MHWS	Mean High Water Springs
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
MSL	Mean Sea Level
MS-LOT	Marine Scotland Licensing Operations Team
nm	Nautical Mile
PMF	Priority Marine Feature
Ramsar	Wetlands of international importance, designated under The Convention on Wetlands (Ramsar, Iran, 1971)
SAC	Special Areas of Conservation
SACFOR	Super-abundant, Abundant, Common, Frequent, Occasional, Rare (and less than rare)
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
UKHO	United Kingdom Hydrographic Office
WFD	Water Framework Directive

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

Appendices



Innovative Thinking - Sustainable Solutions

ABP mer

A Drop-Down Camera Survey Report

A.1 Introduction

This survey report reviews the baseline ecological characteristics of the subtidal habitats in the vicinity of the Hunterston B Power Station cooling water intake. The specific objectives of the survey were to achieve the following:

- Characterise the density and distribution of kelp species within the survey area (proposed seaweed reduction area);
- Produce a broad-scale map of subtidal habitats; and
- Confirm the presence and distribution of any protected or nationally scarce biotopes such as maerl beds, horse mussel beds or seagrass beds.

A.2 Survey Methodology

The drop-down camera survey was undertaken on 31 May 2017 using the commercial fishing vessel *Eilidh Anne*. The survey approach was based on the procedures identified in the Marine Monitoring Handbook, Procedural Guidance No 3-5 (Holt and Sanderson, 2001) and guidance prepared by the Northeast Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC) (Hitchin et al. 2015).

The survey used a drop-down underwater camera with a cable to the vessel to allow video footage to be viewed in real time. In addition, a Go Pro action camera (with red filter) was also used which was collecting both video and still images. The cameras were mounted on a mobile frame unit (Image A.1).

For shallow infralittoral areas with the highest potential kelp densities (depths of approximately 4-6 m), the frame was fixed below the hull of the boat and towed slowly at approximately 1-2 knots along two transect lines (T1 and T2). An error with the vessels data communication tracking system occurred on the day of the survey; therefore, the actual position of the vessel along each of the transect lines was derived from positions inputted into a handheld Garmin Global Positioning System (GPS) (see Image A.2 for site locations).

Image A.1. Mobile frame used for drop down video survey

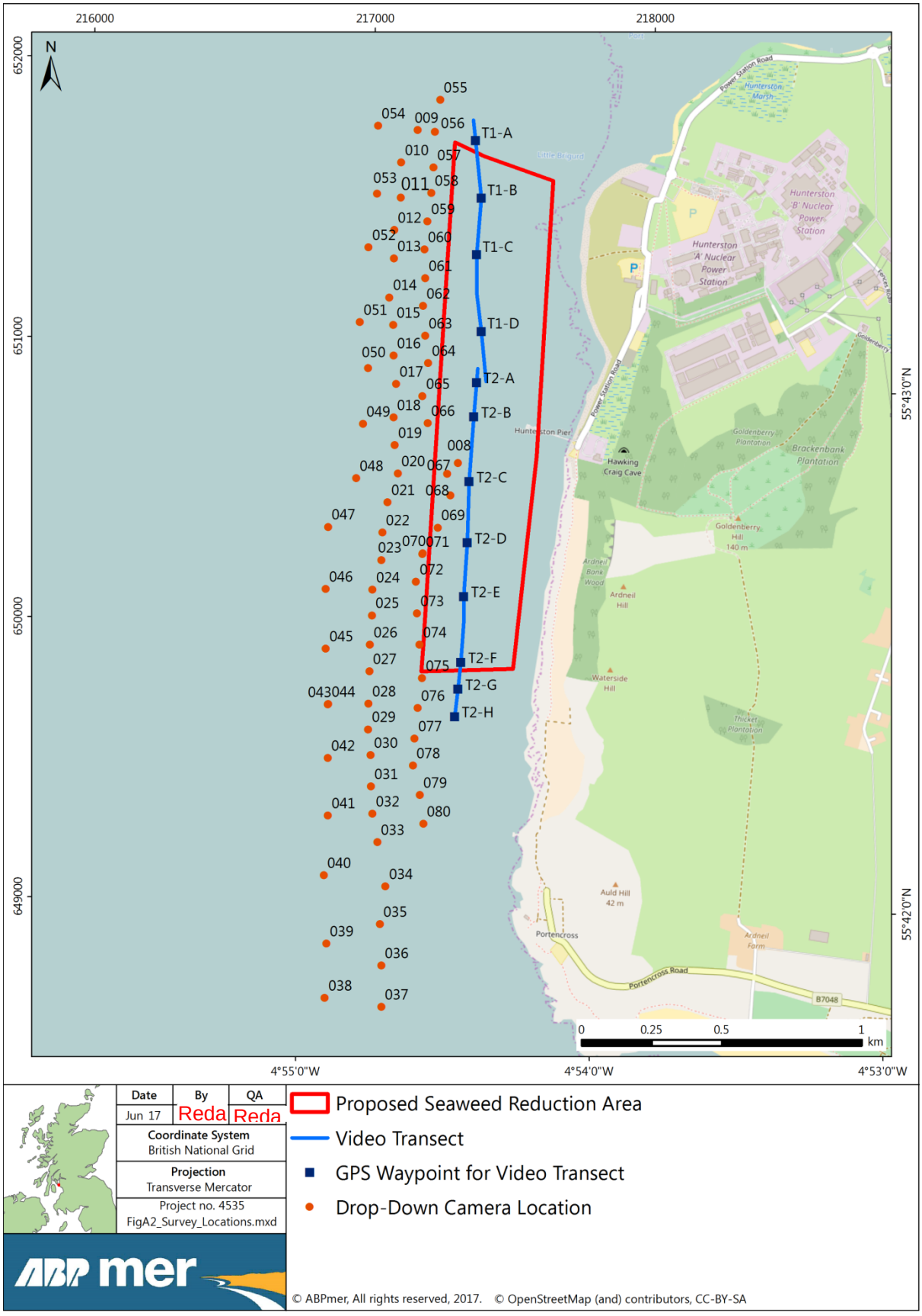


Image A.2. Transect and drop-down video survey points

For deeper areas (greater than approximately 8 m depth), the frame was dropped at fixed intervals, towed for a short distance before being retrieved. In total, 79 stations were sampled using this technique.

At each location, the density and coverage of kelp was recorded based on the Marine Nature Conservation Review (MNCR) SACFOR abundance scale (Table A.1). Biotopes were also assigned based on the Marine Habitat Classification for Britain and Ireland (MHCBI) 04.05 to biotope class levels 4 or 5 (Conner et al. 2004).

Table A.1. SACFOR Abundance Scale

Code	Description	Coverage
S	Super-abundant	>80%
A	Abundant	40-79%
C	Common	20-39%
F	Frequent	10-19%
O	Occasional	5-9%
R	Rare	1-5% or density
L	Less than rare (indicated by extrapolation)	<1% or density

A.3 Results

In total, over six hours of video footage was collected from the survey and analysed. Annex A.1 presents a summary of the survey results. This includes details of the depth, kelp coverage (based on the SACFOR scale), habitat type and species observed, as well as still images from the video at representative locations along the transects and also for each of the drop-down locations.

To further summarise the key findings from this work, the survey area was divided into three broad areas based on the depth profile. These areas are as follows:

- Shallow infralittoral (approx. 4-7 m depth);
- Mid infralittoral (approx. 8-15 m depth); and
- Lower infralittoral (depths deeper than approx. 15 m).

The broad habitats recorded at each of these depths are described in more detail below. It should be noted that no protected or nationally scarce habitats were recorded in the survey.

A.3.1 Shallow Infralittoral

The habitat within the shallow infralittoral to the north of the Hunterston B cooling water intake was characterised by mixed sediment (predominantly sand with gravel and cobbles along with boulders and shell debris). Within this area, sugar kelp *Saccharina latissima* (*Laminaria saccharina*) coverage was very dense (Image A.3). Occasional oarweed *Laminaria digitata* was also present attached to larger boulders. Based on the SACFOR abundance scale, kelp density generally varied from abundant to super-abundant (coverage >40%) in this area. Kelp fronds were approximately 1 to 3 m in length (Image A.4).

Image A.3. Dense kelp coverage within the infralittoral north of the cooling water intake

Image A.4. Example of *Saccharina latissima* frond on deck of survey vessel

Red seaweeds (such as *Plocamium cartilagineum*, *Polysiphonia elongata* and *Lomentaria clavellosa*) and brown seaweeds (including dead man's rope *Chorda filum*) were frequently observed in between kelp patches and under the kelp canopy. Epifaunal species commonly recorded included spiny starfish *Marthasterias glacialis* and edible sea urchin *Echinus esculentus*. The invasive wireweed *Sargassum muticum* was also recorded on several occasions. Mobile species recorded included the edible crab *Cancer pagurus*, shore crab *Carcinus maenas*, small-spotted catshark *Scyliorhinus canicula* and various wrasse species.

This habitat is most appropriately assigned to SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments) and IR.LIR.K.Lsac.Ldig (*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock).

Sugar kelp *S. latissima* coverage was generally less dense and patchier to the south of the Hunterston B cooling water intake (Image A.5). Kelp density generally varied from frequent to occasional in this area based on the SACFOR abundance scale (coverage >20%). The sediment generally had less cobbles and boulders compared with the area north of the Hunterston B cooling water intake, although several boulder fields were observed with denser kelp coverage evident. Spiny starfish *M. glacialis* and edible sea urchin *E. esculentus* were frequently recorded, with the common starfish *Asteria rubens* recorded occasionally. On several occasions, dead man's fingers *Alcyonium digitatum* were recorded attached to larger cobbles. Towards the south of the towed transect in this area, kelp coverage was particularly sparse with the area characterised predominately by red and brown algae species and spiny starfish.

The shallow infralittoral habitat to the south of the Hunterston B cooling water intake is most approximately assigned to SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand).

Image A.5. Spiny starfish *Marthasterias glacialis* and sugar kelp *Saccharina latissima* frond

A.3.2 Mid Infralittoral

At depths of approximately 8-15 m (mid infralittoral), coverage of sugar kelp *S. latissima* was generally very sparse with only occasional fronds recorded (coverage on the SACFOR abundance scale of <5%, i.e. classified as rare). The substrate consisted of silty sand with shell debris. Brown algae along with the sea beard *Nemertesia antennina,* spiny starfish *M. glacialis and* common starfish *A. rubens* were frequently recorded (Image A.6. Dead man's fingers *Alcyonium digitatum* and the sponge *Suberites carnosus* were also occasionally observed. This habitat has been assigned to SS.SSa.IMuSa (Infralittoral muddy sand).

A.3.3 Lower Infralittoral

No kelp was evident at the deeper depths surveyed, with the habitat consisting of sandy silt (SS.SMu.ISaMu: Infralittoral sandy mud, see Image A.7).

Image A.6. Spiny starfish *Marthasterias glacialis* and common starfish *Asteria rubens* with shell debris

Image A.7. Sandy mud habitat recorded at deeper depths sampled during survey

A.3.4 Other Ecological Observations

A common seal *Phoca vitulina* was observed hauled out at low water on a flat rock below the Hunterston B Power Station (in the vicinity of the cooling water outfall). A solitary short-beaked common dolphin *Delphinus delphis*, known locally as 'Kylie', was also observed while on the return journey to Largs Marina. In addition, large numbers of moon jellyfish *Aurelia aurita*, lion's mane jellyfish *Cyanea capillata*, comb jellies and sea gooseberrys were observed.

A.4 References

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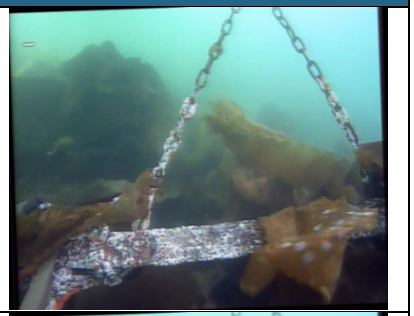
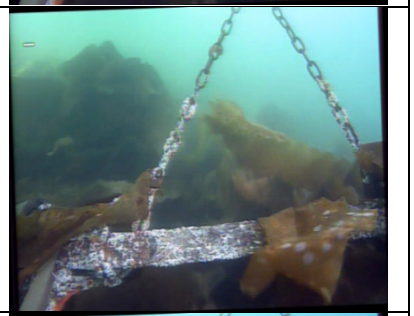
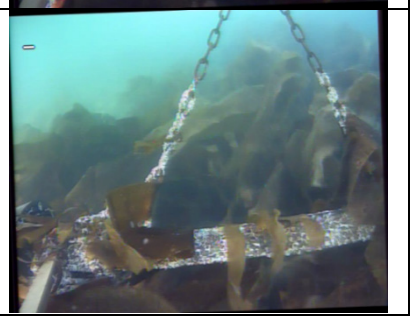
A.5 Abbreviations/Acronyms

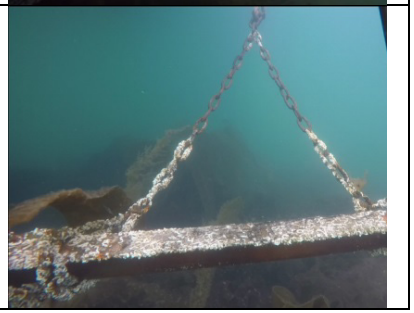
GPS	Global Positioning System
MHCBI	Marine Habitat Classification for Britain and Ireland
MNCR	Marine Nature Conservation Review
NMBAQC	Northeast Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC)
SACFOR	Abundance scale: Super-abundant (S), Abundant (A), Common (C), Frequent (F), Occasional (O), Rare (R), Less than rare (L)

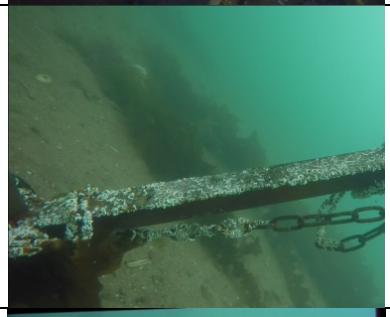
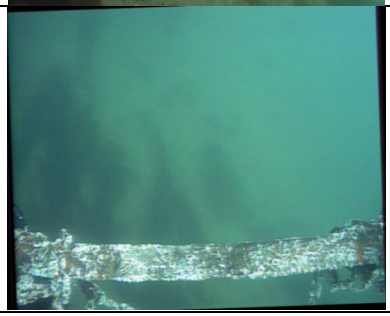
Cardinal points/directions are used unless otherwise stated.

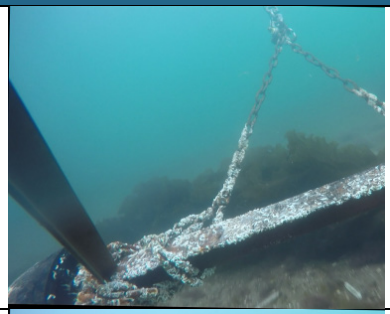
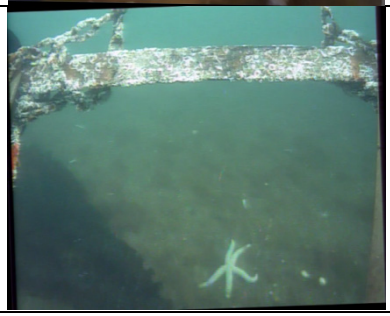
SI units are used unless otherwise stated.

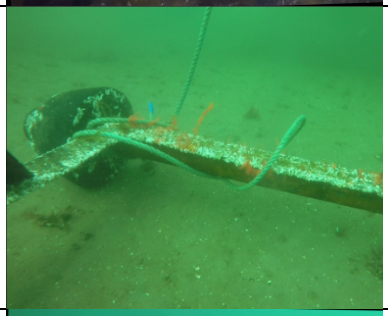
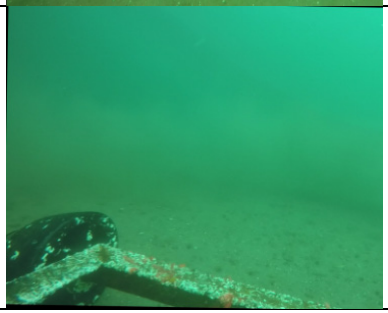
Annex A.1 Survey Results

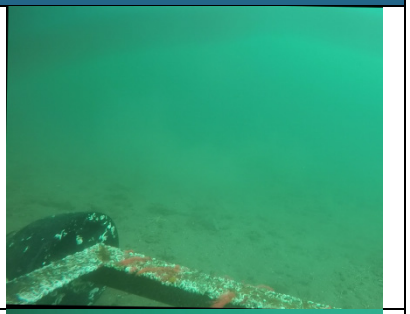
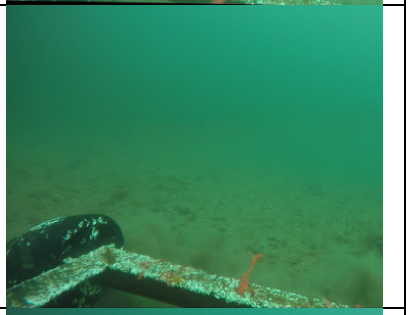
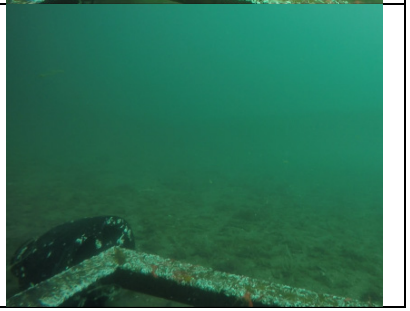
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
T1-a		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles. Dense coverage of sugar kelp *Saccharina latissima* and very occasional oarweed *Laminaria digitata*. Red seaweeds and brown seaweeds (including dead man's rope *Chorda filum*. Spiny starfish *Marthasterias glacialis* and edible sea *urchin Echinus esculentus* observed frequently.	
T1-a		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles. Dense coverage of sugar kelp *Saccharina latissima* and very occasional oarweed *Laminaria digitata*. Red seaweeds and brown seaweeds (including dead man's rope *Chorda filum*. Spiny starfish *Marthasterias glacialis* and edible sea *urchin Echinus esculentus* observed frequently.	
T1-b		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles. Dense coverage of sugar kelp. Brown and red seaweeds. Spiny starfish, common sea urchin.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
T1-c		S-A	Mixture of SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments) and IR.LIR.K.Lsac.Ldig (*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock)	Boulder field with dense sugar kelp coverage. Oarweed *Laminaria digitata* attached to larger bouderes and cobbles.	
T1-d		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles and occational boulders. Dense coverage of sugar kelp. Brown and red seaweeds. Spiny starfish, common sea urchin.	
T2-a		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles Dense coverage of sugar kelp. Red and brown seaweeds including dead man's rope and wireweed *Sargassum muticum*. Spiny starfish abundant.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
T2-b		S-A	SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments)	Sand with gravel and cobbles. Dense coverage of sugar kelp. Brown, green and red seaweeds. Spiny starfish and common sea urchin common.	
T2-c	8 m	F-O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with gravel and cobbles. Patches of sugar kelp along with spiny starfish, occational common starfish *Asteria rubens* and common sea urchin. Evidence of dead man's fingers (*Alcyonium digitatum*) attached to larger cobbles.	
T2-d	8 m	F-O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with gravel and cobbles. Patches of sugar kelp. Red and brown algae. Spiny starfish.	

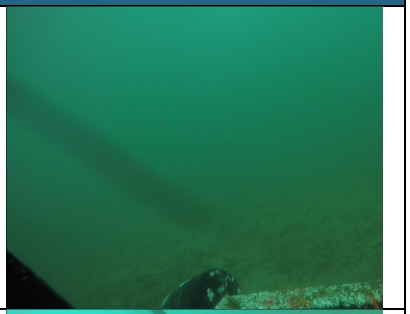
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
T2--e	8m	F-O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with gravel and cobbles. Patches of sugar kelp. Red and brown algae. Spiny starfish. Edible crab observed.	
T2-f	5-6 m	A	Mixture of SS.SMp.KSwSS.LsacR (*Laminaria saccharina* and red seaweeds on infralittoral sediments) and IR.LIR.K.Lsac.Ldig (*Laminaria saccharina* and *Laminaria digitata* on sheltered sublittoral fringe rock)	Boulder field with dense sugar kelp coverage. Oarweed attached to larger bouderes and cobbles. Sea urchins attached to rocks. Spiny starfish.	
T2-g	8 m	O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with gravel and cobbles. Sparse patches of sugar kelp along with starfish and urchins.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
T2-h	8 m	R	SS.SSa.IMuSa (Infralittoral muddy sand) *Note: kelp in drop-down video still frame was attached to the frame (i.e. not from locality).	Sand with shell debris. Very occasional sugar kelp fronds. Starfish and sea urchins.	
8	Drop-down. 11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris.	
9	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
10	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with spiny starfish evident.	
11	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with sea beard *Nemertesia antennina*.	
12	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with sea beard *Nemertesia antennina*.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
13	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with shell debris.	
14	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand. Common starfish. Single sugar kelp frond.	
15	9-10 m	O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Silty sand. Common starfish. Occasional sugar kelp fronds.	

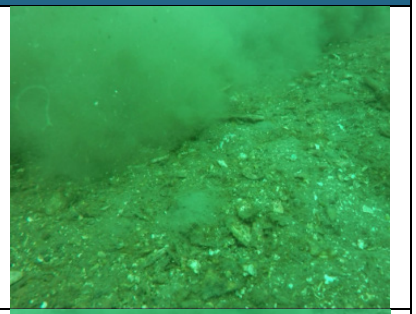
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
16	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with no starfish.	
17	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with sea beard *Nemertesia antennina*. Sparse algae.	
18	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Frame upside down.	

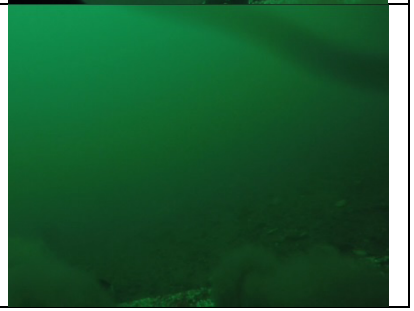
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
19	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
20	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
21	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
22	9-10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Mixed sand and shell debris with occasional common starfish.	
23	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Mixed sand and shell debris including razor shells.	
24	12 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Mixed sand and shell debris including razor shells.	

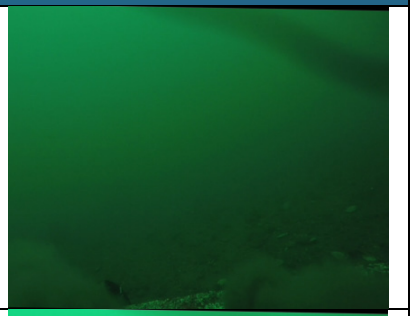
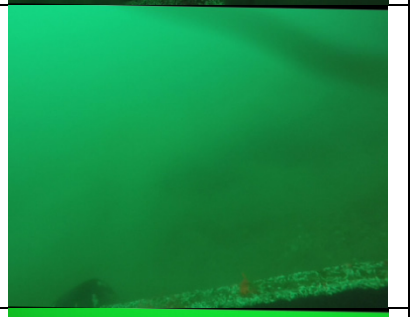
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
25	12 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris with a spiny starfish.	
26	14 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris. Starfish and a flatfish (species undetermined).	
27	14 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with sea beard *Nemertesia antennina*.	

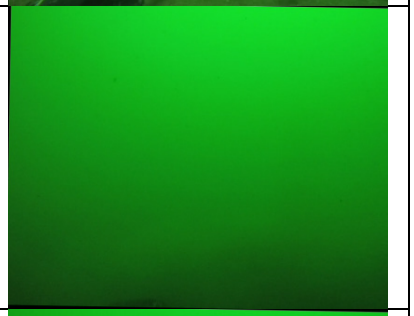
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
28	14 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris.	
29	14 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Shore crab *Carcinus maenas* and starfish species.	
30	14 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris.	

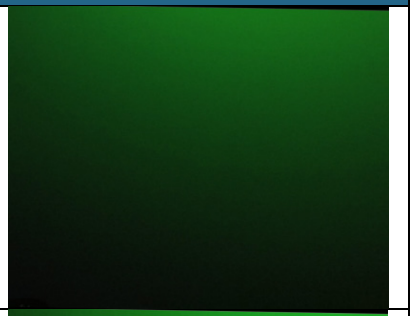
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
31	14 m	R	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris. Single frond of sugar kelp recorded.	
32	14.3 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand and shell debris. Spiny starfish.	
33	13 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand and shell debris.	

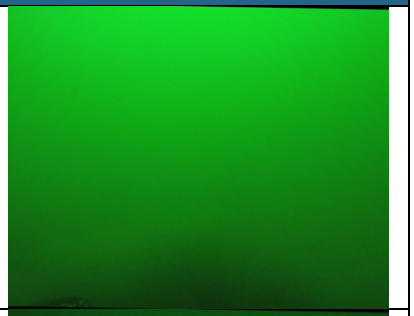
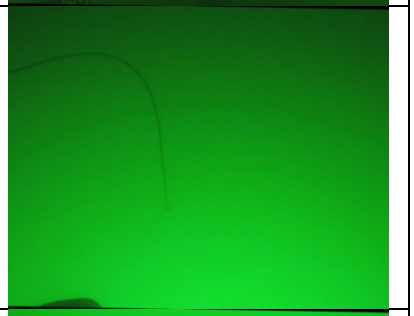
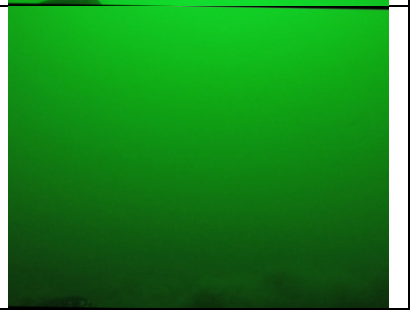
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
34	18.5 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand and shell debris.	
35	18.5 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand and shell debris.	
36	20 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand and shell debris.	

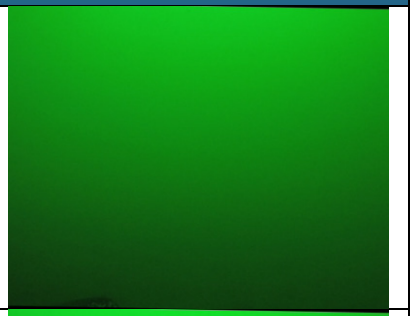
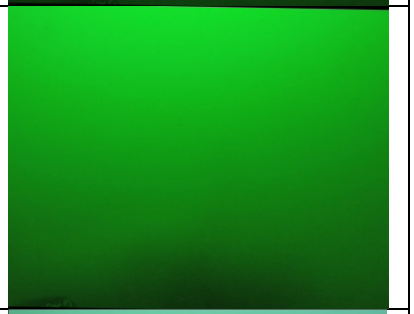
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
37	21 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Frame upside down.	
38 New SD Card	23 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
39	22 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Frame upside down.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
40	23 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
41	20 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
42	20. 5 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
43	21.5 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
44	23 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Silt.	
45	25 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Silt.	
46	45 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)		Not enough light to view sediment.

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
47	28 m		SS.SMu.ISaMu (Infralittoral sandy mud)	Silt.	
48	26 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Silty sand with starfish.	
49	26 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
50	28 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
51	28 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Upside down.	
52	28 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
53	29 m	L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
54		L	SS.SMu.ISaMu (Infralittoral sandy mud)	Sandy silt.	
55	6 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and occasional algae.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
56	7 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Single frond of sugar kelp, spiny starfish.	
57	7 m	R	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Single frond of sugar kelp, common starfish.	
58	7 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae and spiny starfish. Kelp stuck on wheel.	

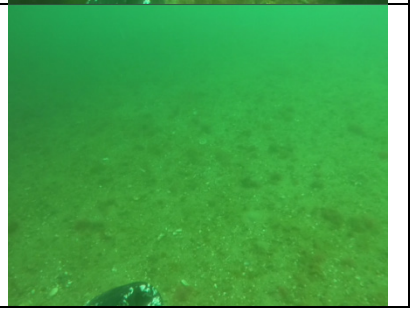
Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
59	7 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae.	
60	7 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae. Spiny starfish and common starfish.	
61	6.6 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae. Spiny starfish and common starfish.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
62	6.6 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae. Lots of starfish and occasional sea urchins. Algae.	
63	7.3 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris and gravel. Red and brown algae. Starfish.	
64	7.4 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris. Red and brown algae. Starfish.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
65	8 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
66	8 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
67	8 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with gravel.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
68	8 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris. Red and brown algae. Occasional sugar kelp fronds.	
69	9 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris. Sparse algae.	
70	9. 5 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris. Sparse algae.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
71	10 m	O	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with shell debris. Very occasional sugar kelp frond and starfish.	
72	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris.	
73	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
74	10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Sand with shell debris. Shore crab *Carcinus maenas*.	
75	9 m	F-C	SS.SMp.KSwSS.LsacR.S (*Laminaria saccharina* and filamentous red algae on infralittoral sand)	Sand with shell debris. Frequent sugar kelp fronds, catshark, spiny starfish and common urchins. Red algae. Dead man's rope *Chorda filum*.	
76	10 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
77	10.5 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
78	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	
79	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand with occasional cobble debris. Dead man's fingers *Alcyonium digitatum*. Sponge *Suberites carnosus* and spiny starfish.	

Site	Approx. Depth	Kelp Coverage[1]	Biotope	Survey Notes	Drop-Down Video Still Frame
80	11 m	L	SS.SSa.IMuSa (Infralittoral muddy sand)	Silty sand.	

[1] Seabed kelp coverage based on SACFOR scale (http://www.marlin.ac.uk/glossary/typicalabundance; Accessed June 2017):
S = Super-abundant (>80%); A = Abundant (40-79%); C = Common (20-39%); F = Frequent (10-19%); O = Occasional (5-9%); R = Rare (1-5%);
L = Less than rare indicated by extrapolation (<1%).

B Water Framework Directive (WFD) Compliance Assessment

B.1 Introduction

B.1.1 Project Overview

ABPmer has been commissioned by Hunterston B Power Station, owned and operated by EDF Energy, to undertake an environmental appraisal of the potential marine environmental effects of seaweed clearance from the vicinity of its cooling water intake (see Main Report). To support the marine licence application, a Water Framework Directive (WFD) compliance assessment has been undertaken to determine whether the proposed works at Hunterston complies with the objectives of the WFD. This information together with the environmental appraisal will be submitted to Marine Scotland as part of the marine licensing process. Figure B.1 shows the location of the proposed works and surrounding WFD water bodies.

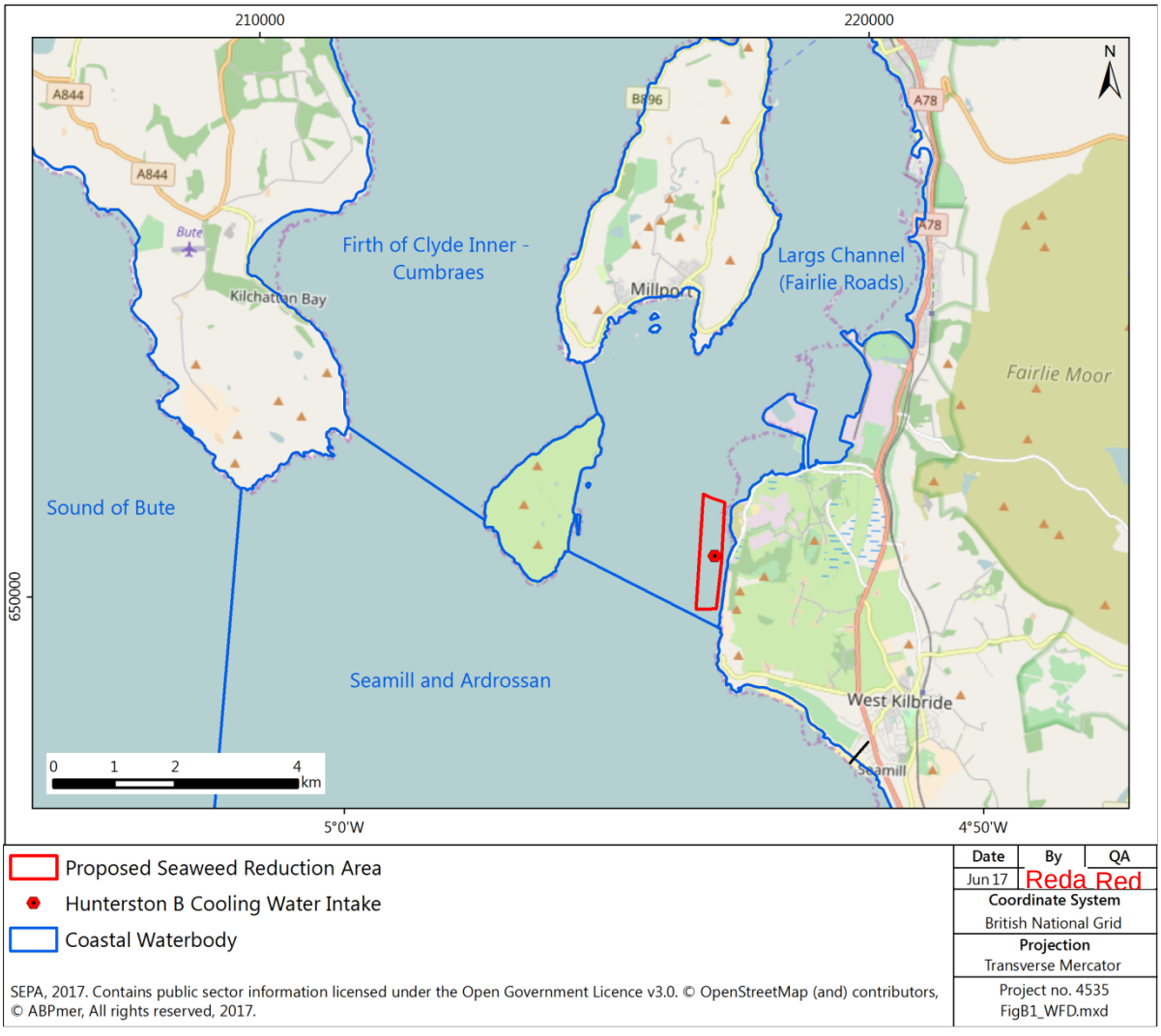


Figure B.1. Location of Hunterston B Power Station, cooling water intake, proposed seaweed reduction area and surrounding water bodies

B.1.2 Water Framework Directive (WFD)

The WFD (2000/60/EC) came into force in 2000 and establishes a framework for the management and protection of Europe's water resources. It is implemented in Scotland through the Water Environment Water Services (Scotland) Act 2003 and the Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activity Regulations (CAR). The overall objective of the WFD is to achieve good status (GS) in all inland, transitional, coastal and ground waters by 2015, unless alternative objectives are set and there are appropriate reasons for time limited derogation.

The WFD divides rivers, lakes, lagoons, estuaries, coastal waters (out to one nautical mile from the low water mark), man-made docks and canals into a series of discrete surface water bodies. It sets ecological as well as chemical targets (objectives) for each surface water body. For a surface water body to be at overall GS, the water body must be achieving good ecological status (GES) and good chemical status (GCS). Ecological status is measured on a scale of high, good, moderate, poor or bad, while chemical status is measured as good or fail (i.e. failing to achieve good).

Each surface water body has a hydromorphological designation that describes how modified a water body is from its natural state. Water bodies are either undesignated (i.e. natural, unchanged), designated as a heavily modified water body (HMWB) or designated as an artificial water body (AWB). HMWBs are defined as bodies of water which, as a result of physical alteration by sustainable human use activities (such as flood protection and navigation) are substantially changed in character and cannot therefore meet GES. AWBs are artificially created through human activity. The default target for HMWBs and AWBs under the WFD is to achieve good ecological potential (GEP), a status recognising the importance of their human use while ensuring ecology is protected as far as possible.

The ecological status of surface waters is classified using information on the biological (e.g. fish, benthic invertebrates, phytoplankton, angiosperms and macroalgae), physico-chemical (e.g. dissolved oxygen and salinity) and hydromorphological (e.g. hydrological regime) quality of the body of water, as well as several specific pollutants (e.g. copper and zinc). Compliance with chemical status objectives is assessed in relation to environmental quality standards (EQS) for a specified list of 'priority' and 'priority hazardous' substances. These substances were first established by the Priority Substances Directive (PSD) (2008/105/EC) which entered into force in 2009. The PSD sets objectives, amongst other things, for the reduction of these substances through the cessation of discharges or emissions. As required by the WFD and PSD, a proposal to revise the list of priority (hazardous) substances was submitted in 2012. Subsequently, an updated PSD (2013/39/EU) was published in 2013, identifying new priority substances, setting EQSs for those newly identified substances, revising the EQS for some existing substances in line with scientific progress and setting biota EQSs for some existing and newly identified priority substances.

In addition to surface water bodies, the WFD also incorporates groundwater water bodies. Groundwaters are assessed against different criteria compared to surface water bodies since they do not support ecological communities (i.e. it is not appropriate to consider ecological status of a groundwater). Therefore, groundwater water bodies are classified as good or poor quantitative status in terms of their quantity (groundwater levels and flow directions) and quality (pollutant concentrations and conductivity), along with chemical (groundwater) status.

River Basin Management Plans (RBMPs) are a requirement of the WFD, setting out measures for each river basin district to maintain and improve quality in surface and groundwater water bodies where necessary. In 2009, the Scottish Environment Protection Agency (SEPA) published the first cycle (2009 to 2015) of RBMPs for Scotland, reporting the status and objectives of each individual water body. SEPA subsequently published updated RBMPs for Scotland as part of the second cycle (2015 to 2021).

The proposed works at Hunterston are located within the Largs Channel (Fairlie Roads) coastal water body (see Figure B.1) in the Scotland river basin district which is reported in the Scotland RBMP (SEPA, 2015).

Consideration of WFD requirements is necessary for developments which have the potential to cause deterioration in ecological, quantitative and/or chemical status of a water body or to compromise improvements which might otherwise lead to a water body meeting its WFD objectives. Therefore, it is necessary to consider the potential for the proposed works at Hunterston to impact WFD water bodies, specifically referring to the following environmental objectives of the WFD:

- Prevent deterioration in status of all surface water bodies (Article 4.1 (a)(i));
- Protect, enhance and restore all surface water bodies with the aim of achieving good surface water status by 2015 or later assuming grounds for time limited derogation (Article 4.1 (a)(ii));
- Protect and enhance all HMWBs/AWBs, with the aim of achieving GEP and GCS by 2015 or later assuming grounds for time limited derogation (Article 4.1 (a)(iii));
- Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances (Article 4.1 (a)(iv));
- Prevent or limit the input of pollutants into groundwater and prevent deterioration of the status of all groundwater water bodies (Article 4.1 (b)(i));
- Protect, enhance and restore all groundwater water bodies and ensure a balance between abstraction and recharge of groundwater (Article 4.1 (b)(ii));
- Ensure the achievement of objectives in other water bodies is not compromised (Article 4.8); and
- Ensure compliance with other community environmental legislation (Article 4.9).

In the absence of formal guidance for the preparation of WFD compliance assessments in Scotland, the Environment Agency's "Clearing the Waters for All" process has been used as a template for the assessment[11]. This guidance outlines how to assess the impact(s) of activities in transitional and coastal waters in relation to WFD objectives, setting out the following three discrete stages:

- **Screening**: excludes any activities that do not need to go through the scoping or impact assessment stages (Section B.2);
- **Scoping**: identifies the receptors that are potentially at risk from an activity and need impact assessment (Section B.3); and
- **Impact Assessment**: considers the potential impacts of an activity, identifies ways to avoid or minimise impacts, and indicates if an activity may cause deterioration or jeopardise the water body achieving GS (Section B.4).

B.2 Screening

B.2.1 Project Description

Hunterston B Power Station utilises the sea as a source of cooling water for plant systems. The cooling water enters the station by passing through a coarse screen located at the cooling water intake jetty (see Figure B.1). On a number of occasions, the station has experienced high levels of seaweed ingress onto the cooling water intake screens. The high levels of impingement have reduced water flow through the screens requiring the station to reduce energy generation.

[11] https://www.gov.uk/guidance/water-framework-directive-assessment-estuarine-and-coastal-waters (Accessed June 2017).

The station undertook a limited programme of seaweed clearance in 2016 from within the vicinity of the cooling water intakes with the approval of Marine Scotland. This is considered to have led to a subsequent reduction in seaweed impingement. The station therefore proposes to undertake similar works in 2017. Based on drop-down camera surveys in 2016 and 2017, the main species of seaweed present within the proposed seaweed reduction area is the kelp *Saccharina latissima* (formerly *Laminaria saccharina*). This is also the main type of seaweed that collects on the cooling water intake screens (Hunterston B Power Station, *pers. comm.*).

Hunterston B Power Station is seeking a one year marine licence for seaweed removal within the proposed seaweed reduction area. Table B.1 provides a summary of the proposed works at Hunterston.

Table B.1. Summary of proposed works

Location of Proposed Works	See Figure B.1.
Area of Proposed Works	0.64 km^2 (64 hectares).
Duration and Timing of Proposed Works	Up to three campaigns during the one year licence period (expected to be conducted in July/August 2017, September/October 2017 and April/May 2018; up to approximately ten days per campaign; subject to weather conditions, the working pattern will involve 12-hour working days.
Seaweed Removal Methodology	The removal technique will consist of using a standard fishing net supplemented with a mobile chain mat were practicable, deployed from a suitable commercial fishing vessel. The fishing net is a standard nephrops trawl 460 meshes in circumference made with 80 mm braided netting. This is mounted on 24 m of standard 250 mm rock hoppers rigged to have minimum bottom contact to reduce the disturbance of the seabed and associated marine life. The net will have an approximate weight in the water of 400 kg. The deployment of the net involves a pair of No. 5 Bison trawl doors producing an opening net of approximately 12 to 15 m. The mobile chain mat is made of 12 m of 16 mm chain mounted in a U-shape onto a 100 mm pipe with 450 mm wheels. The mobile mat is designed to reduce ground contact and disturbance to a minimum. For each campaign, it is envisaged that a visual survey of the proposed seaweed reduction area would be undertaken using a drop-down camera to identify the distribution and density of seaweed growth. Based on this survey, a plan would be developed by EDF Energy prior to the removal activity taking place, targeting areas of denser seaweed growth. Daily monitoring of the amounts of seaweed entering the cooling water intakes will also be undertaken to assess the effectiveness of the activity with a view to reducing the area over time.
Quantity of Seaweed to be Removed	150 tonnes (wet weight; three campaigns at 50 tonnes wet weight) of seaweed from within the proposed seaweed reduction area, primarily comprising the kelp *S. latissima*.
Seaweed Disposal Methodology	Seaweed collected during the activity will be stored on the vessel and contained within 1 tonne rubble style sacks or an open bunded 1,000 litre pallet tank; the contained seaweed would then be craned ashore for disposal using an approved method.

A teleconference between EDF Hunterston, ABPmer and Marine Scotland on 19 May 2017 confirmed that the works did not require a formal environmental impact assessment (EIA), but that an environmental appraisal would be required to support marine licence application with specific consideration of the potential impacts on WFD objectives (discussed here).

B.2.2 Potentially Affected Water Bodies

To determine which water bodies would potentially be affected by the proposed works, all surface and groundwater water bodies located within 2 km of the site were recorded (see Figure B.1). The following water bodies were initially screened in:

- Largs Channel (Fairlie Roads) coastal water body;
- Firth of Clyde Inner – Cumbraes coastal water body;
- Seamill and Ardrossan coastal water body;
- West Kilbride groundwater water body; and
- North Ayrshire Coastal groundwater water body.

Based on the location and scale of the proposed works at Hunterston, it is considered unlikely to cause a significant non-temporary effect on the Firth of Clyde Inner – Cumbraes coastal water body (ID: 200028) or the West Kilbride (ID: 150534) and North Ayrshire Coastal (ID: 150785) groundwater water bodies, or cause deterioration in status at the water body level. Therefore, these three water bodies have been screened out of the assessment and will not be discussed further.

Table B.2. Largs Channel (Fairlie Roads) coastal water body summary

Water Body Name	Largs Channel (Fairlie Roads)
Water Body ID	200026
Water Body Type	Coastal
Water Body Area	29.87 km^2
Hydromorphological Designation	N/A
Protected Area Designations	Bathing Water Directive, Shellfish Waters Directive
Overall Status	Good
Ecological Status	Good
Chemical Status	Good (Pass)
Parameters Not At Good Status	N/A

Table B.3. Seamill and Ardrossan coastal water body summary

Water Body Name	Seamill and Ardrossan
Water Body ID	200024
Water Body Type	Coastal
Water Body Area	98.02 km^2
Hydromorphological Designation	N/A
Protected Area Designations	Bathing Water Directive, Shellfish Waters Directive
Overall Status	Good
Ecological Status	Good
Chemical Status	Good (Pass)
Parameters Not At Good Status	N/A

Table B.2 and Table B.3 provide a summary of the Largs Channel (Fairlie Roads) (ID: 200026) and Seamill and Ardrossan (ID: 200024) coastal water bodies respectively, including current water body status (overall, ecological and chemical). The proposed works at Hunterston are located within the Largs Channel (Fairlie Roads) coastal water body (Figure B.1).

The Largs Channel (Fairlie Roads) and Seamill and Ardrossan coastal water bodies are both currently classified as being at overall good status, based on good ecological potential and good (pass) chemical status. The overall, ecological and chemical status/potential is determined by the "one-out, all-out" principle, whereby the poorest individual parameter's classification defines the assessment level. Therefore, if any parameter is assessed as less than good (e.g. moderate), then the status for that water body is reported at that level. An overall good status confirms that each individual parameter measured within these two coastal water bodies is achieving at least the standard required to report good status.

B.2.3 Protected Areas

The WFD requires that activities are also in compliance with other relevant legislation, such as the Habitats Directive (92/43/EEC as amended), Birds Directive (2009/147/EC), Ramsar Convention, Bathing Water Directive (2006/7/EC), Nitrates Directive (91/676/EEC), Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) and the provisions of the Shellfish Waters Directive (2006/113/EC).

Nature Conservation Designations

Article 3 of the Habitats Directive (92/43/EEC as amended) requires the establishment of a European network of important high-quality conservation sites known as Special Areas of Conservation (SAC) that will contribute to conserving habitats and species identified in Annexes I and II of the Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). In accordance with Article 4 of the Birds Directive (2009/147/EC), Special Protection Areas (SPA) are strictly protected sites classified for rare and vulnerable birds (Annex I of the Directive), and for regularly occurring migratory species. Ramsar sites are wetlands of international importance designated under the Ramsar Convention (adopted in 1971 and came into force in 1975), providing a framework for the conservation and wise use of wetlands and their resources.

There are no international nature conservation protected areas located within 2 km of the proposed works at Hunterston (see Figure B.2). The Renfrewshire Heights and Arran Moors SPAs are located greater than 10 km from Hunterston; however, these two sites are designated for terrestrial features and thus unlikely to be affected by the proposed works. The nearest nature conservation protected areas which are designated for marine features are the Inner Clyde SPA and Ramsar site, located more than 25 km to the northeast of Hunterston, while the Inner Hebrides and the Minches SAC is located approximately 42 km to the west.

Bathing Water Directive

The revised Bathing Water Directive (rBWD) (2006/7/EC) was adopted in 2006, updating the microbiological and physico-chemical standards set by the original Bathing Water Directive (BWD) (76/160/EEC) and the process used to measure/monitor water quality at identified bathing waters. The rBWD focuses on fewer microbiological indicators, whilst setting higher standards, compared to those of the BWD. Bathing waters under the rBWD are classified as excellent, good, sufficient or poor according to the levels of certain types of bacteria (intestinal enterococci and Escherichia coli) in samples obtained during the bathing season (May to September). The BWD was repealed at the end of 2014 and monitoring of bathing water quality has been reported against rBWD indicators since

2015. The new classification system considers all samples obtained during the previous four years and, therefore, data has been collected for rBWD indicators since 2012.

There are no designated bathing waters situated within 2 km of the proposed works at Hunterston. As shown in Figure B.3, the closest bathing waters to the proposed works are Seamill and Millport Bay at approximately 3 km to the southeast and north, respectively (both bathing waters assessed as good in 2016; SEPA, 2016).

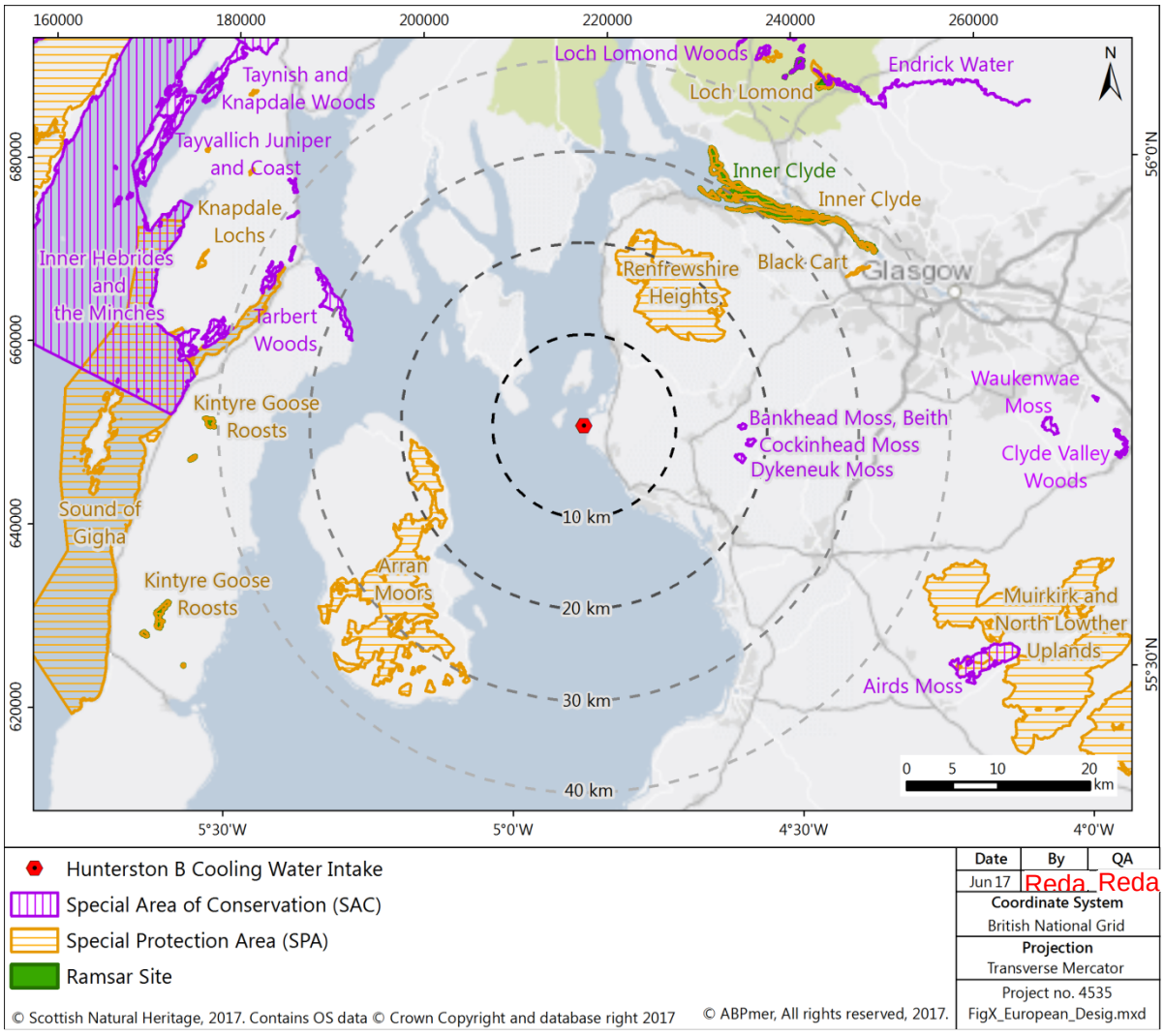


Figure B.2. Location of nature conservation protected areas in the vicinity of the proposed works at Hunterston

Nitrates Directive

The Nitrates Directive (91/676/EEC) aims to reduce water pollution from agricultural sources and to prevent such pollution occurring in the future (nitrogen is one of the nutrients that can affect plant growth). Under the Nitrates Directive, surface waters are identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water body.

The Largs Channel (Fairlie Roads) and Seamill and Ardrossan coastal water bodies are not designated under the Nitrates Directive and there are no surface water Nitrate Vulnerable Zones (NVZs), designated as being at risk from agricultural nitrate pollution, located in the vicinity of the proposed

works at Hunterston. The nearest NVZ is Stranraer Lowlands, located greater than 100 km to the south[12].

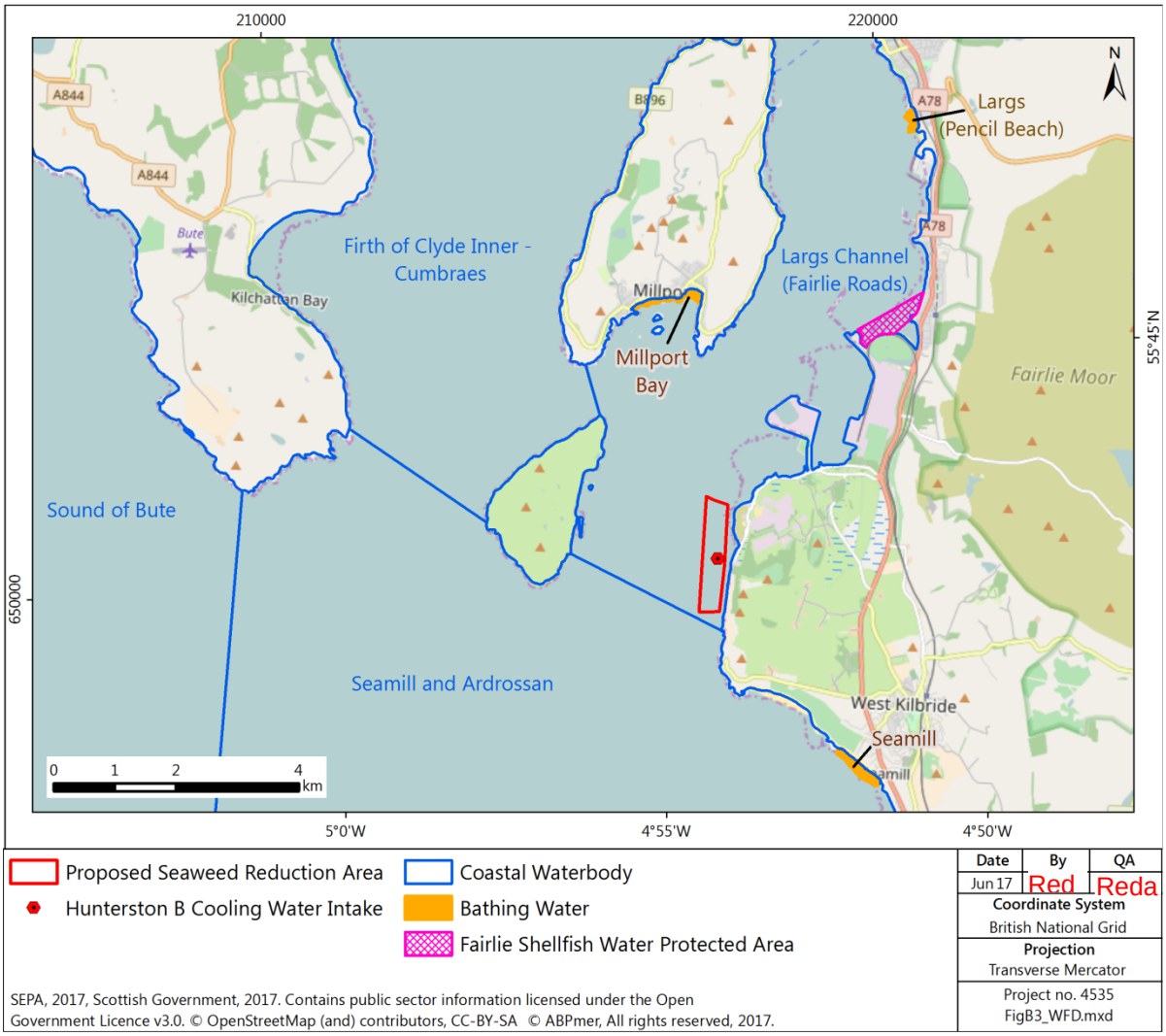


Figure B.3. Location of Bathing and Shellfish Water Protected Areas

Shellfish Waters Directive

The Shellfish Waters Directive (2006/113/EC) was repealed in December 2013 and subsumed within the WFD. In Scotland, it has been replaced by the Water Environment (Shellfish Water Protected Areas: Designation) (Scotland) Order 2013 which came into force on 22 December 2013, and subsequently updated in 2016. The Order identifies 85 coastal areas as shellfish waters, which are identified on a series of maps.

The closest Shellfish Water Protected Area to Hunterston is Fairlie at approximately 4 km to the northeast[13] (Figure B.3). The Fairlie production area is designated for Pacific oyster (Crassostrea gigas). Food Standards Scotland is responsible for ensuring that shellfish from designated harvesting areas meet the health standards laid down in European Commission (EC) Regulation 853/2004. The latest classification report categorised the site as Class B for the period April 2017 to March 2018, whereby 90% of samples collected during the review period must present less than 4,600 *E. coli* per

12 http://www.gov.scot/Resource/0049/00490702.pdf (Accessed June 2017).

13 http://www.gov.scot/Topics/Environment/Water/15561/ShellfishWaters/LocationMaps (Accessed June 2017).

100 g of the flesh and intravalvular liquid. The remaining 10% of samples must present less than 46,000 *E. coli* per 100g of flesh and intravalvular liquid. Harvested products must be subject to purification, relaying in an approved Class A area or cooked (heat treated) by an approved method[14].

Urban Waste Water Treatment Directive

The UWWTD (91/271/EEC) aims to protect the environment from the adverse effects of the collection, treatment and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges. In general, the UWWTD requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water. Sensitive areas under the UWWTD are water bodies affected by eutrophication of elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

There are no designations under the UWWTD located within 2 km of the proposed works at Grays (Defra, 2012). The nearest designated areas are the River Irvine (Cessnock confluence to Tidal Weir) and Lugton Water "Sensitive Area (Eutrophic and Freshwater Fish) Rivers" which are approximately 20 km to the southeast of Hunterston at the mouth to Irvine Bay.

B.3 Scoping

The Environment Agency's "Clearing the Water for All" guidance provides a scoping template to record findings and consider potential risks for several key receptors, specifically:

- Hydromorphology;
- Biology;
  - Habitats;
  - Fish;
- Water quality;
- Protected areas; and
- Invasive non-native species (INNS).

Each receptor is considered in the following sections for the two water bodies potentially affected by the proposed works (i.e. Largs Channel (Fairlie Roads) and Seamill and Ardrossan coastal water bodies; see Section B.2.2). Potential risks that have been scoped into the assessment are highlighted in green and considered within the impact assessment stage (Section B.4), while those scoped out of the assessment are highlighted in red.

B.3.1 Hydromorphology

Hydromorphology is the physical characteristics of estuaries and coasts, including the size, shape and structure of the water body and the flow and quantity of water and sediment. Table B.4 presents a summary of hydromorphological considerations and associated risk issues for the proposed works at Hunterston. As at least one hydromorphological consideration indicates that a risk could be associated with the proposed works within the Largs Channel (Fairlie Roads) coastal water body, this receptor has been scoped into the impact assessment (Section B.4).

[14] http://www.foodstandards.gov.scot/sites/default/files/Final%202017-18%20Annual%20Classification%20Document_0.pdf (Accessed June 2017).

Table B.4. Hydromorphology scoping summary

Hydromorphology Considerations	Hydromorphology Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Consider if your activity could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status?	No (hydromorphology at good status). Impact assessment not required.	No (hydromorphology at high status, but unlikely to be impacted by the proposed works). Impact assessment not required.
Consider if your activity could significantly impact the hydromorphology of any water body?	Yes (potential changes to hydromorphology as a result of works). Requires impact assessment.	No (hydromorphology unlikely to be impacted by the proposed works). Impact assessment not required.
Consider if your activity is in a water body that is heavily modified for the same use as your activity?	No (the water body is not heavily modified). Impact assessment not required.	No (the water body is not heavily modified). Impact assessment not required.

B.3.2 Biology

Habitats

It is necessary to consider the impact of the physical footprint of an activity on nearby marine and coastal habitats. This specifically refers to habitats of higher sensitivity (e.g. intertidal seagrass, maerl and saltmarsh) and lower sensitivity (e.g. cobbles, gravel and shingle, subtidal rock reef and intertidal soft sediments like sand and mud). Table B.5 presents a summary of biology (habitat) considerations and associated risk issues for the proposed works at Hunterston. As at least one biology (habitats) consideration indicates that a risk could be associated with the proposed works within the Largs Channel (Fairlie Roads) coastal water body and the adjacent Seamill and Ardrossan coastal water body, this receptor has been scoped into the impact assessment (Section B.4).

Table B.5. Biology (habitats) scoping summary

Biology (Habitats) Considerations	Biology (Habitats) Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Is the footprint of the activity 0.5 km^2 or larger?	Yes (0.64 km^2). Requires impact assessment.	
Is the footprint of the activity 1% or more of the water body's area?	Yes (2.1%). Requires impact assessment.	No (0.7%). Impact assessment not required.
Is the footprint of the activity within 500 m of any higher sensitivity habitat?	Yes (saltmarsh habitat within 500 m; Gardline Environmental Ltd, 2007). Requires impact assessment.	
Is the footprint of the activity 1% or more of any lower sensitivity habitat?	Yes (cobbles, gravel and shingle, intertidal soft sediments like sand and mud, rocky shore, subtidal soft sediments; Gardline Environmental Ltd, 2007). Requires impact assessment.	

Fish

Activities occurring within an estuary could impact on normal fish behaviour such as movement, migration or spawning. Table B.6 presents a summary of biology (fish) considerations and associated risk issues for the proposed works at Hunterston. As at least one biology (fish) consideration indicates that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment (Section B.4).

Table B.6. Biology (fish) scoping summary

Biology (Fish) Considerations	Biology (Fish) Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Consider if your activity is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary?	Yes. "Continue with questions".	
Consider if your activity could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)?	Yes (disturbance of potential nursery habitat). Requires impact assessment.	
Consider if your activity could cause entrainment or impingement of fish?	No (not applicable). Impact assessment not required.	

B.3.3 Water Quality

Consideration should be made regarding whether phytoplankton status and harmful algae could be affected by the proposed works, as well as identifying the potential risks of using, releasing or disturbing chemicals. Table B.7 presents a summary of water quality considerations and associated risk issues of the proposed works at Hunterston. As at least one water quality consideration indicates that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment (Section B.4).

Table B.7. Water quality scoping summary

Water Quality Considerations	Water Quality Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Consider if your activity could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)?	No (duration of proposed works up to approximately ten days per campaign; temporary and minor effects on water quality anticipated). Impact assessment not required.	
Consider if your activity is in a water body with a phytoplankton status of moderate, poor or bad?	No (phytoplankton classification is good). Impact assessment not required.	No (phytoplankton classification is high). Impact assessment not required.
Consider if your activity is in a water body with a history of harmful algae?	No (there is no known history of harmful algae). Impact assessment not required.	
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if the chemicals are	No (not applicable). Impact assessment not required.	

Water Quality Considerations	Water Quality Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
on the Environmental Quality Standards Directive (EQSD) list?		
If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if it disturbs sediment with contaminants above Cefas Action Level 1?	Yes (potential for sediments to be disturbed). Requires impact assessment.	
If your activity has a mixing zone (like a discharge pipeline or outfall) consider if the chemicals released are on the Environmental Quality Standards Directive (EQSD) list?	No (not applicable). Impact assessment not required.	

B.3.4 Protected Areas

Consideration should be made regarding whether WFD protected areas are at risk from an proposed activity, including SACs and SPAs (Natura 2000 sites), as well as bathing waters, shellfish waters and nutrient sensitive areas. Table B.8 presents a summary of protected area considerations and associated risk issues of the proposed works at Hunterston. As the protected areas considerations indicate that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment (Section B.4).

Table B.8. Protected areas scoping summary

Protected Areas Considerations	Protected Areas Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Consider if your activity is within 2 km of any WFD protected area?	No (there are no protected areas within 2 km of the proposed works). Impact assessment not required.	

B.3.5 Invasive Non-Native Species (INNS)

Consideration should be made regarding whether there is a risk the activity could introduce or spread INNS. Risks of introducing or spreading INNS include materials or equipment that have come from, had use in or travelled through other water bodies, as well as activities that help spread existing INNS, either within the immediate water body or other water bodies. Table B.9 presents a summary of INNS considerations and associated risk issues of the proposed works at Hunterston. As the INNS considerations indicate that a risk could be associated with the proposed works, this receptor has been scoped into the impact assessment (Section B.4).

Table B.9. Invasive non-native species (INNS) scoping summary

INNS Considerations	INNS Risk Issue(s)	
	Largs Channel (Fairlie Roads)	Seamill and Ardrossan
Consider if your activity could introduce or spread INNS?	Yes (potential for introduction or spread of INNS). Requires impact assessment.	

B.4 Impact Assessment

An impact assessment should be conducted for each receptor identified during the scoping stage as being at risk from an activity. As highlighted in Section B.3, the following receptors have been scoped into the impact assessment:

- Hydromorphology;
- Biology;
  - Habitats;
  - Fish;
- Water quality;
- Invasive non-native species (INNS).

Each of these WFD parameters has been evaluated in order to determine whether the proposed activities might cause deterioration in the status of the relevant water body (defined as a non-temporary effect on status at water body level), or an effect that prevents the water body from meeting its WFD objectives. Where possible, the assessment has drawn on information presented in the environmental appraisal (see Main Report).

B.4.1 Hydromorphology

The coastline at Hunterston B Power Station is west facing and, therefore, wave action from the south would impact littoral habitats/sediments through refraction towards the coast while wave action from a southwest direction could directly impact the coastline at Hunterston. It is these wave conditions, combined with low water tidal states, which are considered to push seaweed towards the Hunterston B cooling water intake.

The presence of seaweed within the proposed seaweed reduction area, predominantly *S. latissima*, is largely seasonal in nature and thus highest densities are likely to occur during the spring and summer months. In contrast, reduced densities of seaweed are likely to be present during winter storm events. Therefore, it is unlikely that the presence of seaweed within the proposed seaweed reduction area has a major attenuation effect on wave action against the adjacent coastline. As removal of seaweed from within the proposed seaweed reduction area is unlikely to change the prevailing wave conditions and given the rocky/hard coastline at Hunterston which is highly resistant to wave impact, the impact on kelp removal is therefore assessed as minor (see Section 4.1 of the main report).

In conclusion, the proposed works at Hunterston are not expected to lead to a deterioration of the assessed hydromorphological elements within the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from meeting future WFD objectives.

B.4.2 Biology

Habitats

The proposed works will remove some but not all of the kelp from the areas within which the activity occurs. Immediately following the removal, the habitat will support less kelp/less dense kelp than prior to the activity, but the habitat type will not change. Rather some of the ecological functioning of the area could be reduced. The nearest saltmarsh habitat is adjacent to the site along the Hunterston coastline, while seagrass beds are located to the north of the proposed seaweed reduction area as part of Hunterston Sands. However, the saltmarsh and seagrass habitat is unlikely to be indirectly effected by the proposed works as wave action will not be significantly altered by seaweed removal.

Furthermore, all seaweed removed from within the proposed seaweed reduction area will be disposed to land, as opposed to disposal at sea. This mitigation measure avoids potential adverse impact pathways between the disposed material and other marine habitats (e.g. smothering of saltmarsh).

In conclusion, the proposed works at Hunterston are not expected to lead to a deterioration of seabed habitats within the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from meeting future WFD objectives.

Fish

Kelp forests also serve as a nursery for many fish species, including Atlantic Cod (*Gadus morhua*) and pollack (*Pollachius pollachius*). They are also feeding grounds for fish species such as ballan wrasse (*Labrus bergylta*) and Goldsinny wrasse (*Ctenolabrus rupestris*), which prey on kelp associated invertebrates (Norderhaug et al. 2005), as well as attracting commercially important species such as European sea bass (*Dicentrarchus labrax*), pollack (*P. pollachius*) and conger eels (*Conger conger*) (Smale et al. 2013). In turn, elevated fish densities in kelp forests attract large piscivores, such as large fish, seals and otters.

However, as highlighted above, the proposed works will remove some but not all of the kelp from the areas within which the activity occurs. Immediately following the removal, the habitat will support less kelp/less dense kelp than prior to the activity, but the habitat type will not change. Rather some of the ecological functioning of the area could be reduced. Smale et al. (2013) noted that the biodiversity of *S. latissima* beds did not change significantly across the SACFOR scale, suggesting that some aspects of ecological functioning may not be significantly impaired (e.g. fish nursery). *S. latissima* is likely to regrow rapidly in the targeted areas. This regrowth may offset some of the lost function of the affected habitat. Given the relatively small area over which the activity may occur in relation to the overall scale of the resource within the Clyde Sea, the limited impact on ecological structure/functioning and the scope for rapid recovery, the impact on kelp habitat is therefore assessed as minor (see Section 4.3.1 of the main report).

In conclusion, the proposed works at Hunterston are not expected to lead to a deterioration of fish within the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from meeting future WFD objectives.

B.4.3 Water Quality

The proposed seaweed reduction activity could lead to small quantities of sediment being raised into suspension through contact with the seabed, although any disturbance will be temporary and sediment will quickly disperse. Given the nature and small scale of the proposed works, water quality will not be affected and no impact pathway has been identified in Section 4.2 of the marine report. Therefore, the proposed works at Hunterston are not expected to lead to a long-term deterioration of water quality elements within the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from meeting future WFD objectives.

B.4.4 Invasive Non-Native Species

As with most activities which occur in the marine environment, there is potential risk that the proposed works at Hunterston could result in the introduction or spread of INNS. For example, this could include the movement of vessels (and ballast) from differing water bodies and the transfer of organisms attached to the vessel hulls. However, given the scale of the proposed works and the typical locality of the vessel to be commissioned to undertake the works, the risk in terms of introducing or transferring INNS is minimal. Therefore, the proposed works are not expected to lead

to a deterioration of nearby WFD water bodies in terms of INNS, nor prevent any nearby water bodies from meeting their WFD objectives.

B.5 Conclusion

Based upon the information presented within this WFD compliance assessment, and considering the additional information presented in the environmental appraisal (see Main Report), it is concluded that the proposed works at Hunterston are not likely to have a permanent (i.e. non-temporary) effect on the status of WFD parameters that are significant at water body level. The proposed works are therefore not predicted to cause either deterioration to the current status of the Largs Channel (Fairlie Roads) or Seamill and Ardrossan coastal water bodies, nor prevent these water bodies from achieving future WFD objectives.

B.6 References

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B.7 Abbreviations/Acronyms

AWB	Artificial Water Body
BWD	Bathing Water Directive
CAR	Water Environment (Controlled Activities) (Scotland) Regulations 2011 (commonly known as the Controlled Activity Regulations)
Defra	Department for Environment, Food and Rural Affairs
EC	European Commission
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive
GEP	Good Ecological Potential
GES	Good Ecological Status
GCS	Good Chemical Status
GS	Good Status
HMWB	Heavily Modified Water Body
INNS	Invasive Non-Native Species
NVZ	Nitrate Vulnerable Zone
PSD	Priority Substances Directive
RBMP	River Basin Management Plan
rBWD	Revised Bathing Water Directive
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SPA	Special Protection Area
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

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