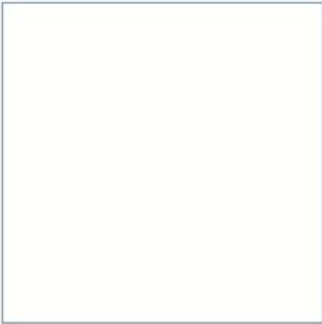
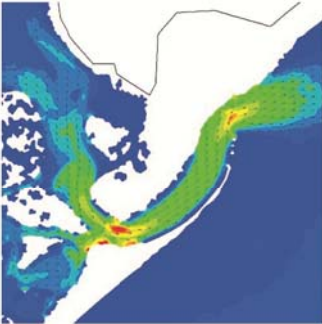
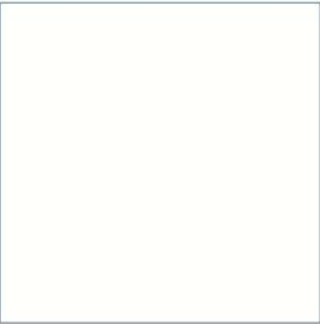
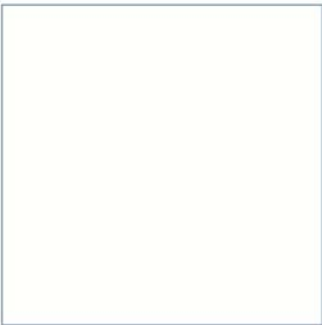


Hunterston B Seaweed Removal

Monitoring and Contingency Plan

August 2017



Innovative Thinking - Sustainable Solutions

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1 Introduction

ABPmer has been commissioned by Hunterston B Power Station, owned and operated by EDF Energy, to develop a strategy to monitor the potential marine environmental effects of the removal of seaweed from the vicinity of its cooling water intake. This monitoring is required as a condition of the Marine Licence to undertake this activity (Licence Number: 06426/17/0). In addition, the Marine Licence requires consideration be made should large colonies of Japanese wireweed *Sargassum muticum* be detected within the seaweed reduction area. Therefore, this report describes both the monitoring and contingency plans associated with these Marine Licence conditions.

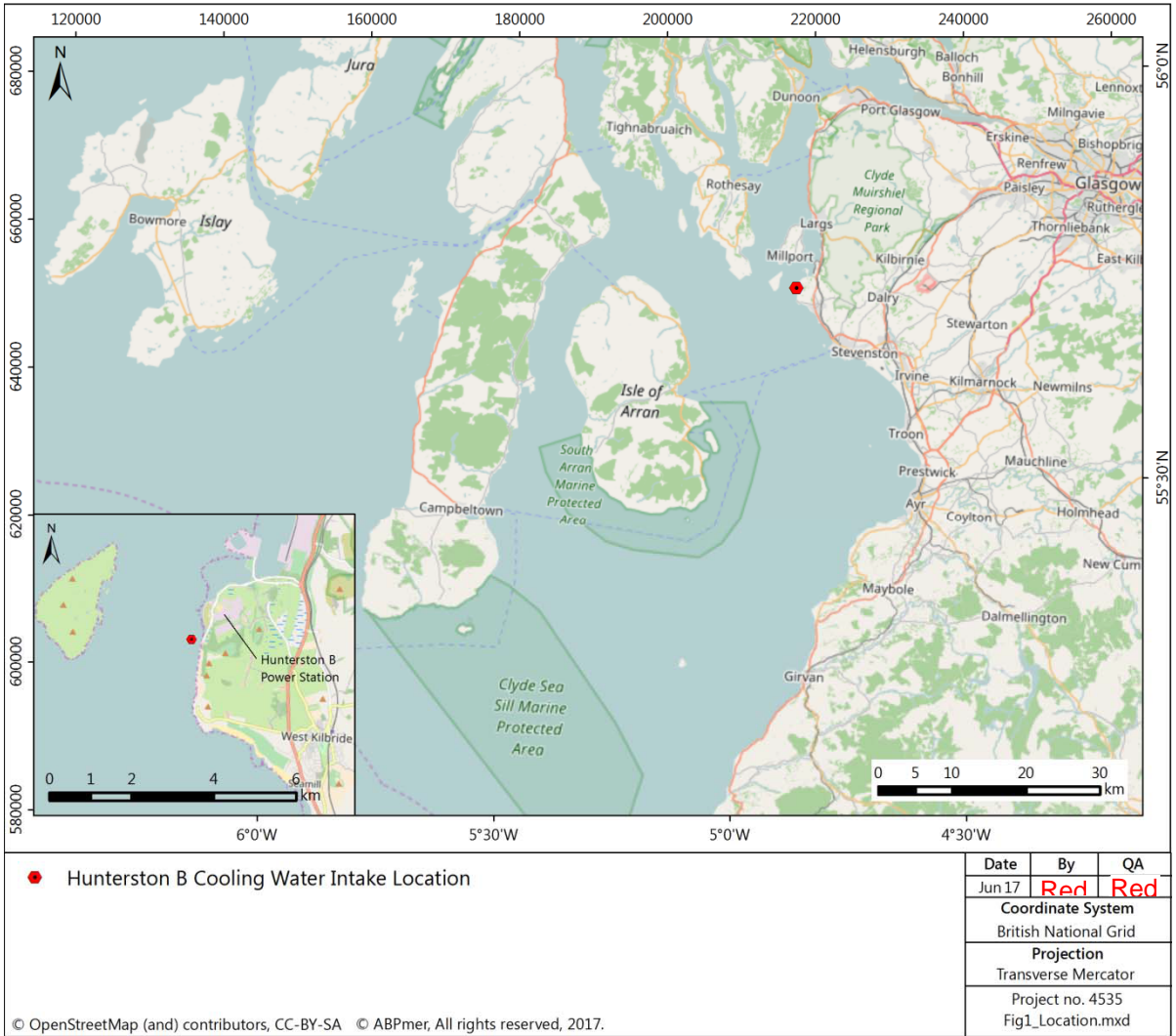


Figure 1. Location of Hunterston B cooling water intake

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 (Figure 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. The station undertook a limited trial 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.

EDF Energy were granted a one year Marine Licence by Marine Scotland on 28 August 2017 (Licence Number: 06426/17/0) to remove up to 150 tonnes of seaweed from an area near to the cooling water intake, referred to as the seaweed reduction area (Figure 2).

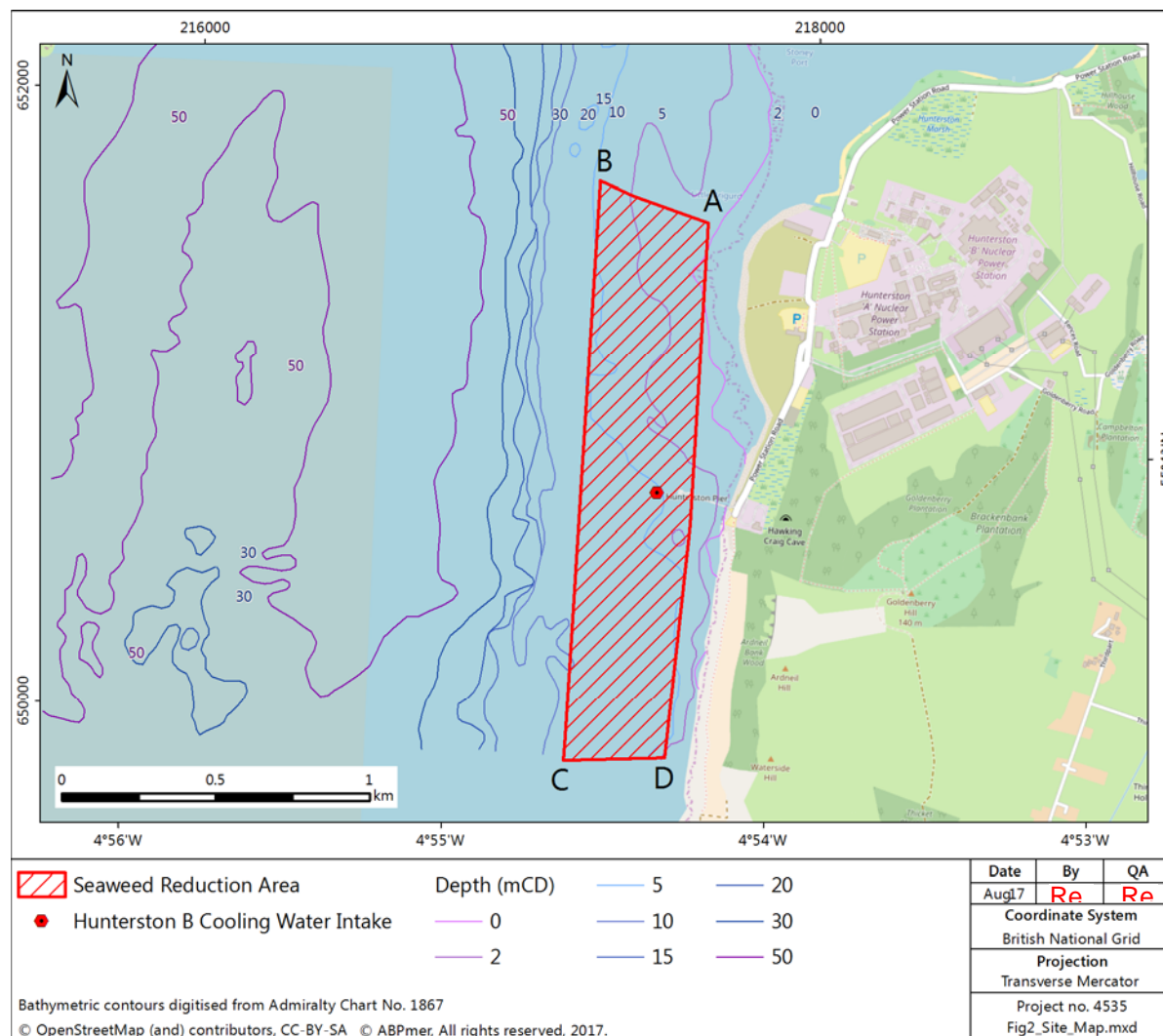


Figure 2. Location of seaweed reduction area and Hunterston B cooling water intake

The Marine Licence stipulates the following conditions:

- **Condition 5:** The licensee shall undertake monitoring of the licensed area before and after removal activity. The licensee should liaise with the licensing authority and Scottish Natural Heritage (SNH) to produce a monitoring plan for approval prior to the commencement of the works; and
- **Condition 6:** The licensee must produce a contingency plan for the monitoring and response if large colonies of *Sargassum muticum* are detected. The licensee should liaise with SNH and submit this plan to licensing authority for approval prior to the commencement of the works.

Further information on the proposed approach to monitoring applicable to these conditions, including contingency plans for potential *Sargassum muticum* proliferation, is provided in Sections 2 and 3. As stipulated in the Marine Licence conditions, this report will be submitted to Marine Scotland and SNH for their approval prior to commencing the licensed activity.

2 Monitoring Plan

2.1 Aims

During the one year Marine Licence period (28 August 2017 to 27 August 2018), it is anticipated that three discrete campaigns will be undertaken to remove seaweed from within the seaweed reduction area. The proposed monitoring plan is based on the provision of monitoring surveys before and after each seaweed removal campaign, as required by Condition 5 of the Marine Licence. These surveys are hereafter referred to as pre- and post-monitoring surveys, respectively. The aims of these monitoring surveys are as follows:

- **Pre-monitoring survey:** To collect information on the density and distribution of kelp and other algal species prior to the campaign. The pre-monitoring survey would also produce a current broad-scale map of subtidal habitats, used to establish/confirm baseline conditions for impact verification purposes, and also identify key areas for seaweed removal in the vicinity of the Hunterston B cooling water intake; and
- **Post-monitoring survey:** To understand changes in kelp density and subtidal habitat distribution following each campaign. This information will be valuable to understanding any potential environmental effects of the licensed activity, as well as understanding whether a campaign has successfully reduced seaweed coverage.

2.2 Methodology

The pre- and post-monitoring surveys will be undertaken within four weeks prior to and following each campaign, respectively¹. The baseline (drop-down camera) survey conducted on 31 May 2017 and used to support the marine licence application is considered appropriate to function as the pre-monitoring survey for the first campaign only, assuming this is undertaken in September/October 2017 at the latest (otherwise a further pre-monitoring survey will be required). The methodology described below will be used for both pre- and post-monitoring surveys.

The approach has been based on the baseline survey that was undertaken on 31 May 2017 (ABPmer, 2017). Based on the results of this survey, it is considered most effective to survey kelp density through dropping a camera unit to the seabed at fixed stations along a series of transects (Figure 3). The mobile camera frame or sledge will then be slowly towed a short distance (approximately 5 to 10 m) before being retrieved. Towing a camera frame or sledge for longer distances within the seaweed reduction area is not recommended as kelp and other algae quickly becomes detached from the seabed, potentially blocking the camera lens. Boulders and cobbles in the area can also turn the camera frame over. However, in between camera drops, fixing the frame to the bottom of the hull with the camera positioned in a downward orientation could also provide additional data in shallow infralittoral areas.

The baseline survey undertaken on 31 May 2017 generally found kelp to be absent from depths greater than approximately 10 m. The pre- and post-monitoring surveys will therefore focus predominantly on depths less than 10 m within the seaweed reduction area. It is envisaged that up to 60 stations will be monitored using a drop-down camera; sampling will aim to provide coverage of the whole extent of the seaweed reduction area subject to accessibility.

¹ If weather conditions and/or sea state after a campaign are considered unsuitable within the four week period specified, the post-monitoring survey should then be undertaken in the next available window of suitable conditions.



Figure 3. Still image from survey along a transect sampled on 31 May 2017

At each station, the density and coverage of kelp (and other seaweed) will be recorded based on the Marine Nature Conservation Review (MNCr) SACFOR abundance scale (see Table 1). Biotopes will be 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). In addition, notes on key characterising algae and epifaunal benthic species at each station including any rare, protected or invasive (non-native) species will also be recorded.

Table 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
L	Less than rare	<1

Figure 4 provides an example illustration of kelp abundance within the seaweed reduction area as reported in the Environmental Appraisal to support the Marine Licence application (ABPmer, 2017); however, it should be noted that pre- and post-monitoring surveys will focus on determining kelp abundance within the seaweed reduction area as opposed to wider characterisation. It is possible that limited monitoring of stations outside of the seaweed reduction area will be undertaken, although previous surveys have indicated limited kelp coverage in deeper areas, most likely due to reduced light levels.

The results of the pre- and post-monitoring surveys will be summarised as part of a monitoring report which will be submitted to Marine Scotland within four weeks of the end date of the Marine Licence (27 August 2018).

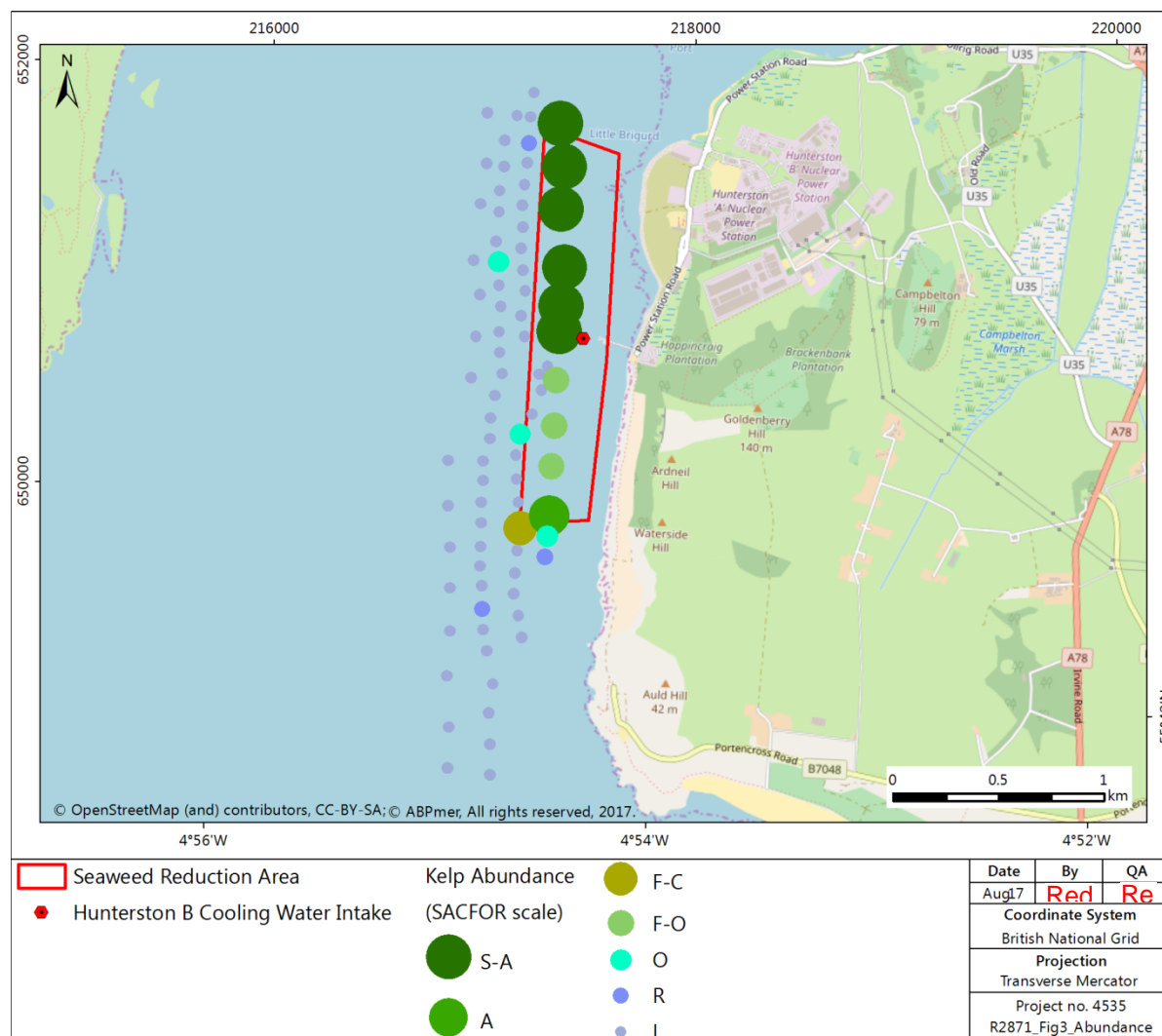


Figure 4. Kelp abundance as observed on 31 May 2017

2.3 On-Site (Ingress) Monitoring

The ultimate objective of the licensed activity is to reduce the ingress of seaweed at the Hunterston B Power Station cooling water intake. While monitoring of seaweed ingress at the cooling water intake is not a condition of the Marine Licence, it is considered prudent that any ongoing ingress of kelp and other material at the Hunterston B cooling water intake is recorded. Such monitoring is already undertaken to ensure a continuous flow of cooling water to facilitate the safe operation of the plant. To provide context as to the effectiveness of the licensed activity, this includes the following:

- Daily monitoring of the cooling water intake system for ingress of material;
- Attempts made to monitor and identify material (species) routinely collected from the coarse screens/trash baskets;
- Photographs taken of all material removed from the coarse screens/trash baskets; and
- Maintain records of the volume of waste material removed from the coarse screens/trash baskets and disposed of to land.

It should be noted that the ingress of material within the cooling water intake system also includes marine species other than kelp (*Saccharina latissima*), such as red seaweeds and jellyfish. It may not be possible to separate these various contributions as part of additional ingress monitoring; however,

it is assumed that the provision of photographs will assist in the identification (at a high level) of ingress material during future ingress events. EDF Energy plan to engage with Marine Scotland and SNH in the coming months to discuss the Marine Licence, including on-site monitoring.

3 Contingency Plan

Japanese wireweed *Sargassum muticum* is a large brown seaweed (with a frond often over 1 m in length) and the stem has regularly alternating branches with flattened oval blades and spherical gas bladders. It originates from the Pacific and first appeared on the Isle of Wight in 1973, having spread to Britain from France, and has been recorded in Strangford Lough, Northern Ireland and Loch Ryan and the Firth of Clyde, Scotland. It typically grows on hard substrata in shallow waters and can also tolerate estuarine conditions. It can out-compete native algae species due to fast growth rates, the ability to reproduce within the first year of life and being monoecious (i.e. individuals can self-fertilise) (Pizzolla, 2008).

In providing their consultation response to the Marine Licence application, SNH highlighted that *Sargassum muticum* has become established in the Clyde area in recent years and was recorded at one station during the drop-down camera survey on 31 May 2017 (ABPmer, 2017). A potential impact of the licensed activity is that removal of the predominant kelp species (*Saccharina latissima*) may allow *Sargassum muticum* to establish in its place. Therefore, Condition 6 of the Marine Licence requires a contingency plan to monitor and respond should the invasive *Sargassum muticum* become established at high densities within the seaweed reduction area. The presence of *Sargassum muticum* will be routinely monitored as part of the pre- and post-monitoring surveys as described in Section 2. At each of the survey stations, the abundance of *Sargassum muticum* will be recorded using the SACFOR scale (see Table 1), similar to kelp abundance.

If the abundance of *Sargassum muticum* is recorded at densities of 'frequent' (F) or higher at 10% or more stations, or more than 5 stations (whichever comes first), during a monitoring survey (assuming an even distribution of stations across the seaweed reduction area), this will trigger a series of actions. On observing the above increased densities of *Sargassum muticum*, the seaweed removal activity will initially be ceased for a period of six months. While such abundances of *Sargassum muticum* do not necessarily indicate a significant issue for the ongoing operation of Hunterston B Power Station, it is considered appropriate that further considerations regarding the licensed activity would be made at this point. Furthermore, this timeframe may allow kelp to re-establish in the area following removal. During this period, observations of ingress material at the cooling water intake will continue to check for the presence of *Sargassum muticum*. At the end of the six month period, a monitoring survey (as described in Section 2) will be undertaken to assess the coverage of *Sargassum muticum* compared with other algal species and compared to the findings of previous surveys. The survey results will be reported to SNH and the proposed response will be discussed through further consultation with Marine Scotland and SNH. Responses could include one of the following:

- Continuation of seaweed removal as defined in the Marine Licence (e.g. abundance of *Sargassum muticum* is no longer recorded as 'frequent' (F) or higher on the SACFOR scale; kelp has re-established as dominate species);
- Reduction in the frequency and/or quantity of seaweed removal;
- Adjustment to the area of seaweed removal (e.g. reduction in the size of the seaweed reduction area; focus on area of increased *Sargassum muticum* abundance); or
- Licensed activity to cease permanently.

In addition to *Sargassum muticum*, it is noted that the invasive non-native colonial carpet sea squirt *Didemnum vexillum* has been recorded in previous surveys in the Clyde not far from the seaweed reduction area at Hunterston. To support wider monitoring in the Clyde by SNH, footage from monitoring surveys will continue to be checked for the presence of this species and, should notable observations be made, this will be reported to Marine Scotland and SNH.

4 References

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5 Abbreviations

MHCBI	Marine Habitat Classification for Britain and Ireland
MNCR	Marine Nature Conservation Review
SNH	Scottish Natural Heritage

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