Kyleakin Fish Feed Factory

Marine Harvest

Report to Inform Appropriate Assessment

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1. Introduction

1.1 Background

Marine Harvest (Scotland) Ltd (Marine Harvest) has proposed a scheme to develop a Fish Feed Plant (the Proposed Development) to be located at Allt Anavig Quarry, Kyleakin, Isle of Skye (on the northern shore of southern Skye).

This document provides the information to inform the Stage Two Appropriate Assessment of the Habitats Regulations Assessment (HRA) for the proposals and supports the applications for planning permission for those proposals.

Under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive'), a network of protected areas for certain habitats and species of conservation importance (those listed on Annex I and II of the Directive) has been established by EU member states; these are known as European Sites.

The Conservation of Habitats and Species Regulations 2010 (as amended) (the 'Habitats Regulations') require all plans or projects to be assessed by the relevant Competent Authority before permission can be granted. The Competent Authority must determine if there is likely to be a significant effect on a European Site from effects acting either alone, or in combination with other plans or projects. The Competent Authority with respect to the Town and Country Planning Act 1990 application is the Highland Council.

During the screening stage, Likely Significant Effects (LSEs) to two European Sites could not be excluded on the basis of objective information. The sites and qualifying features requiring Appropriate Assessment are as follows:

- Inner Hebrides and Minches Candidate Special Area of Conservation (cSAC) – Harbour porpoise (*Phocoena phocoena*); and
- Ascrib, Isay and Dunvegan SAC – Harbour seal (*Phoca vitulina*).

Therefore, the HRA has progressed to Stage 2 and information to inform an Appropriate Assessment has been collated to ascertain the effect on site conservation objectives, integrity and the avoidance and mitigation of effects.

1.2 This Report

The purpose of Appropriate Assessment is to identify if LSEs identified at Stage 1 Screening could cause adverse effects to the integrity of the respective European Site when considered against that site's Conservation Objectives. If adverse effects to site integrity are identified, further mitigation would be required and/or the assessment would proceed to Stage 3 assessment.

The sections that follow consider whether specific project activities would result in an adverse effect to the integrity of the respective European Sites identified in Stage 1 Screening in view of the sites' Conservation Objectives.

1.3 Structure of this Report

This appropriate assessment is structured to assess the adverse effects of the Proposed Development and the mechanisms by which the integrity of European sites may be affected. The structure is as follows:

- description of the Proposed Development under consideration including specific details of marine activities that were identified as having a likely significant effect in the Stage 1: screening report (**Section 2**);
- outline of the HRA process (**Section 3**);

- description of the European sites and their qualifying features that have been identified as having potential source effect pathways (**Section 4**);
- assessment of effects that may arise from the Proposed Development, including discussion on how this will impact the designated features of the European sites (**Sections 5 and 6**);
- assessment of whether any of the identified potential effects will lead to likely adverse effect on the integrity of the European sites (**Sections 5 and 6**);
- description of the mitigation measures to be put in place in order to reduce any identified adverse effects (**Sections 5 and 6**); and
- concluding statements of whether there are any adverse effects on the integrity of the European site network arising from the Proposed Development (**Sections 5.8 and 6.7**).

In-combination and cumulative effects are considered in **Sections 5.6** and **6.5**. In-combination effects are those that may arise from a development proposal when considered in-combination with other plans and projects, proposed or consented, but not yet built and operational. Cumulative effects are multiple effects on the same habitat or site that could arise from a development proposal when considered together with those effects associated with other developments that have been built and are in operation (SNH, 2015) (**Ref. 1-1**).

2. Description of Proposed Development

The development of the fish feed plant is proposed, by Marine Harvest, to be located at Allt Anavig Quarry at Kyleakin in Scotland. This is on the northern shore of southern Skye at grid reference NG737263 (173789, 826444), adjacent to the Kyleakin Narrows and the Skye Bridge crossing. The Development Area covers approximately 50,000m^2 and is illustrated in **Figure 2.1**.

The site was formerly operated as a sand and gravel quarry which worked from 1992 up to 2012 under the terms of a 20 year planning permission. Currently the main access routes to the Proposed Development are by road via the A87, and by sea via a 110m pier.

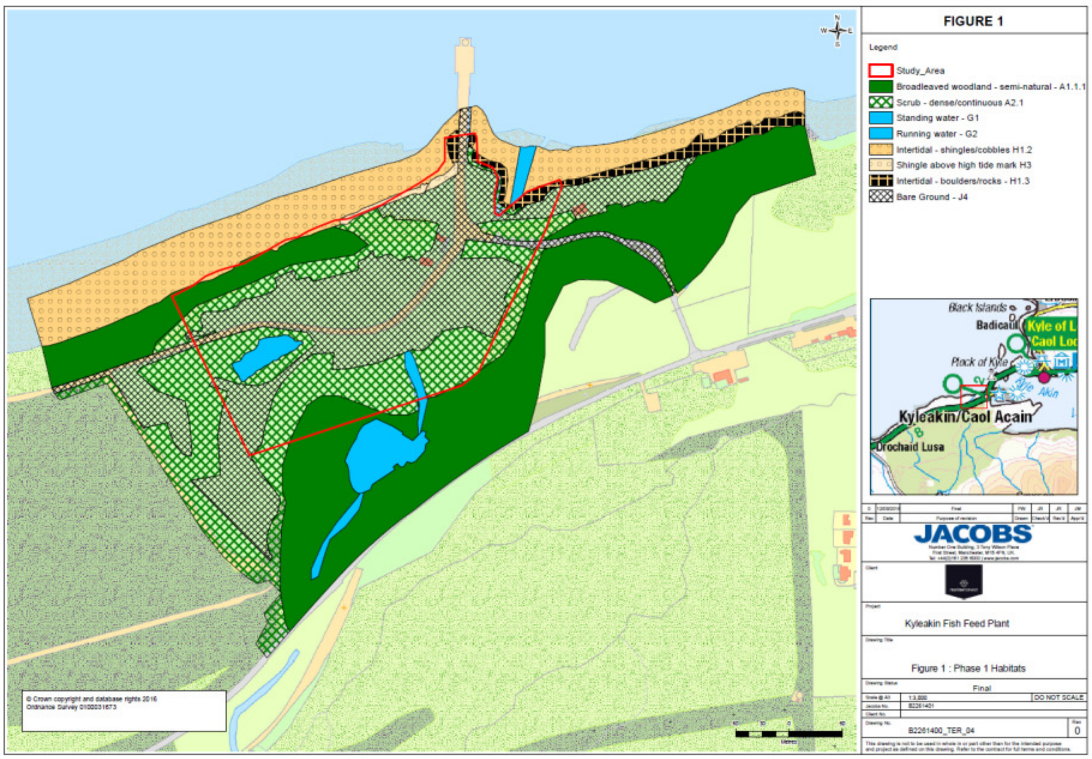


Figure 2.1 : Proposed Development Area of the Kyleakin Fish Feed Plant facility.

Operations at Kyleakin Fish Feed Plant would consist of two production lines for conventional salmon feed and one off the line for medicated / functional feed. It is projected that the plant will have a production output of 170,000 tons of fish feed per year, consisting mainly of salmon feed for Marine Harvest's farming operations. This is for fish feed which has the main components of protein, fat, vitamin and minerals which are classified as raw materials.

These predictions of production output are based on the operation facility having 55 staff who will work in shift patterns. The Proposed Development will also be operating for approximately 66,000 hours or more per year and the plant will need to be designed and constructed to accommodate these operating times. The planned operational life of the Proposed Development is up to 50 years for the foundations, building structures and pier and quay. Installations will be designed and built in order to meet a 25 year lifetime and the decommissioning of the Proposed Development has been considered to have the same impacts or less than those of the construction phase.

The Proposed Development will require both planning permission and marine licence as it will include both terrestrial and marine development. The Marine Licence will consent the main marine construction activities of the Proposed Development, the specific details for which come from the Project Development Marine Works Description (revision D), Wallace Stone (2016) (**Ref. 1-2**).

The main marine construction period is anticipated to last for 52 weeks, with key activities including the following:

- piling (includes piling of quayside and slipway);
- capital dredging;
- pier extension (includes construction of the foundation bund and completion of the caisson walls); and
- rock armouring and shore reclamation.

All pier and quayside piling will use a land based piling plant which will be located on either the existing pier, temporary piled pier (at the outer end) or on rock fill bunds pushed out seaward behind the line of the new quayside wall and slipway. The piling plant likely to be used would be large vibrating hammers with impact piling only used in latter stages to get down to design tow levels in harder materials. A combination of combi piling (large diameter tube with sheet piles between them) and infill sheet piling tied to an anchor wall with tie rods will be used for the pier and quayside. Piling operations are estimated to extend for an approximate 14 weeks. The diameter of the combi piles will be 1220mm and for the infill sheet piles will be 1220-1300mm and has a 124.6cm^2 sectional area. Steel H piles with the dimensions of 356x365x133mm are to be used for the ship unloader.

Where possible all dredge material will be reused and much of it made available for the Proposed Development. The material has commercial value as fill and will be stockpiled on land for future use. Ground investigation works identified that the dredged material will be comprised of sand and gravel with very low silt content. As a result the dredging would use a combination of a trailer suction hopper dredger and a large backhoe dredger, the low silt content meaning sediment dispersal from the bucket will be no worse than the suction dredger operation. A trailer suction dredger scrapes the sea bed and hoovers up the material into its internal hopper to be collected and the pumper water discharged over a few weirs back to the sea. Once the vessel’s hopper is full, the material is pumped to shore for storage. At the start of the dredge the backhoe will be used to remove the cobbles that lie on the existing bed surface. The cobbles will then be stockpiled and replaced on the surface of the dredged side slopes in order to provide scour protection, for which it is estimated that a volume of 7,000m^3 will be required. This is to ensure long term stability of the dredged slope from current and wave attack. The area to be dredged is 58,000m^2 and has a volume of 190,000m^3, the operation for which has been estimated to require a period of 8 to 12 weeks. The time taken is dependent on how much the trailer suction hopper dredger is used, which in comparison to the backhoe, has a greater capacity.

At the pier the anticipated movements of vessels will consist of the following once the pier is fully operational:

- bulk vessels delivering raw material at the side berth – 2 per week;
- cargo carriers being loaded with fish feed at the outer berth – 2 per week;
- tankers delivering vegetable oils at the outer berth – 1 per week; and
- LNG vessels delivering to the plant at the outer berth – 0.5 per week.

The key marine operational activities include:

- general operation activities;
- maintenance dredging; and
- vessel movements – (average of two movements per day).

3. Outline of the HRA Process

3.1 Introduction

It is set out in article 6(3) of the EC Habitats Directive (**Ref. 1-3**) that *any plan or project, which is likely to have a significant effect on a European site, either individually or in combination with other plans or projects, but is not directly connected with or necessary to the site, shall be subject to an 'appropriate assessment' in view of the sites conservation objectives. Once it is ascertained that it won't adversely affect the integrity of the site, the competent authority shall agree to the project, unless in exceptional circumstances where the provisions of Article 6(4) are met* (**Ref. 1-1**).

European Sites were established under EU law by member states to protect particular habitats and species of conservation importance. The network of European Designated Sites in the UK comprises Special Areas of Conservation (SACs); Special Protection Areas (SPAs); Ramsar wetland sites; and European Marine Sites. In the UK, the EU directive is implemented through the Habitats Regulations, which has established a network of European sites comprising SACs, candidate SACs (cSAC), SPAs and Sites of Community Importance Interest (SCI). Due to policy requirements, the term 'European Sites' in this report also refers to potential SPAs (pSPA), possible SACs (pSAC), and listed or proposed Ramsar wetland sites each of which includes sites at varying stages in the designation process.

In Scotland, the Habitats Regulations Assessment (HRA) process is used to satisfy the requirements of the Habitats and Birds Directives through The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) that govern the assessment of the implications of projects and plans on European sites (**Ref. 1-4**).

The approach to HRA in this assessment has been informed by the following sources:

- EC (European Commission) (2011). Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal zones, with particular attention to port development and dredging (2011) (**Ref. 1-5**).
- EC (European Commission) (2002). Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological Guidance on the Provisions of Article 6 (3) and (4) of the Habitats Directive 92/43/EEC. Office for official publications of the European Communities, 2000, Luxembourg (**Ref. 1-3**).
- EC (European Commission) (2000). Managing Natura 2000 sites. The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC. Office for official publications of the European Communities, 2000, Luxembourg (**Ref. 1-6**).
- Information provided by SNH (Scottish Natural Heritage) (2016) - http://www.snh.gov.uk/planning-and-development/environmental-assessment/habitat-regulations-appraisal/ Website accessed 23/11/2016 (**Ref. 1-7)**.
- Scottish Natural Heritage (SNH) (2015). Habitats regulations appraisal of plans. Guidance for plan-making bodies in Scotland (**Ref. 1-8**).

3.2 Procedure and Process

The HRA process is detailed in a series of four key stages, which have been outlined and recommended by Scottish Natural Heritage (SNH) as the approach to methodology and reporting which should meet the requirements of most competent authorities.

There are four stages in the HRA process (**Ref. 1-3**), which are illustrated below:

- Stage One: Screening — the process which identifies the likely impacts upon a European site from a project or plan, either alone or in-combination with other projects or plans, and considers whether these impacts are likely to be significant;
- Stage Two: Appropriate Assessment — the consideration of the impact on the integrity of the European site from the project or plan, either alone or in-combination with other projects or plans, with respect to the

site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;

- Stage Three: Assessment of alternative solutions — the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site; and
- Stage Four: Assessment where no alternative solutions exist and where adverse impacts remain — an assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

If it is concluded that a plan or project may have an 'adverse effect' such that would compromise the integrity of a European Site in view of the Conservation Objectives for that site, then consent cannot be given unless the conditions of all three derogation tests cited in Article 6(4) are satisfied, that is completion of stages three and four (as outlined above).

3.3 Interpretation of Adverse Effect on Integrity

To ensure that adequate information is available to support Appropriate Assessment, a review of the baseline information was undertaken. In addition underwater noise modelling was undertaken in consultation with the Competent Authority and assessed by relevant experts with the outputs used to assess whether or not effects on site integrity would arise, and to identify the need for, and design of, avoidance measures or mitigation.

The importance of the international conservation interest of a designated European site is at the forefront of decision making through the HRA process. It must be identified in the Appropriate Assessment whether a plan or project will have an adverse effect on site integrity. This is based on the scientific judgement of whether there are any impacts on the conservation objectives for the qualifying interests for the Natura site (**Ref. 1-9**).

Under EC guidance, in order for adverse effects to be fully assessed, proper reasoning and consideration of the adverse effects in terms of loss, fragmentation, disruption, disturbance and changes to key elements of the site must be considered in order for the assessment to fulfil its purpose. The evidence that supports the assessment of adverse effects must be able to stand up to scientific scrutiny but there are no set rules for what constitutes an adverse effect, but rather it is based on each individual case.

3.4 HRA Consultation

Consultation and advice, regarding the HRA process for the Kyleakin Fish Feed Plant and the associated European Sites, has occurred between Marine Harvest and the following organisations:

- Marine Scotland – Licencing Operations Team (MS-LOT);
- Scottish Natural Heritage (SNH);
- Marine Scotland Science (MSS);
- Scottish Environment Protection Agency (SEPA);
- Highland Council; and
- Ministry of Defence (MOD).

This leads on to the conservation objectives which SNH have set out and which must be incorporated into each phase of the HRA:

- maintain or increase the extent of habitat;
- maintain a healthy structure and function; and
- maintain the diversity and abundance of characteristic species.

Table 3.1 : Consultation responses.

Date response received	Organisation	Consenting route / deliverable	Outline of comment
12th May 2016	SNH	Letter ref: 16/01492/SCOP	'*Our advice is that the proposed development is likely to have significant effects on the environment, including on sensitive areas. Key natural heritage issues arising from this development include effects on:* *The designated features of Lochs Duich, Long and Alsh Nature Conservation Marine Protected Area, particularly the flame shell bed;* *Reefs in Lochs Duich, Long and Alsh Special Area of Conservation;* *Cetaceans, including harbour porpoise within Inner Hebrides and the Minches proposed Special Area of Conservation'*
12th May 2016	SNH	Letter ref: 16/01492/SCOP Annex A	Lochs Duich, Long and Alsh SAC: '*Based on current information it seems likely that avoidance of ballast water discharge inside the SAC and agreement of a robust pollution prevention plan will be two of the key requirements to protect the SAC'*
12th May 2016	SNH	Letter ref: 16/01492/SCOP Annex A	Inner Hebrides and the Minches cSAC: *'The construction methods should be clarified following site investigations. The type of piling (impact vs vibrating hammer) or drilling should be defined. Dredging techniques and any rock blasting requirements should also be detailed. An underwater noise assessment should be carried out and appropriate mitigation put forward based on relevant best practice'*
26th May 2016	MS-LOT	Screening and scoping opinion	*'As issues in relation to HRA have been raised during the scoping consultation process (please refer to Annex 1), HRA screening should be considered prior to application submission. This will allow advice to be given in greater detail regarding the protected sites and qualifying interests to be considered within the required HRA report'*
27th May 2016	SNH	Letter - FAO: Victoria Bell Annex A	Inner Hebrides and the Minches cSAC: *'The construction methods should be clarified following site investigations including:* *Piling – what type of piles would be installed; how many; impact or vibratory piling; duration of installation.* *Dredging techniques and duration.* *Blasting – what size of charge; how many; over what duration'*
27th May 2016	SNH	Letter - FAO: Victoria Bell Annex A	*'An underwater noise assessment should be carried out including:* *predicted noise levels from all noisy activities (taken from published literature);* *description of the possible noise footprint;* *use of Southall et al (2007) to assess marine mammal injury thresholds plus Lucke et al (2009) for harbour porpoise injury thresholds (full references available on request);* *assessment of disturbance. There are no agreed disturbance thresholds. However, NOAA interim disturbance thresholds can be used initially to determine whether this needs to be considered in more detail – see http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/threshold_guidance.html description of the sound propagation in the area together with rationale as to the propagation model used.*
10th June 2016	MOD	Email: offshore safeguarding – BUTEC range Rassay	*'the applicant should prepare an appropriate noise impact mitigation strategy as part of a management plan to support any marine license application submitted to demonstrate what measures will be put in place to ensure pile driving type works are coordinated with the operation of the MOD BUTEC range and conducted at times when the range is not in operation. It is recommended that the applicant*

Date response received	Organisation	Consenting route / deliverable	Outline of comment
			enters into further dialogue with the range operator to establish what type of mitigation measures will be appropriate'
02nd August 2016	SEPA	Email: from Cerian Baldwin	*'Ballast Water - This is not regulated us but instead the operator is expected to work to the IMO guidelines - http://www.imo.org/en/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx. Again this is something I would expect Marine Scotland to lead on'*

4. European Sites and Features Potentially Affected by the Proposed Development

Based on the construction and operational activities for the Proposed Development there is the potential that underwater noise disturbance, vessel strike (from underwater piling and dredging activities) and the risk of sediment dispersion and deposition would affect qualifying features of European Sites, and therefore the conservation objectives.

There are many vessel movements within the immediate vicinity of the proposed development. Ships enter and leave Kyle of Lochalsh and also transit around the Isle of Skye (Harland *et al.,* 2016 (**Appendix C**)). The Proposed Development requires a number of vessels for transportation of goods to and from the works and these are detailed in Section 2. It is, however, unlikely that the additional vessel movements will significantly add to the general noise level (**Appendix C**) and so are not considered as a source of significant underwater noise disturbance.

Through the Stage One Screening process potential effects from sediment dispersion and deposition were screened out of the assessment as hydraulic modelling suggested that the sediment release from the proposed suction dredging technique is likely to be localised to the jetty structure. The potential influence of any sediment plume was shown to be restricted to a small area, and would therefore not extend to affect the reef feature of the Loch Duich, Long and Alsh Reefs SAC.

Following Stage One Screening there remains the potential for significant effects on qualifying features of the following two European sites from anthropogenic noise generated during piling and dredging operations:

- Inner Hebrides and Minches cSAC; and
- Ascrib, Isay and Dunvegan SAC.

4.1 Underwater Noise

4.1.1 Background

Anthropogenic noise is a generic term that refers to any man-made sound or vibration which intrudes into the natural environment and which can mask a biologically useful sound (a 'signal'), disturb the natural behaviour of the animals, impair hearing or cause injury. Such anthropogenic noise sources include piling, shipping, dredging, drilling, earth works and underwater explosives.

Noise is described in terms of two characteristics: sound, which is measured at the receptor as a sound pressure, and vibration, which is usually described in terms of particle velocity. A sound or vibration is defined in terms of its frequency (pitch) and amplitude (level or loudness). Frequency is measured in Hertz (Hz) where 1Hz = 1 cycle per second. The amplitude of sound pressure is measured in units of Pascal's, whereas vibration is measured as a velocity, e.g. millimetres per second (mms^{-1}); in either case, amplitude is usually expressed in decibels (dB) in biological applications.

A pressure in decibels expresses a logarithmic ratio between the measured pressure and a reference pressure (typically one micro Pascal or 1µPa) and is often written as dB re 1µPa, where the "re" means "referenced to" whichever reference value is then described. The equation for converting units of mms^{-1} (particle velocity) to dB (particle velocity) is [$dB= 20\log V/V_{ref}$] where V is the measured particle velocity and V_{ref} is the reference particle velocity. For dB (pressure) this becomes [$dB= 20 \log P/P_{ref}$], where P is pressure.

To be audible, a sound 'signal' must be detectable against the background noise and when looking at noise in terms of underwater sound, it can be most usefully represented as a source level (SL) and by convention, represented as the effective noise amplitude of sound estimated at one metre from the source.

4.1.2 Piling

Noise level comparisons between hammer and vibro-piling on Offshore Windfarm Projects have identified that vibro-piling has noise levels 15-20dB lower than impact piling, primarily in the 300–1,250Hz mid-range (**Appendix C**; Hawkins, 2006 (**Ref. 1-10**)). Use of water jets further reduce the vibrations and hence associated noise levels which have been reported to reduce noise level by a further 20dB, hence the 1.08m H-Piles were calculated to give rise to noise levels of 185.2dB re 1 µPa, peak to peak at 1m (Henderson, 2014) (**Ref. 1-11**).

Pile driving associated with the removal and reconstruction of a jetty was monitored at a busy harbour in the North East of Scotland (**Ref. 1-10**). Measured background noise levels of 118–149dB re 1µPa RMS over a bandwidth of 10Hz to 10kHz were recorded; percussive pile driving was used in this area and estimated source levels of 177–202dB re 1µPa; this reduced to 162–168dB re 1µPa more than 220m away from the pile driving activity. Vibro-piling also generated high sound levels in water, with a SPL within the harbour ranging between 142–155dB re 1µPa RMS and SLs between 173–185dB re 1µPa RMS.

Henderson (**Ref. 1-11**) compiled a noise monitoring and modelling report which looked at the installation of HZM-structured walls consisting of sheet piles and king piles (H-piles). The site was located within the Cromarty Firth, Scotland with an approximate water depth of 9m (Affric Ltd, 2013) (**Ref. 1-12**). The majority of piles were sunk to the required depth utilising the water jet vibro-piling technique. However, there was also the potential of impact piling where obstacles such as rocks or boulders were encountered.

The H-pile dimensions used in the Cromarty Firth were similar in length (450mm) to the ones proposed for the Kyleakin development ((356mm) see Section 2) however; they are nearly three times the width (1,080mm compared to 365 mm). The combi-pile that has been proposed for the Proposed Development is similar in diameter (1,220mm compared to 1,080mm) to that used in the Cromarty Firth development (**Ref. 1-11**).

Henderson (**Ref. 1-11**) utilised the following equation for percussion piling which was deemed the worst case scenario:

- SL (dB re 1µPa, peak to peak, at 1m) = 179 + (24.3 x pile diameter (m)).

Due to the similarities of the combi-pile at the proposed development, the above equation provides a good estimation of SL. The following SL has therefore been calculated as follows:

- A cylindrical pile of diameter 1.22m would have a source level of 209dB re 1µPa, peak to peak at 1m.

Harland *et al.* (2016) (**Appendix C**) reported unpublished data from sheet piling operations using impact piling during the Nigg Fabrication Yard development in the Cromarty Firth in 2014 gave peak sound levels around 205dB re 1µPa at a distance of 29m from the pile with a SL of 167dB re 1µPa at 750m from the pile. Similarly, in support of the above information at the same location in the Cromarty Firth, Harland *et al.* (2016) (**Appendix C**) reported data for vibro-piling of sheet piles to have peak SL of 159dB re 1µPa at 750 metres.

Henderson (**Ref. 1-11**) stated that an H-pile would not resonate in the same way as a cylindrical pile would. For example, a 1.08m cylindrical pile would have direct impacts on an area of water of $5.8m^2$, whereas the H-pile would impact on an area of water $0.486m^2$, it is therefore expected that the noise generated from an H-beam of this size will be much lower than that of a cylindrical pile.

Thalheimer *et al.* (2014), cited in Harland *et al.* (2016) (**Appendix C**), reported a vibro-piling SL of 155dB re 1µPa at 32m from a bank-strengthening pile driven in a water depth of 2m. Similarly, Rodkin and Pommerenck (2014), cited in Harland *et al.* (2016) (**Appendix C**), reported a peak SL of 165dB re 1µPa at 10m from a 12" (365mm) H-pile vibro-piled in 5m of water. The pile diameter and water depth in this instance is in-line with the Kyleakin development.

Harland *et al.* (2016) (**Appendix C**) also reported the peak sound level of 182dB re 1µPa from a 24" AZ pile at 10m distance being driven in 15m of water.

4.1.3 Dredging

The most likely impact of dredging activities will be through sound disturbance and local habitat modification. Underwater noise from three dredging sources has been described by Richardson *et al*. (1995) (**Ref. 1-13**). According to (Evans, 2000) (**Ref. 1-14**) dredging activities produce sounds varying from 172dB–185dB re 1µPa at1m over a range of 45-7kHz. The strongest underwater sounds from the transfer dredges are found to be at low frequencies (below approximately 300Hz). Sounds from the clamshell dredge were variable (99-124dB re 1µPa at 150m at 91.5Hz) depending on status of operation, it was found that winching the loaded clamshell on-board the barge produced levels from 150-162dB re 1µPa and centred around 250Hz (Green, 1985a, 1987b cited in **Ref. 1-13**).

Transfer dredges are moored or anchored ships that extend suction pipes to the seafloor and discharge onto a barge; a hopper dredge moves over the dredging site and once the hoppers are filled, moves to a discharge site to offload. Clamshell dredges pull up material within opposing buckets and clamp together and dispose of it onto a barge.

Other dredging methods include Trailer Suction Hopper Dredger (TSHD) or backhoe dredging. TSH dredgers (SL of 186dB re 1µPa RMS) operate from ships by deploying hose which is then towed across the seabed and a suction inlet brings the material onto the vessel. Backhoe dredging (SL of 165dB re 1µPa RMS) removes material from the seabed with a boat-mounted excavator which lifts material onto the vessel. The choice of dredging method for the proposed development is likely to be either TSHD or backhoe dredging (**Ref. 1-2).**

Dredging can be a strong source with periods of continuous noise in near-shore regions, emitting their highest levels at low frequencies. Although noise levels from dredges do not normally exceed ship noise, ships seldom produce strong noise in one area for a prolonged period of time (**Ref. 1-13**).

4.1.4 Noise and Marine Mammals

At present the effect of human-generated noise on marine mammals is not fully understood. It is recognised that noise levels in the sea has increased steadily with the onset of industrialisation in the mid-nineteenth century but very little is known of the impact of noise on the long-term well-being of marine mammals and the ecosystems on which they depend (OSB, 2003) (**Ref. 1-15**).

Ocean Studies Board (**Ref. 1-15**) reviewed the behavioural responses of marine mammals to noise which are known to be highly variable and dependent on a suite of internal and external factors.

Internal factors include:

- individual hearing sensitivity and tolerance;
- activity pattern; and
- motivational and behavioural state at time of exposure.

Internal factors are also affected by the level of past exposure of the animal to the noise as this may have led to habituation or sensitisation; and demographic factors such as age, sex and presence of dependent offspring (**Ref. 1-15**).

External factors include:

- whether the sound source is stationary or moving;
- environmental factors influencing sound transmission; and
- habitat characteristics, such as being in a confined location or proximity to a shoreline.

Behavioural responses range from changes in surfacing patterns, to cessation of vocalisations, to active avoidance or exit from the area with the highest sound levels (**Ref. 1-15**).

With no reliable information available on the levels of sound likely to cause hearing damage for certain marine mammal species, it has been common practice to transfer human Damage Risk Criteria (DRC) to other mammals such as humans. Humans exposed in air to continuous sound levels 80dB above their absolute hearing thresholds are likely to suffer TTS (Temporary Threshold Shift) and eventual PTS (Permanent Threshold Shift). If this DRC can be applied to marine mammals it would be predicted that at low frequencies (<500Hz) TTS would occur at around 165–180dB re 1µPa in pinnipeds and at around 180–210dB re 1µPa in small odontocetes. An investigation by Lucke *et al*. (2009) (**Ref. 1-16**) shows that the SPL required for a harbour porpoise to experience TT\S where hearing is temporarily impacted is likely to be in the region of 184dB re 1µPa.

More recently, NOAA (2016) (**Ref. 1-17**) have provided interim guidance on in-water and in-air acoustic thresholds for pinnipeds and cetaceans (excluding tactical sonar and explosives) and these are displayed in **Table 4.1** and **Table 4.2.**

Table 4.1 : NOAA Fisheries current in-water acoustic thresholds (excluding tactical sonar and explosives) (NOAA, 2016).

Criterion definition threshold	Threshold (dB re 1µPa)
Level A - PTS (injury) conservatively based on TTS	190dB (RMS) for pinnipeds
Level A - PTS (injury) conservatively based on TTS	180dB (RMS) for cetaceans
Level B - behavioural disruption for impulsive noise (e.g., impact pile driving)	160dB (RMS)
Level B - behavioural disruption for non-pulse noise (e.g., vibratory pile driving, drilling)	120[1]dB (RMS)

Table 4.2 : NOAA Fisheries current in-water acoustic thresholds (excluding tactical sonar and explosives) (NOAA, 2016).

Criterion Definition Threshold	Threshold (dB re 20µPa)
Level A - PTS (injury) conservatively based on TTS	None established
Level B - behavioural disruption for harbour seals	90dB (RMS)

4.1.5 Modelling

4.1.5.1 The Impulse Noise Sound Propagation and Impact Range Estimator (INSPIRE) Model

In shallow coastal environments, the lower the frequency of sound, the more efficiently it propagates; in contrast, high frequencies tend to be more heavily attenuated. This is particularly the case in situations where depth decreases with distance. In shallow waters, sound interacts more with the seabed and is therefore more rapidly absorbed, sounds spread not only through the water column but also through the sediments resulting in lower attenuation as a result of lost energy. The Impulse Noise Sound Propagation and Impact Range Estimator (INSPIRE) model has been specifically developed by Subacoustech to model propagation of impulsive noise through shallow water (Hughes *et al*., 2013) (**Ref. 1-18**). Barham and Mason (2016) (**Appendix D**) utilised the INSPIRE model to estimate noise levels from impact piling, this model is based upon a large database of measured data and takes differences in bathymetry into account when calculating noise propagation through the shallow water column.

4.1.5.2 The Simple Propagation Estimator and Ranking (SPEAR) Model

The Simple Propagation Estimator and Ranking (SPEAR) model is a SL-TL model based on the noise measurement database of Subacoustech (**Appendix D**). The results of the model can be easily compared to determine the significance of the predicted sound and the significance of predicted impacts. Whilst the SPEAR model does not take local bathymetry into account it is believed for the Proposed Development that this will have a negligible impact due to the relatively short distances involved. The SPEAR model has been used in to estimate noise levels from vibro-piling and dredging activities (**Appendix D**).

[1] 120 dB threshold may be slightly adjusted if background noise levels are at or above this level

5. Inner Hebrides and Minches cSAC

5.1 Background

The Inner Hebrides and Minches cSAC is located within the West Scotland harbour porpoise management unit, where there is an area of high predicted and observed densities of harbour porpoise. This site is being considered for designation for its importance in supporting harbour porpoise (*Phocoena phocoena*) which is listed in Annex II of the Habitats Directive. This area has been identified as being suitable as a protected area due to the high densities of harbour porpoise during the summer as well as the presence of important summer habitats (Heinänen and Skov, 2015 (**Ref. 1-19**); Booth *et al*., 2013 (**Ref. 1-20**); Embling *et al*., 2010 (**Ref. 1-21**); Marubini *et al*., 2009 (**Ref. 1-22**)). Despite seasonal variation in their densities, harbour porpoise are present year round (Paxton *et al.,* 2011 (**Ref. 1-23**)) and therefore the designation will apply all year round. Based on SCANS-II survey data (July 2005) it is estimated that the site supports approximately 5,335 individuals, representing 31.4% of the population within the UK part of the West Scotland MU (Hammond *et al.,* 2013) (**Ref. 1-24**). Further studies have also shown that the Inner Hebrides and Minches site has been identified as being within the top 10% of areas that have persistently high densities of harbour porpoise in the UK (**Ref. 1-19**).

The Inner Hebrides and Minches cSAC covers an area of 13,539.77km^2. The physical characteristics of the cSAC are heterogeneous in nature and this is exemplified by the substrate. The dominant substrate type within the site ranges from shallow sand, rock and coarse or mixed sediment in the southern area (south of Mull and north-west of Islay) to mainly mud, interspersed with rock and course or mixed sediments in the central area (Mull, the Small Isles and Skye) which is where the Proposed Development is located. Similarly, the northern most area is dominated by both muddy and sandy dominated substrate.

The conservation objectives for the site have been defined as follows (**Ref. 1-25**):

- to maintain site integrity and ensure the site continues to make a contribution to harbour porpoise remaining at favourable conservation status in UK waters;
- to avoid significant killing, injury, or disturbance of harbour porpoise; and
- to maintain the habitat and prey of harbour porpoise in favourable condition.

5.2 Harbour Porpoise Hearing

Audiograms have been produced for harbour porpoise using data recorded by Andersen (1970), Bibikov (1992), Kastelein *et al.* (2002) and Popov *et al*. (1986) all of which are presented in Nedwell *et al.* (2004) (**Ref. 1-26**) and are shown in **Figure 5.1**.

The audiograms for harbour porpoise (**Figure 5.1**) and that reported by Thomsen *et al*. (2006) (**Ref. 1-27**) indicate that this species has a very wide range of hearing ability from <1–140kHz.

In general, harbour porpoise exhibit the following hearing thresholds (**Ref. 1-26**):

- 92–115dB RMS re 1 µPa below 1kHz;
- 60–80dB RMS re 1 µPa from 1-8kHz;
- 32–46dB RMS re 1 µPa from 16–140kHz where RMS equates to Root Mean Squared and is closest to the dB(A) model used on land; and
- between 120–140kHz, each of the four harbour porpoise test subjects exhibit a hearing threshold between 9 and 60dB re 1 µPa.

In addition to these, more recent guidelines have been produced by NOAA (**Ref. 1-17**) who describe weighted Temporary Threshold Shift (TTS) onset acoustic threshold (SEL_{cum}) of high-frequency (HF) cetaceans (which includes the harbour porpoise) as 153dB re 1 µPa.

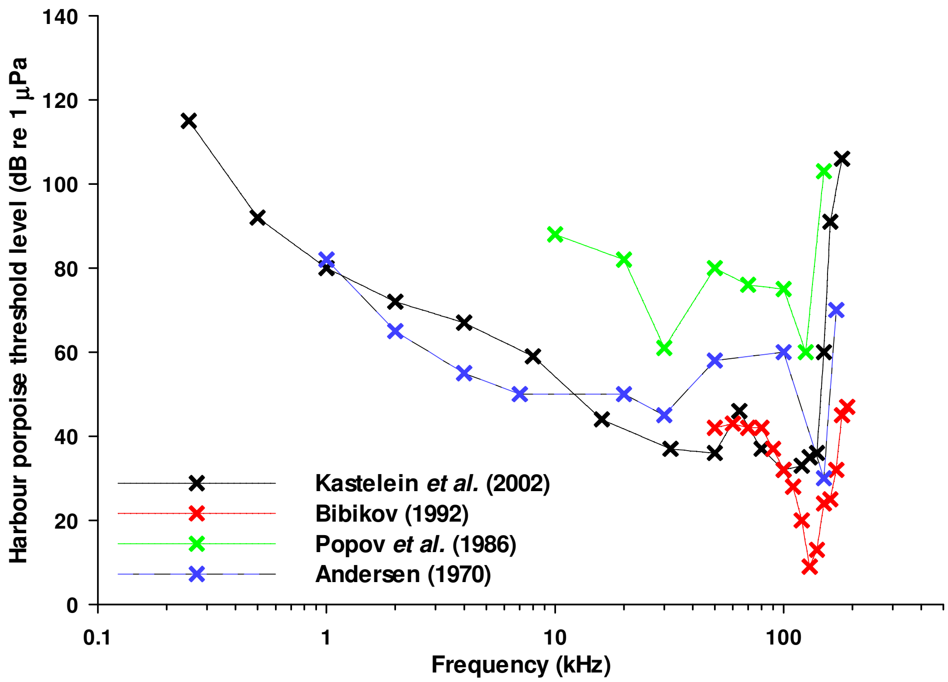


Figure 5.1 : Audiograms for harbour porpoise. Data adapted from Nedwell *et al.* (Ref. 1-26).

5.3 Baseline

5.3.1 Distribution

The baseline information used for this section of the HRA refers to the marine mammals (cetaceans – harbour porpoise) sightings data interpretation report conducted by the Sea Watch Foundation (2016), which can be found in **Appendix A**. Further data was called upon from that used to support the cSAC site selection assessment (**Ref. 1-25**).

Harbour porpoise distribution is restricted to areas of the seas in the northern hemisphere which are temperate and sub-arctic (mainly 11-14^{o}C). In British waters it is the most frequently observed (and stranded) cetacean, being most abundant around Scotland, Eastern England, West Wales and Southwest England (Evans *et al*, 2003 (**Ref. 1-28**); Reid *et al*, 2003 (**Ref. 1-29**); Hammond *et al*, 2013 (**Ref. 1-24**); Heinanen and Skov, 2015 (**Ref. 1-19)**; Paxton *et al*., 2016 (**Ref. 1-30**).

Once corrected for effort, the rates of sightings of harbour porpoise (since 1980) are highest off north-east Skye, east of Raasay, but are distributed all over the 50km^2 study area (see **Figure 5.2** and **Appendix A**) including the most inshore waters of Loch Alsh. Harbour porpoise are found throughout the year though they show a clear seasonal pattern in the number of sightings. Peak numbers of porpoise sightings occur in June – September, with the number of individuals peaking in August – September. The number of sightings appears to be a lot lower from November to March, even when the lower observation effort is taken into consideration. The main mating season is during summer, when harbour porpoise numbers are also at their highest, calving is usually between May and August with a peak in June.

Higher densities of harbour porpoise were noted to be consistently associated with depths of between 50m and 150m when constructed under various models (Booth, 2010) (**Ref. 1-31**; **Ref. 1-20**). Within the Inner Hebrides and Minches SAC the water depth ranges from low mean water springs at the coast to depths of around 250m. Within the vicinity of the Proposed Development the depths range from approximately 5–80m, but no apparent decrease in harbour porpoise sightings has been shown to occur in shallower water depths below 50m.

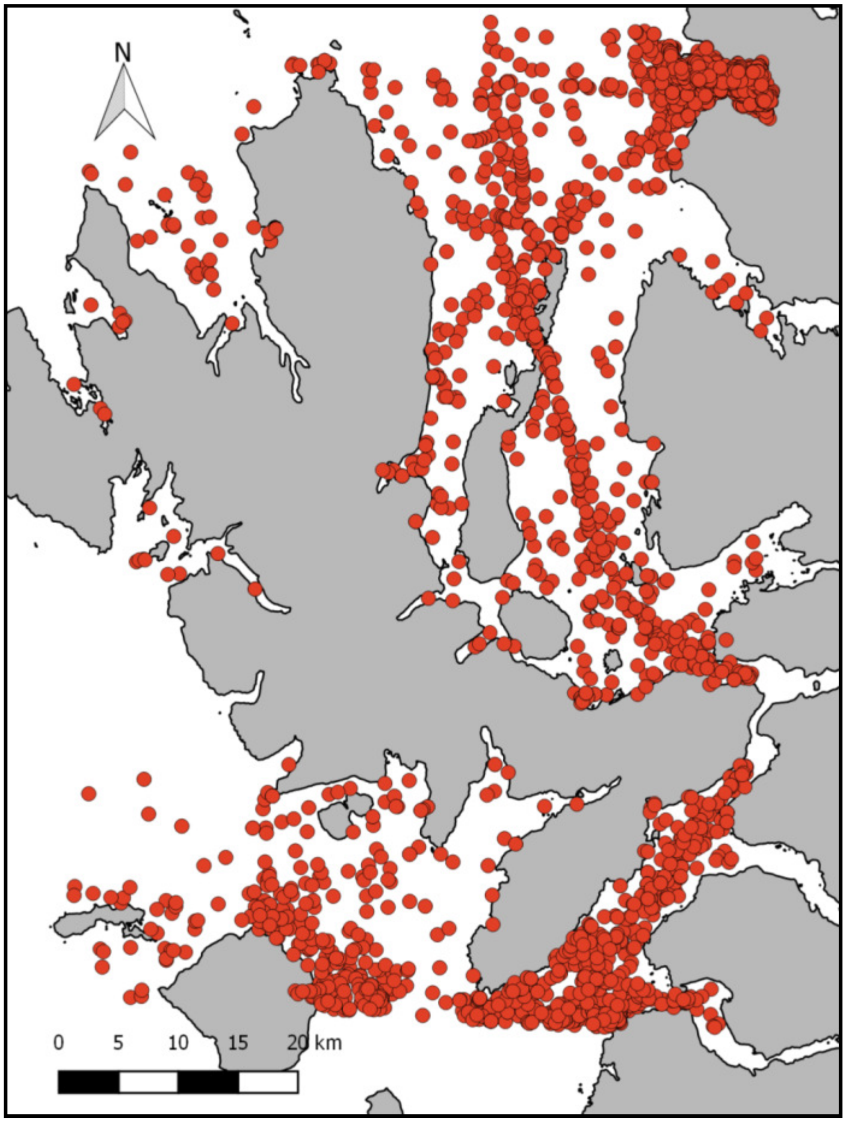


Figure 5.2 : Rate of harbour porpoise sightings (since 1980), from Sea Watch Foundation (2016)

5.3.2 Habitat Use

The Inner Hebrides and Minches cSAC is a productive foraging area for harbour porpoise owing to the variety of sediments within the site supporting a range of prey species. The sandy sediments of the cSAC support sandeels (*Ammodytidae*), which are the main prey species of harbour porpoise (Wright *et al.,* 2000) (**Ref. 1-32**). Small demersal and pelagic shoaling species, such as mackerel (*Scomber scombrus*) and herring (*Clupea harengus*), also constitute the foraging diets of the harbour porpoise (Santos and Pierce, 2003 (**Ref. 1-33**); Pierce *et al.,* 2007 (**Ref. 1-34**)). A range of nursery and spawning areas have been recognized by Coull *et al.* (1998) (**Ref. 1-35**) and Ellis *et al.* (2012) (**Ref. 1-36**) within the area, including ones for herring and mackerel as well as a spawning ground for sandeel (spawning period November to February). However, looking at adult landings of these species in the area of the Proposed Development, no herring or mackerel were caught from 2006–2010 therefore the area around the Proposed Development is not likely to be important for foraging of harbour porpoise.

It is believed that the narrow passage at Kyle Rhea is an important corridor between core habitats that are used for foraging and high-use areas, aiding the highly mobile and wide transits of the harbour porpoise around the Hebrides. Of these habitats the Sound of Sleat has been identified as an area of high importance for the harbour porpoise (**Ref. 1-21**; **Ref. 1-31**). This use of the Kyle Rhea passage by harbour porpoise can be inferred by the sightings data in **Figure 5.2** but was also the conclusion by the Hebridean Whale and Dolphin Trust (HWDT) who used visual and acoustic data from 2003-2011 and 2004-2011 respectively (**Ref. 1-37**).

5.4 Modelling Results

5.4.1 Piling Operations

Barham and Mason (2016) (**Appendix D**) provided the modelling outputs for vibro-piling (using SPEAR) and impact piling (using INSPIRE) in relation to PTS and TTS in harbour porpoise using the Southall *et al.* (2007) (**Ref. 1-38**) criteria. These are shown in **Table 5.1**.

Table 5.1 : PTS and TTS distances from source for harbour porpoise (using Southall *et al.*, 2007, criteria)

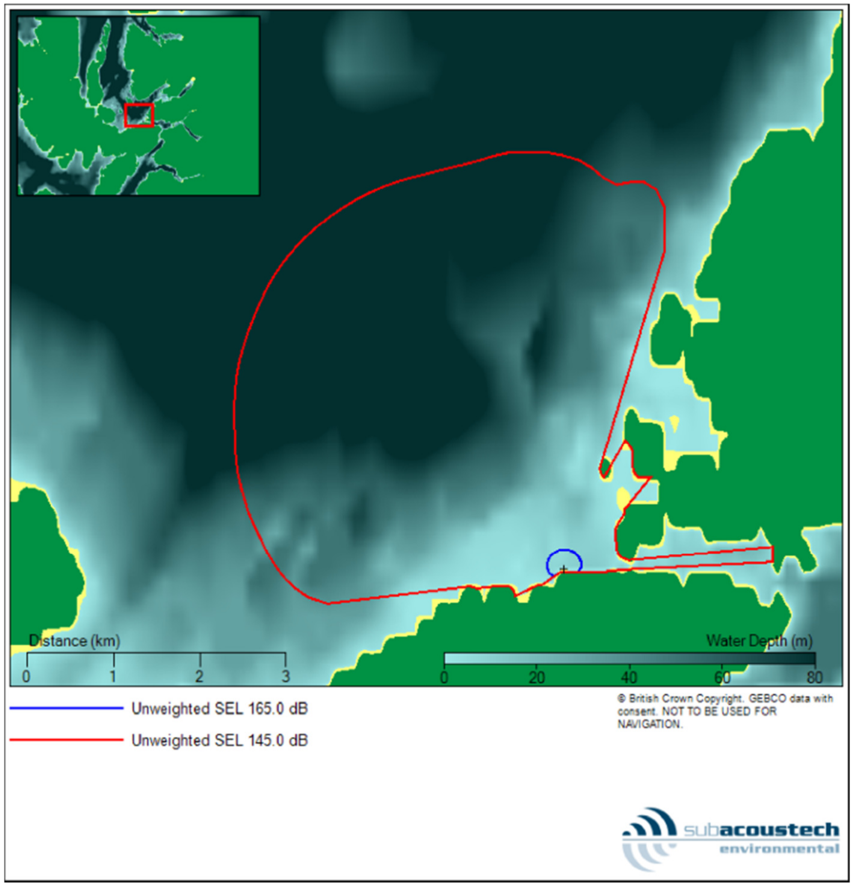
Harbour porpoise using Southall *et al* (2007) (Ref. 1-38) criteria	Tubular piles (1,225mm diameter)		Sheet piles (365 x 356 x 133mm)	
	Vibro-piling	Impact piling	Vibro-piling	Impact piling
230dB re 1µPa^{2}s (SPL_{peak}) (**PTS** in harbour porpoise)	<1m	<1m	<1m	<1m
218bB re 1µPa^{2}s (SPL_{peak}) (**TTS** in harbour porpoise)	<1m	3m	<1m	<1m
215dB re 1µPa^{2}s(M_{hf}) (M-Wtd SEL) (**PTS** in harbour porpoise, multiple pulse)	<1m	3m	<1m	<1m

Modelling based on criteria defined from Nehls *et al.* (2014), Tougaard (2013) and Lucke *et al* (2009) all cited in **Appendix D** assumed continuous piling and predicted the following SEL outputs:

- Tubular piles
  - PTS is likely within 1m from the source for vibro-piling and 21m from source for impact piling (**Appendix D**).
  - TTS is likely up to 19m from the source for vibro-piling and 224m from source for impact piling (**Appendix D**).
- Sheet piles
  - PTS is likely within 1m from the source for both vibro-piling and impact piling (**Appendix D**).
  - TTS is likely up to 5m from the source for vibro-piling and 7m from source for impact piling (**Appendix D**).

For vibro-piling behavioural avoidance could be exhibited up to 250m from the source of sound for tubular piles and up to 68m from the sheet piles. Both vibro-piling tubular and sheet piles allows free movement of harbour porpoise outside this area and no barrier effects preventing transiting to the east of the Proposed Development.

For impact piling of tubular piles behavioural avoidance could extend up to 4.8km from the source of sound and 145m from the source of sound for sheet piles (**Figure 5.3** (left)). Owing to the topography of the surrounding area, continuous impact piling of tubular piles could create a barrier effect for the harbour porpoise to the east of the Proposed Development. The level of sound could be such that 145dB SEL prevents harbour porpoise from utilising this area for the duration of the 14 week piling works. Continuous impact piling of sheet piles shows only a very small behavioural impact zone (145m) allowing free movement of harbour porpoise outside this area and no barrier effects preventing transiting to the east of the Proposed Development (**Figure 5.3** (right)).



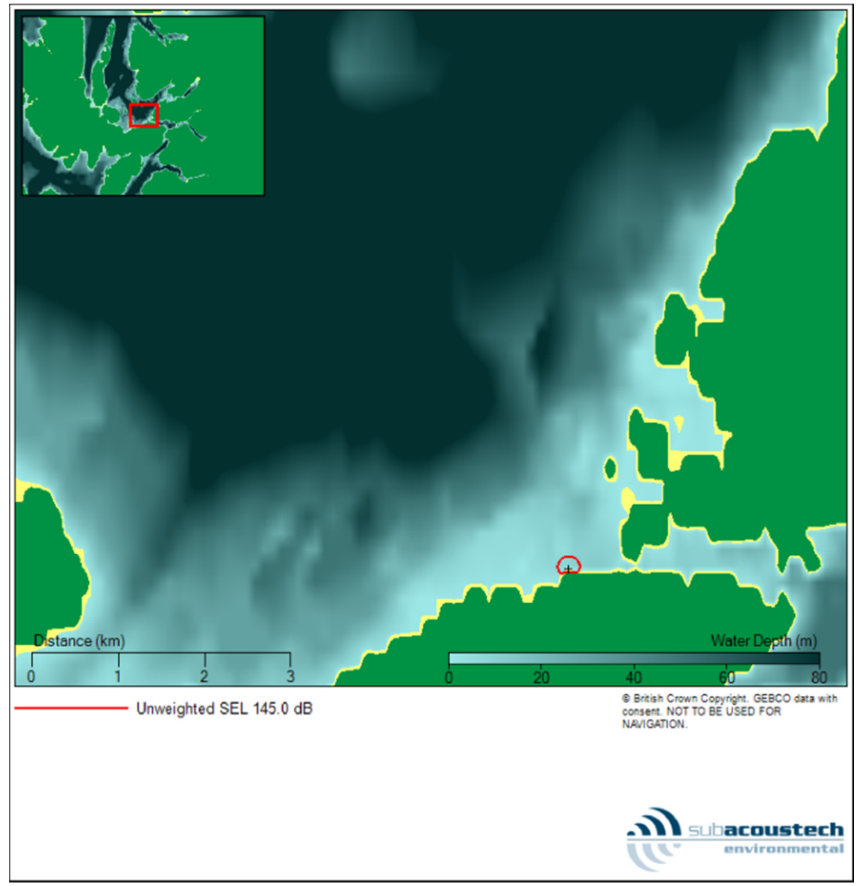


Figure 5.3 : Contour plots showing TTS (blue) and behavioural avoidance (red) in harbour porpoise using the criteria set by Nehls et al (2014) and Lucke et al (2009) for impact piling of a tubular piles (left) and sheet piling (right) (Appendix D).

Modelling based on interim criteria defined from NOAA (**Ref. 1-17**) and assuming continuous piling predicted the outputs for both tubular and sheet impact piling are shown in **Table 5.2.**

Table 5.2 : Modelling outputs for tubular and sheet piling, using NOAA interim criteria

NOAA Interim Sound Thresholds (Level B behavioural disruption) in Mairne Mammals	Tubular piles (1,225mm diameter)	Sheet piles (365 x 356 x 133mm)
160dB re 1µPa (RMS) (Impulsive noises e.g. impact piling)	490m	160m
120dB re 1µPa (RMS) (Non-pulse noise – e.g. vibro-piling)	11km	3.1km

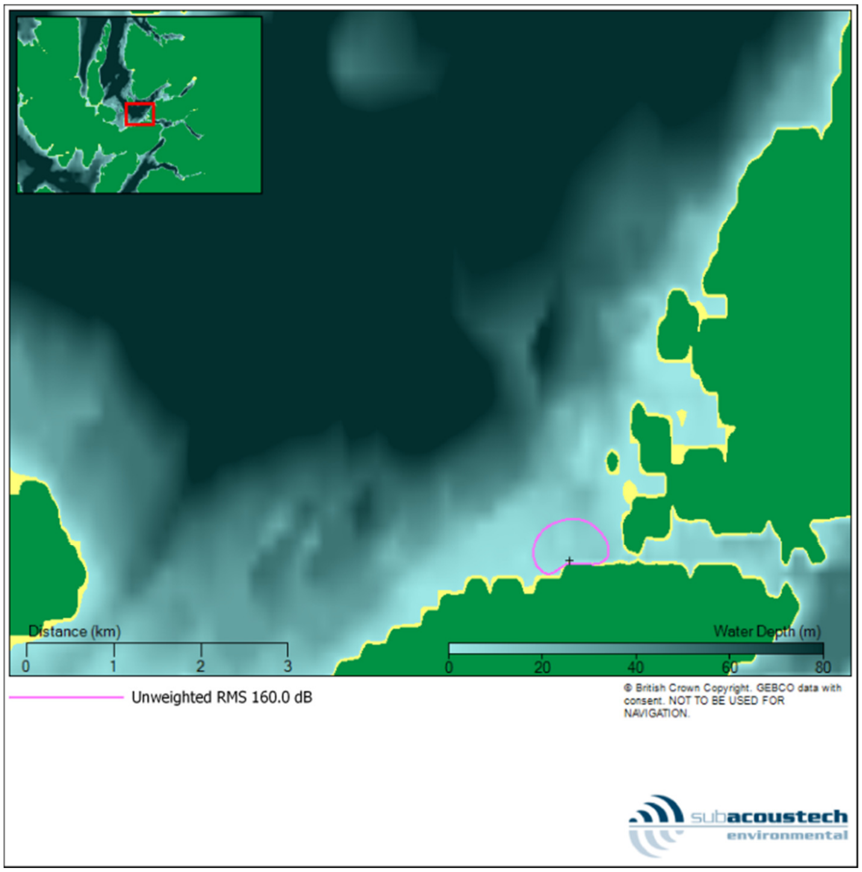


Figure 5.4 : Contour plot showing Level B behavioural disruption in marine mammals using the NOAA interim criteria for impulsive noise for impact piling of a tubular pile (Appendix D).

5.4.2 Dredging

Appendix D from Subacoustech provides the following modelling outputs using the SPEAR model for dredging on PTS and TTS in harbour porpoise based on the Southall *et al.* (**Ref. 1-38**) criteria. These are shown in **Table 5.3**.

Table 5.3 : Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) from dredging for harbour porpoise using the Southall et al (2007) criteria (Appendix D).

Harbour porpoise using Southall *et al* (2007) criteria	TSHD	Backhoe dredger
230dB re 1µPa^{2}s (SPL_{peak}) (**PTS** in harbour porpoise)	<1m	<1m
218dB re 1µPa^{2}s (SPL_{peak}) (**TTS** in harbour porpoise)	<1m	<1m
215dB re 1µPa^{2}s(M_{hf}) (M-Wtd SEL) (**PTS** in harbour porpoise, multiple pulse)	<1m	<1m

Modelling based on criteria from Nehls *et al.* (2014), Tougaard (2013) and Lucke *et al* (2009) all cited in **Appendix D** and assuming continuous dredging (TSHD) provided the following SEL outputs from the SPEAR modelling were produced:

- TSH dredger - PTS is likely at source up to 5m from source with onset of TTS exhibited up to 23m from the source of sound (**Appendix D**).
- Backhoe dredger – PTS is likely at source to less than 1m away with TTS exhibited up to 2m from the source of sound (**Appendix D**).

Modelling shows that behavioural avoidance would be exhibited up to 190m from the source of sound for TSH dredging and up to 14m from the source of sound for backhoe dredging. Both dredging methods allow for free movement of harbour porpoise outside this area and no barrier effects preventing transiting to the east of the Proposed Development.

Modelling based on interim criteria defined by NOAA (**Ref. 1-17**) and assuming continuous dredging and predicted the outputs for TSHD and back hoe dredger are displayed in **Table 5.4.**

Table 5.4 : NOAA interim sound thresholds (Level B - Behavioural disruption) for dredging for marine mammals (Appendix D).

NOAA Interim Sound Thresholds (Level B behavioural disruption)	TSHD	Backhoe dredging
120 dB re 1 µPa (RMS) (Non-pulse noise e.g. dredging)	2.3km	220m

5.5 Mitigation

Predicted potential impacts on harbour porpoise through underwater noise from piling can be reduced to negligible levels through the use of established mitigation designed for this purpose and to which Marine Harvest will be committed. Support for this approach is given in Scottish Government (**Ref. 1-39**) and on the SNH website (**Ref. 1-1**).

> "*Mitigation can sometimes be identified and applied to remove or cancel a likely significant effect once an LSE* [likely significant effect] *is concluded. This should generally only be mitigation which is straightforward and considered integral to the specifications of a plan or project, clearly achievable and sure to succeed. Such mitigation meets the precautionary nature of the HRA process.*"

All mitigation measures will form part of the Construction Environmental Management Plan (CEMP) and this will include a marine mammal (or piling management) protocol. Marine mammal mitigation during piling will follow the JNCC guidance (**Ref. 1-40**) which was specifically "*developed to reduce to negligible levels the potential risk of injury or death to marine mammals in close proximity to piling operations"*. The marine mammal protocol to be used at Kyleakin will include as a minimum the following features and in the knowledge that the Construction Contract allows only for working hours (including piling works) between 07:30 and 20:00 and therefore no piling can occur between 20:00 and 07:30.

1. **Trained Marine Mammal Observers (MMOs) and/or passive acoustic monitoring (PAM) operatives will be present during the piling start-up procedure to enforce a marine mammal mitigation zone**. They will be deployed on piling vessel or on nearby elevated platform to observe an area with radius no

less than 500m from the pile head. The MMO/PAM will acknowledge at all times the JNCC guidance on minimising the risk of disturbance and injury to marine mammals (JNCC, 2010) (**Ref. 1-40**).

2. **Avoidance of the commencement or re-commencement of piling during darkness, poor visibility or in sea state above 4** when only MMO's are present as marine mammals are too hard to visually detect in these conditions. It is acknowledged within Section 4 of the JNCC guidelines (2010) that there may be commercial reasons to consider piling re-commencement during the hours of darkness before 20:00 and after 07:30 and in these circumstances, PAM operatives will need to be present to provide extensive coverage of the whole mitigation zone if suitable mitigation measures are to be maintained.

3. **Pre-piling searches will be undertaken across the mitigation zone visually by MMOs and/or acoustically using PAM for a minimum of 30 minutes to confirm the absence of marine mammals within the 500m clear zone**. At the start of the working day, if visibility is less than the mitigation zone, then PAM will be used to determine the presence of marine mammals.

4. Throughout the piling operations a buoy affixed with a hydrophone (a T-Pod) will be deployed to facilitate the PAM of the mitigation zone and help full coverage to be achieved.

5. **Delay to piling start when marine mammals are present within the 500m clear zone or within 20 minutes of the previous sighting**.

6. **Soft start to piling noise over at least a 20 minute period, ramping up the noise to encourage dispersal of sensitive features**. Given the type and size of piling to be employed at the Kyleakin Pier project the impact piling plant may not be of a type that can gradually ramp up power to achieve a traditional soft start. Alternative methods will instead be adopted to achieve a similar effect of "soft start" to build up power and marine noise gradually to encourage marine mammals to exit the area without encountering hearing damage. A formal soft start process will be achieved through a mechanical system, fitted to an existing or newly installed pier pile to continuously create impact noise similar to a piling hammer with soft start capability. This "soft start" noise will be created for at least 20 minutes after MMO/PAM clearance of the area for start of impact piling.

7. **Should marine mammals be detected within the mitigation zone during the soft-start, then piling will either cease or at least the power will not be increased until the mammal leaves the mitigation zone and there is no further detection for 20 minutes**. It should be noted that if marine mammals are observed in the mitigation zone once piling activities are fully operational there is no need to cease operations as mammals have moved into the area with a known noise level being generated

8. **Repeat procedures 2 to 7 of this list when there is a break in piling activities of more than 10 minutes**. However, as a watch will be kept by the MMO and/or PAM operative during piling operations the MMO or PAM operative should be able to confirm the presence or absence of marine mammals, and it may thus be possible to commence the soft-start immediately and forego the pre-piling search.

Currently, the expectation is to use vibro-piling as the main piling method but with impact piling possible in the latter stages to accommodate harder substrates such as bedrock. Any additional mitigation measures will be determined before completion and submission of the CEMP.

5.6 In-combination Effects

It is possible that significant effects may arise from two or more insignificant effects through factors operating in combination with those from other plans and projects. Effects can combine through spatial or temporal overlap or act cumulatively through the near continuous activity of successive projects. **Table 5.5** identifies the known planning applications that have been submitted and which would remain active during the period of construction at the Proposed Development, as well as any permission already in place that may have a similar effect.

Table 5.5 : Known planning applications in the vicinity during the Kyleakin construction period.

Applicant / Permission holder	Description of works	Designated site	Marine licence application/licence ref.	Programme update
Kishorn Port Ltd	Regeneration of Kishorn Yard, Dry Dock and Quays, Wester Ross	Inner Hebrides and the Minches cSAC	Construction licence - 05003/13/0 Mooring licence - 05074/14/0	Works not yet commenced. Noise emissions may affect harbour porpoise. 16km from Kyleakin. Construction licence valid from 1 June 2014 until 31 May 2019 Mooring licence valid until 2020
Marine Harvest	Installation of a raft, Loch Na Beiste, Loch Alsh	Lochs Duich, Long and Alsh SAC	Application - 05529	Application may no longer be proposed; noted but consideration not required. Following consultation with Marine Scotland, it is considered that these proposed works are now complete
Kyle and Lochalsh Community Trust	Installation of 10 moorings on trots, Kyle of Lochalsh	Lochs Duich, Long and Alsh SAC	Mooring licence - 05436/15/0	Impact potential is through physical damage or indirect change in sedimentation patterns. However, installation of the moorings is believed to now be complete; consideration therefore not required.
Ministry of Defence (MOD)	BUTEC[2] underwater acoustic testing range (Inner Sound)	Inner Hebrides and the Minches cSAC		Intermittent testing periods already permitted.

It is believed this list of projects is comprehensive and covers all applications, pre-applications and permissions that have the potential to construct within the next three years.

It is possible that the regeneration of Kishorn Port may occur around the same time as the Kyleakin jetty extension. There is the potential for piling works to occur over the same time period which would increase overall levels of disturbance for harbour porpoise more than if either one construction were to occur at a time. It is however likely that a collaborative approach can be sought between the two parties to avoid the situation of simultaneous piling activities.

Similarly, underwater operations by BUTEC within the Inner Sound have the potential to increase any effect on harbour porpoise within the Sound as well as negatively affect the testing parameters in the BUTEC range. Close collaboration is already underway between Marine Harvest and the MOD/Qinetic at BUTEC in Kyle of Lochalsh and this will enable an ongoing arrangement between the two organisations to prevent in-combination effects on underwater noise and harbour porpoise.

[2] The British Underwater Test and Evaluation Centre (BUTEC)

5.7 Discussion

An adverse impact on site integrity would be one which affects the ability to maintain conservation objectives for the site. Conservation objectives for the Inner Hebrides and Minches cSAC (**Ref. 1-25**) are as follows:

- to maintain site integrity and ensure the site continues to make a contribution to harbour porpoise remaining at favourable conservation status in UK waters;
- to avoid significant killing, injury, or disturbance of harbour porpoise; and
- to maintain the habitat and prey of harbour porpoise in favourable condition.

Maintaining favourable conservation status requires consideration of "*the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations*" (**Ref. 1-40**). It goes on to clarify that "*conservation status can be considered favourable if:*

- *Population dynamics data indicate that the species is maintaining itself on a long-term basis as a viable component of its natural habitats;*
- *The natural range of the species is neither being reduced nor is likely to be reduced in the foreseeable future; and*
- *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.*

Assessment of FCS therefore requires consideration of: range, population, main pressures and threats, habitat and future prospects. For harbour porpoise, range and population are equated to distribution and abundance, respectively."

5.7.1 Disturbance

Harbour porpoise in the area of the Proposed Development will be disturbed by the underwater noise arising from piling and dredging, with some localised disturbance from vessel movements and other associated shore-based noise. The Proposed Development site is within the cSAC and harbour porpoise at risk from underwater noise impacts are an important part of the cSAC population.

Behavioural disturbance of harbour porpoise during repeated exposure to peak sound levels (SEL) emitted during underwater tubular impact piling works is anticipated to occur up to 4.8km from the proposed development. This is reduced to 250m when vibro-piling is employed and 190m for dredging (using TSHD).

Interim sound impact criteria guidance from NOAA (**Ref. 1-17**) suggests active avoidance of sound from impact piling occurs above 160dB re 1µPa (RMS), and 120dB for vibro-piling and dredging. Such avoidance behaviour will be stimulated within a zone up to 490m from the impact piling noise source (**Figure 5.4** and **Appendix D**) and up to 11km and 2.3km for vibro-piling and dredging respectively.

The behavioural disturbance zone is large (**Figure 5.4**) and encompasses the passage route between Loch Alsh and the southern Inner Sound such that individuals passing through the gap between the mainland and the Isle of Skye will encounter disturbance from worst case impact piling activities. Such disturbance would be unlikely to deter harbour porpoise from passing through and moving on through the Inner Sound. Models have shown that the perimeter of an area in which harbour porpoise would demonstrate avoidance behaviour (using NOAA interim sound threshold guidance) would not extend as far as the edge of the passage between the Inner Sound and Loch Alsh (**Figure 5.4, Appendix D**); leaving ample room for harbour porpoise passage and negligible restriction on range or distribution of harbour porpoise within the SAC.

It is worth noting that the ranges of impact for the 'continuous' noise sources using NOAA interim guidance, meaning vibro-piling and dredging, are based on much lower thresholds than presented by Lucke *et al.* (**Ref. 1-16**) which lead to much larger ranges presented for behavioural disturbance (11km for vibro-piling and 2.3km for dredging using THSD). The 145dB re 1µPa^{2}s (SEL_{ss}) presented as the behavioural threshold by Lucke *et al.* (**Ref. 1-16**) applies purely to harbour porpoise following experimental trials and is therefore more likely to represent the species-specific response. Additionally, the NOAA interim criteria of 120dB (RMS) for disturbance effects from such noise sources is also approaching the order of typical background noise levels and is therefore unlikely to lead to strong avoidance behaviours.

Harbour porpoise are in the area all year round but peak numbers occur between June and September, with the highest numbers in August and September. Between November and March there are comparatively lower densities, even when accounting for lower survey effort within this period (**Appendix A**). Construction activities to install piles are planned to commence in April 2017 and run for a period of around 14 weeks until mid-July 2017 (**Ref. 1-2**). On this basis, much of the piling works may have been completed prior to the peak season for harbour porpoise in the area. Similarly, the majority of piling activities will incorporate large vibrating hammers as far as possible with drop hammer being used only in the latter stages of driving to accommodate harder materials if required. Impact piling is therefore likely to occur during the peak season for harbour porpoise presence but will be operated for only a short period of time for a specific late stage of piling.

Where there is a risk of strong avoidance behaviour resulting from underwater noise from piling during construction and where that area at risk extends into the passage between the Inner Sound and Loch Alsh, there is a risk of temporary population fragmentation by deterring harbour porpoise from passing the area. However, modelling has shown that the area where noise emissions might be expected to stimulate strong avoidance behaviour, rather than temporary hearing discomfort, does not extend into the passage between these two water bodies. Such strong avoidance behaviour would also require their continuous presence and uses the worst case assumption of pile strikes every second of every day. The overall effect is such that only localised negligible effects on the range and distribution of the harbour porpoise would result from worst case underwater noise emissions and this would be insufficient to have a population wide effect on the range and distribution of harbour porpoise within the Inner Hebrides and Minches cSAC.

5.7.2 Temporary or Permanent Injury

Peak sound pressure (SPL) reaches PTS levels for harbour porpoise only within 1m of the sound source and reaches TTS levels within a very small 3m radius from the source of tube hammer piling, which is used to represent the worst case noise emission from construction activities (TTS threshold ~ 218dB re 1μPa, Southall *et al.* (**Ref. 1-38**), from **Appendix D**). Modelling shows that harbour porpoise exposed to sound pressures from impact piling over a continuous period of time (SEL) may suffer PTS within a zone extending to up to 3m or up to 21m around the noise source (using M-weighted SEL thresholds from Southall *et al.* (**Ref. 1-38**) and SEL_{ss} thresholds from Nehls *et al.*, 2014, cited in **Appendix D**). Similarly, the continuous exposure could lead to TTS if they remain in a zone extending up to 224m from the source piling noise (using 165dB re $1Pa^2s$ (SEL_{ss}) in Nehls *et al.*, 2014, cited in **Appendix D**[3]). It is unlikely for a harbour porpoise to remain within this area for long enough to experience TTS as strong avoidance behaviour is most likely prior to this point (see Section 5.4.1). This TTS area does not extend far enough to affect the free passage of harbour porpoise between Loch Alsh and the southern Inner Sound.

Whilst few harbour porpoise use this area as a key foraging area, there may be a small number of harbour porpoise passing through this area (<224m from the piling hammer) during the anticipated period of piling. The effect on harbour porpoise from such noise exposure is to mask sounds used as a normal part of their foraging, directional and communication strategies and as such may affect them for a period of time after their exposure ends; either through cessation of piling noise or through dispersal by the harbour porpoise. One study that has examined recovery of the hearing threshold of harbour porpoise after the stimulation of TTS has suggested normal hearing will recover within a period between 12 and 55 hours (**Ref. 1-16**).

The area affected ($0.08km^2$ using a radius <224m) represents 0.0006% of the available cSAC habitat and is not known to be a key location for the success of the harbour porpoise population within the cSAC, such as a renowned breeding or key foraging site. Where there is a risk of injury resulting from underwater noise from piling during construction, the area affected is so small and the continuous presence required is such that only isolated exposure may be expected and no effects on the population size within the cSAC would result.

[3] Using 24hour noise emissions at one pile strike per second and a flee rate of $1.5ms^{-1}$.

5.8 Concluding Statement

A study to inform a Stage 1 Screening Assessment was undertaken in respect of the Proposed Development at Kyleakin Fish Feed Plant. The study considered all potential source-receptor pathways between activities associated with the Proposed Development and ecological components of European Sites, including potential effects on mobile species. The study concluded that it was not possible to exclude the possibility of LSEs on the harbour porpoise population of Inner Hebrides and Minches cSAC from the effects of noise disturbance during construction. It was found that all other potential effects would make no, or a negligible contribution to adverse effects and were not considered further.

As the possibility of LSEs on the harbour porpoise population could not be excluded, Marine Harvest is obligated to provide further information to the Competent Authority to enable a more thorough assessment (an Appropriate Assessment) of the proposals on the harbour porpoise population of this cSAC. A study was therefore undertaken by Marine Harvest to identify the potential for effects to site integrity against the draft Conservation Objectives of Inner Hebrides and Minches cSAC due to potential effects on the harbour porpoise interest feature caused by the proposed activities at Kyleakin Fish Feed plant (and other activities acting in combination with the proposals).

The approach of the study was to collate information with respect to the baseline environmental conditions that could provide the benchmark to detect change. A literature review of studies was undertaken relating to the nature of the receiving environment, the nature of the potential effects, the sensitivity of the harbour porpoise receptors and other plans or projects that would be relevant to the European Site, with respect to in-combination effects. Where information gaps existed, further modelling was undertaken in consultation with stakeholders, to assess if effects on site integrity would arise, and to identify the need for, and design of, avoidance measures or mitigation. The geographic scope of the assessment was based on a consideration of the potential extent of effects for each project phase, in view of all potential contributing noise sources.

At the conclusion of the study, no adverse effects to the integrity of Inner Hebrides and Minches cSAC are anticipated. Based on the evidence presented in this report, it is not envisaged that this HRA will progress to Stages 3 or 4.

The draft conservation objectives for harbour porpoise with in the cSAC focus upon maintaining the favourable conservation status of the population at both a site and national level. Specifically, to "*maintain site integrity and ensure the site continues to make a contribution to harbour porpoise remaining at favourable conservation status in UK waters*."

The assessment therefore considered how the project activities could bring about changes to harbour porpoise population levels at a local and national scale. Particular attention has been given to studies which include references to dispersal and foraging distances between European Sites with harbour porpoise as qualifying features. This information was used to rule out European Sites with which interaction with the study area was considered extremely unlikely due to the temporary and relatively insignificant disturbance impacts anticipated (as discussed in the sections below), and separation distances involved.

It is considered that the overall maintenance of site integrity is met through the satisfaction of the two remaining draft Conservation Objectives. First, that there is no *significant killing, injury, or disturbance of harbour porpoise'* associated with the proposals.

Harbour porpoise are likely to be in the study area all through the year, with peak presence during the summer months (June to September). However, on the basis of the best available evidence presented in this report, and in view of the proposed mitigation measures, it is considered that the proposals would not kill, injure or disturb harbour porpoise in significant numbers or magnitude.

The work undertaken for this study indicates that underwater piling activities for extension of the existing pier and reinforcement of the ship unloading crane would not be of a volume sufficient to cause PTS. Impact piling activities would be sufficient, in the absence of mitigation, to cause TTS in harbour porpoise individuals within an approximate 224m radius of the piling noise emission. The area potentially affected (0.08km^2 using a radius

<224m) represents 0.0006% of the available cSAC habitat. This estimate is based on a worst case peak source level sound pressure of around 208dB re 1µPa at 10 metres, if noise emissions started and continued at full capacity.

In this worst case scenario, injury would likely occur to any harbour porpoise present within the TTS boundary distance when peak source pressures were emitted. The noise would mask normal harbour porpoise foraging and communication based hearing for a short period of time. This could restrict the foraging and possibly survival success of a few individuals across the cSAC. The effects, should they occur are not, however, considered to be significant or to present a risk to the integrity of the site. The area affected represents a relatively small proportion of the total cSAC and appears to be of no particular significance for the harbour porpoise population as a key breeding area or host to significant feeding/prey resource.

In summary, the Proposed Development may result in some localised disturbance to harbour porpoise, causing them to be deterred from accessing a small area (c.0.7km^2) affected by underwater noise from piling activities. These areas would be expected to reach the disturbance thresholds outlined within the interim guidance from NOAA (**Ref. 1-17**) of 160dB re 1µPa. Lucke *et al* (**Ref. 1-16**) demonstrated no behavioural reaction in harbour porpoise at exposure levels of less than 174dB re 1µPa, suggesting behavioural disturbance would occur above that sound level.

With the marine mammal mitigation protocol embedded within the mitigation plan for the Project's CEMP there will be negligible risk of injury to harbour porpoise through the avoidance of piling during the hours of darkness, soft start approach to piling noise emissions, searches for individuals within and around the exclusion zone of 500m from the piling noise source and the ability to cease piling operations until the area is once again clear of individuals. With this mitigation in place it is considered that disturbance would only affect a small percentage of these qualifying features; and is likely to be temporary and short term in duration. Any displaced harbour porpoise are likely to readily return to their original foraging areas daily during the hours of darkness when no piling activities will occur and once the three month period of piling activity ceases.

The draft conservation objectives also require that the applicant '*maintain the habitat and prey of harbour porpoise in favourable condition'*. Given the high mobility and range of the harbour porpoise interest, any loss of foraging habitat would constitute a very small fraction of the total area accessible to them. Adjacent areas of suitable habitat would be available where foraging would be relatively unaffected due to the variability in sediment types and prey items acceptable to harbour porpoise. The applicant is not expecting any LSEs on prey species, as established in study to inform the Stage 1 Screening Assessment.

Since the RIAA was compiled, modifications to the design and methodology have included the addition of a long sea outfall and a temporary jetty. Consequently, the effects of these modifications on European designated sites and their conservation objectives have been considered within a memorandum in **Appendix E**, the results of which were that the no AEoI remained valid.

6. Ascrib, Isay and Dunvegan SAC

6.1 Background

The Ascrib, Isay and Dunvegan SAC covers an area of 2,577.9ha and is situated in north-west Isles of Skye, the exact location for which can be seen in **Figure 6.1**. The primary qualifying marine interest is the species harbour seal (*Phoca vitulina*) which is listed on Annex II of the Habitats Directive, where the site encompasses three main haul-out sites. It is estimated that out of the total 1,728 individuals of harbour seal that are present in the Isle of Skye, 35% occur within the Ascrib, Isay and Dunvegan SAC site (SNH, 2005) (**Ref. 1-41**). A 12-year data set, compiled by SMRU up to 2004, showed that the SAC was used by an average 600 to 650 harbour seals through the period.

The highest density of seals is usually found on the islets, skerries and undisturbed mainland shores at the head of Loch Dunvegan. Notable numbers of harbour seal can also be found at the Ascrib Islands, situated at the mouth of Loch Snizort, and the Isay island group, positioned to the west of the Waternish peninsula. Adult harbour seals will typically move around their favoured locations, staying faithful to particular haul out areas (**Ref. 1-41**). A range of habitats are associated with the SAC which are important to the sustainability of the harbour seal populations within this area and despite exposure to severe wave action from the west, the highly indented coastline adds protection to these. The marine habitats that are encompassed in this area ranges from moderately exposed reefs and shallow sandbanks neighbouring the Ascrib Islands to sheltered fine sediments at the head of Loch Dunvegan.

The conservation objectives for the site have been defined as follows:

- population of the species as a viable component of the site;
- distribution of the species within site;
- distribution and extent of habitats supporting the species;
- structure, function and supporting processes of habitats supporting the species; and
- no significant disturbance of the species.

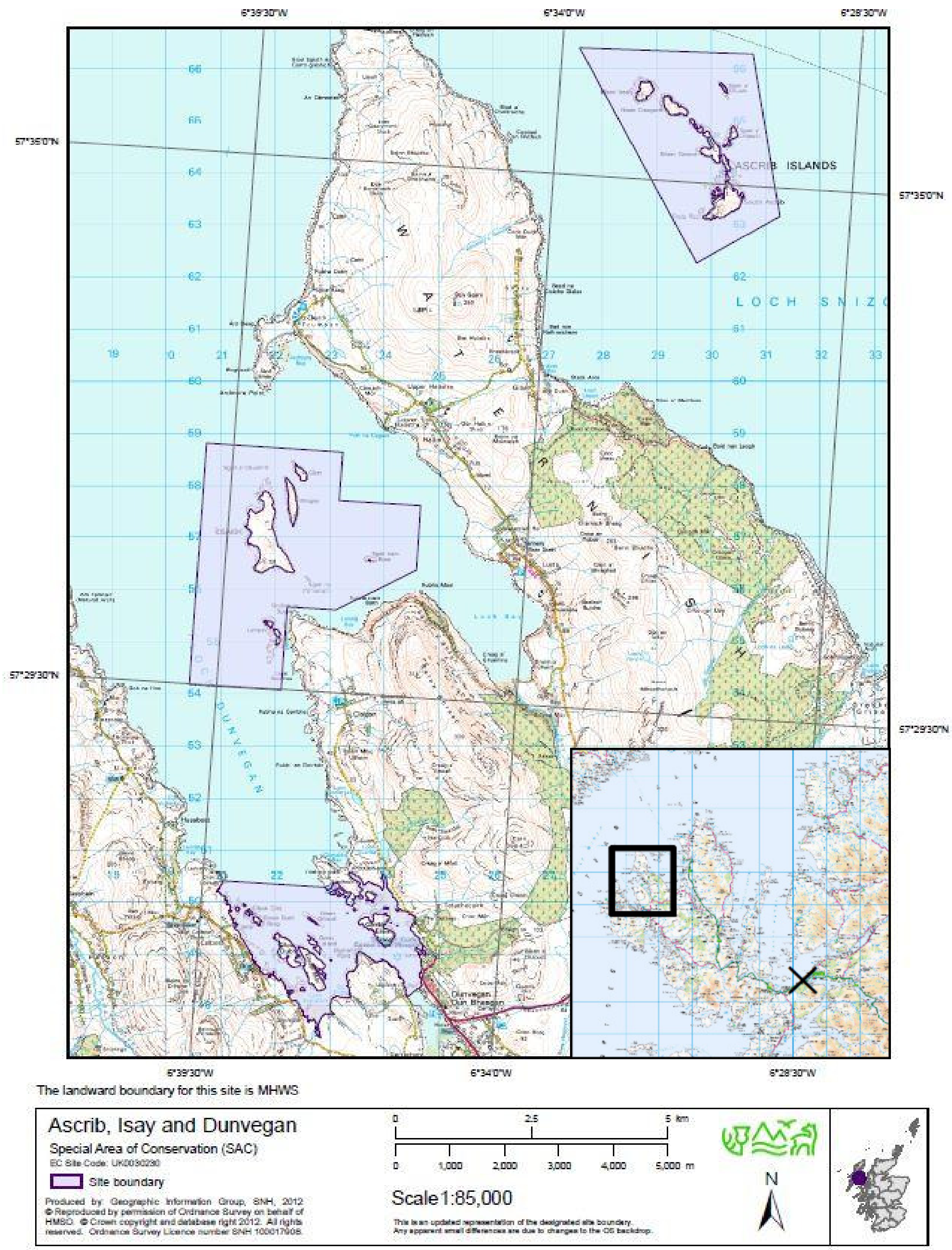


Figure 6.1 : Location of Ascrib, Isay and Dunvegan SAC.

6.1.1 Harbour Seal Hearing

Audiograms have been produced for harbour seal using data recorded by Kastak and Schusterman (1998); Terhune (1998) and Møhl (1968), all of which are presented in Nedwell *et al.* (**Ref. 1-26**) and are shown in **Figure 6.2** and **Figure 6.3** inclusive. More recent data from Kastelein *et al*. (2008) of harbour seal hearing thresholds in-air has also been incorporated into **Figure 6.2**.

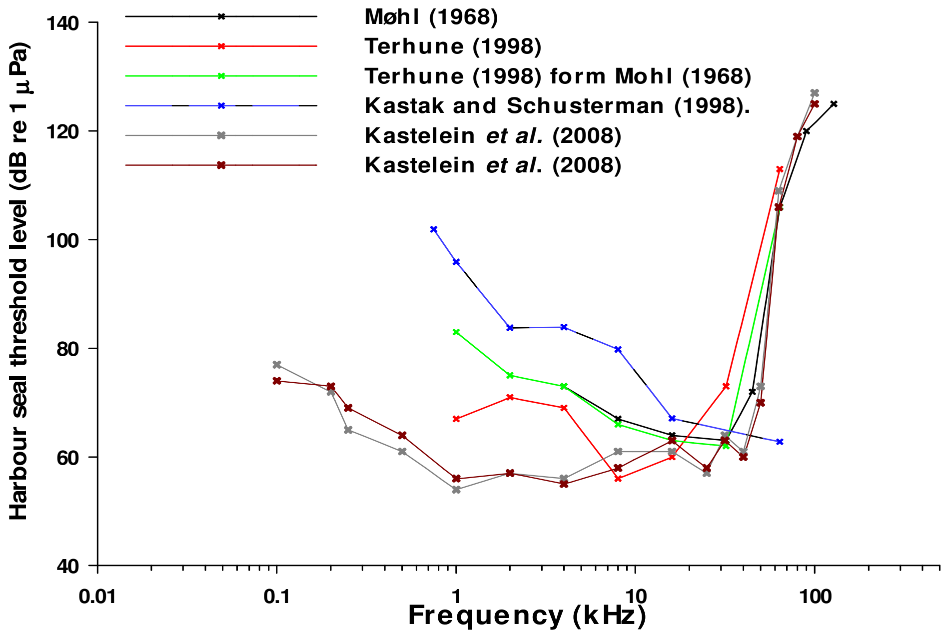


Figure 6.2 : Audiograms for harbour seal (in water). Data adapted from Nedwell *et al.* (Ref. 1-26) and Kastelein *et al.* (2008) (Ref. 1-43).

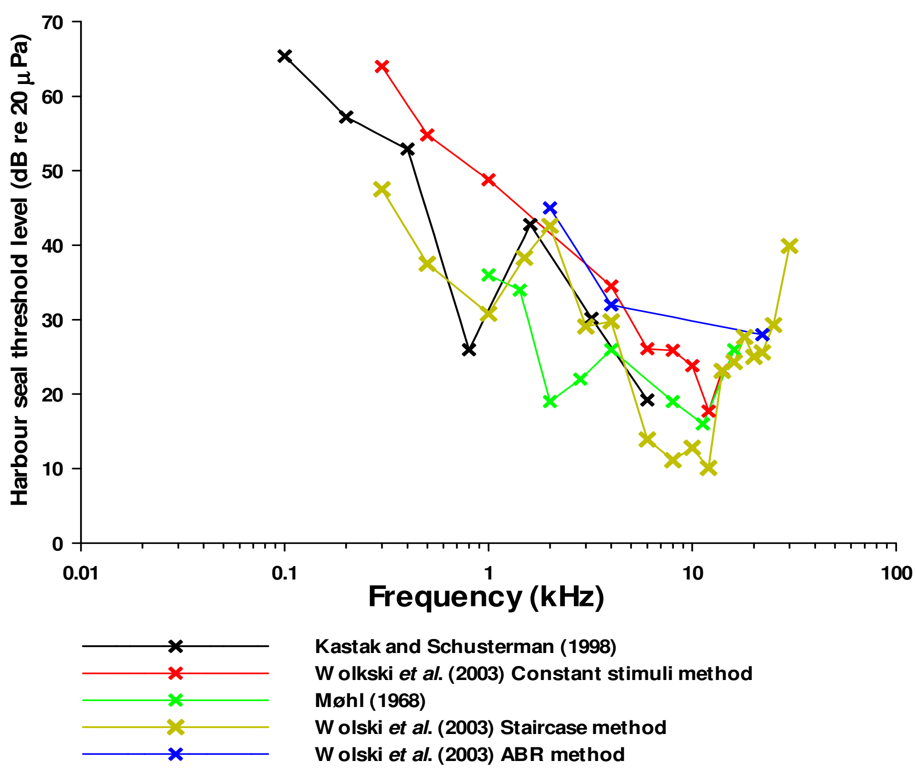


Figure 6.3 : Audiograms for harbour seal (in air). Data adapted from Nedwell *et al.* (Ref. 1-26).

Southall *et al*. (**Ref. 1-38**) estimated functional hearing across all pinnipeds as extending between 75Hz and 75kHz underwater with audiograms produced by Nedwell *et al* (**Ref. 1-26**) and reproduced in **Figure 6.2** show harbour seal to have an average hearing threshold of approximately 65dB re 1µPa between frequencies of 5kHz and 50kHz in water. More recent work by Kastelein *et al*. (**Ref. 1-43**) reported a range of best underwater hearing (10dB from maximum sensitivity) between 0.5–40kHz (**Figure 6.2**).

In addition to these, more recent guidelines have been produced by National Marine Fisheries Service (NMFS) (2016) (**Ref. 1-44**) who described weighted TTS onset acoustic threshold (SEL_{cum}) for pinnipeds in water as 181dB re 1µPa.

Unlike cetaceans, pinnipeds spend a proportion of their time on land and as a result, vocalise both in and out of the water with estimated functional hearing between 75Hz and 30kHz in air (Southall *et al*., 2007). Sensitivity of pinnipeds to airborne noise is thought to be similar to humans (Vella *et al*., 2001) (**Ref. 1-45**; **Ref. 1-38**).

The harbour seal has an optimum underwater hearing range of 8–16kHz (**Ref. 1-26**; **Figure 6.2)** but can hear better than harbour porpoises at levels below 1kHz. In air, a review by the Department of Commerce (2008) (**Ref. 1-46**) state that the hearing range for the pinniped family is greatly reduced in air to between 1kHz and 22kHz with sensitivity at 12kHz compared to 1kHz to 180kHz in water and peak sensitivity at around 32kHz (**Figure 6.3**).

6.2 Harbour Seal Baseline

6.2.1 Distribution

The baseline information used for this section of the HRA refers to the commissioned report by the Sea Mammal Research Unit (Plunkett, 2016; **Appendix B**) who investigated seal haul-out sites and their distribution in relation to the Marine Harvest Fish Feed Plant. Data and research used to support the site selection of the Ascrib, Isay and Dunvegan SAC was also called upon to inform this section (**Ref. 1-30**).

The numbers of harbour seal within Scottish seal population Management Areas, such as Orkney and the North Coast, Shetland, the East coast, the Outer Hebrides, and West Scotland South (Strathclyde), has seen a decline during moult surveys. In contrast, total counts of harbour seal within a 50km^2 study area (**Appendix B**), which encompasses the Proposed Development, have increased from 1,217 in 1996 to 2,589 in 2014, these numbers being relatively high. That is at least during the August moult, for the duration of which 62% of harbour seals hauled-out can be found at haul out sites within 20km of the Proposed Development which also equates to 25% of the total central subdivision of the West Scotland management unit (MU).

Only a very low proportion of tagged harbour seals entered the area from the West Scotland and the Western Isles MU (3 out of 89 tagged, 3.4%). Of 13 harbour seals that were tagged at the Ascrib, Isay and Dunvegan SAC (nearest SAC) none entered into the area. The proportion of time that seals spent in either an SAC or in the area was very small.

Further to this, vantage point surveys conducted at Kyle Rhea (7.5km from the Proposed Development) between July 2011 and July 2012 have shown that in summer months, sightings rates are >45 harbour seals per hour of effort. However, this area was not identified as a breeding site based on the lack of harbour seal pups during the breeding months June and July (Royal Haskoning DHV, 2012 cited in **Ref. 1-37**). This area was identified as a haul-out site which telemetry data showed to be connected with the Proposed Development. Six of the nine seals tagged were shown to move west of the coast of Skye past the Proposed Development site, but still showed no connectivity to a nearby SAC.

6.2.2 Habitat Use

Seals spend a large proportion of their time on land hauled-out in order to rest, moult and breed, particularly so in August when the seal moulting season takes place. The closest haul-out site cluster to the Proposed Development is located on an island 2km away called Eilean a' Mhal where most recently 197 harbour seals were sighted in 2014. The second closest cluster is the Pabay and Ardnish Peninsula designated haul-out site for harbour seals within the central West Scotland Management Unit and is located 4.5km from the Proposed Development. At this haul-out site 396 sightings of harbour seal were made in 2014.

Adult harbour seal populations within the UK generally forage within 60km of their haul-out sites (Thompson *et al.,* 1996) (**Ref. 1-47**) and it has been shown that they have an average foraging range of <40km in the Outer Hebrides; the closest regional tagging deployment to the Proposed Development from the study made by Sharples *et al.,* (2012) (**Ref. 1-48**). The closest known place of foraging to the Proposed Development has been identified at Kyle Rhea, however, this data also suggests that harbour seal may forage around the Proposed Development area considering the close proximity of the acknowledged haul-out sites. Also based on this information, the Ascrib, Isay and Dunvegan SAC is therefore likely to be at or beyond the average foraging range for harbour seal in this region and unlikely to transit to the Proposed Development to do so.

It is indicated, by a limited number of studies, that harbour seal are opportunistic feeders, having a range of prey species that they feed on. Common prey species include sprat, cod, herring, whiting, ling, mackerel and sandeel as well as squid and octopus. Of these species, adults of herring, whiting, mackerel and sandeel have been recognised as not being abundant in this area, however landings of ling were constant from 2006–2011 within the Proposed Development Area and are therefore more likely to be important for harbour seal foraging (**Ref. 1-37**).

6.3 Modelling Results

6.3.1 Piling Operations

Barham and Mason (2016) (**Appendix D**) provided the modelling outputs for vibro-piling (using SPEAR) and impact piling (using INSPIRE) in relation to PTS and TTS in harbour seal using the Southall *et al.* (**Ref. 1-38**) criteria. These are shown in **Table 6.1** and displayed in the contour plot below (**Figure 6.4**).

Table 6.1 : Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) from impact piling for harbour seal using the Southall *et al* (2007) criteria (Appendix D).

Harbour seal using Southall *et al* (Ref. 1-38) criteria	Tubular piles (1,225mm diameter)		Sheet piles (365 x 356 x 133mm)	
	Vibro-piling	Impact-piling	Vibro-piling	Impact piling
224dB re 1µPa2s (SPL_{peak})	<1m	1m	<1m	<1m
212dB re 1µPa^{2}s (SPL_{peak}) (TTS in harbour seal)	<1m	6m	<1m	<1m
186dB re 1µPa^{2}s(M_{pw}) (M-Wtd SEL) (PTS in harbour seal, multiple pulse)	<1m	340m	<1m	<1m

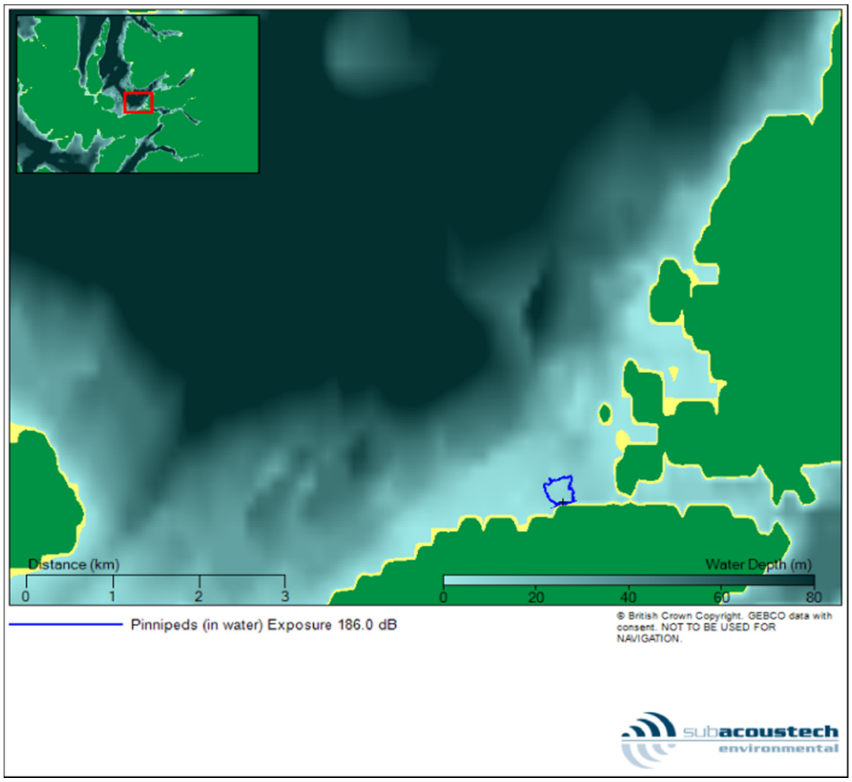


Figure 6.4 : Contour plot showing PTS in harbour seal using the Southall et al (2007) multiple pulse criteria assuming 24 hours exposure and a fleeing animal for impact piling of a tubular pile (Appendix D).

Both vibro-piling tubular and sheet piles allow free movement of harbour seal outside of the immediate vicinity of the Proposed Development and no barrier effects preventing transiting to the east of the Proposed Development or any other haul-out sites in the vicinity of the development

6.3.2 Dredging

Barham and Mason (2016) (**Appendix D**) provided the following modelling outputs using the SPEAR model for dredging on PTS and TTS in harbour porpoise using the Southall *et al.* (**Ref. 1-38**) criteria. These are shown in **Table 6.2**.

Table 6.2 : Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) from dredging for harbour seal using the Southall *et al* (Ref. 1-38) criteria (Appendix D).

Harbour seal using Southall *et al* (Ref. 1-38) criteria	TSH dredger	Backhoe dredger
224dB re 1µPa^{2}s (SPL_{peak}) (**PTS** in harbour seal)	<1m	<1m
212dB re 1µPa^{2}s (SPL_{peak}) (**TTS** in harbour seal)	<1m	<1m

Both dredging methods allows the free movement of harbour seal outside of the immediate vicinity of the Proposed Development and no barrier effects preventing transiting to the east of the Proposed Development or any of the haul-out sites in the vicinity of the Proposed Development.

6.4 Mitigation

From the information provided in Section 6.2.2, it is believed that although connectivity cannot be ruled out, there is no evidence (in this dataset) to suggest that there is any significant connectivity between the study area and the nearest harbour seal SAC.

6.5 In-combination Effects

As with harbour porpoise, underwater operations by BUTEC within the Inner Sound have the potential to increase any effect on harbour seal within the Sound as well as negatively affect the testing parameters in the BUTEC range. Close collaboration is already underway between Marine Harvest and the MOD/Qinetic at BUTEC in Kyle of Lochalsh and this will enable an ongoing arrangement between the two organisations to prevent in-combination effects on underwater noise and harbour seal. Despite this, it is not believed that there will be any in-combination effects arising from the proposed development.

6.6 Discussion

Harbour seal are present in the area between throughout the year and will haul-out to breed in June and July and to moult in August at sites around the Inner Hebrides including the nearest two sites at 2km and 4.5km from the Proposed Development. Although Kyleakin is not within the Ascrib, Isay and Dunvegan SAC, telemetry from tagged seals including those from the SAC suggest there may be some limited movement to this area whilst the majority of movement from the SAC was to the west and north of Skye, leaving only a very small proportion of harbour seals to venture this far south in the Inner Sound.

The implications of unmitigated piling noise on harbour seal are therefore relevant for a small number of individuals and unmitigated disturbance on any harbour seals from nearby haul-out areas needing to forage to feed young pups could have repercussions for the wider harbour seal population and breeding success. However, the marine mammal mitigation protocol to be employed during piling activities will prevent injury of harbour seals by restricting piling activities to those periods when seals are not within the 500m protective zone within which marine mammal presence is monitored by the Marine Mammal Observer. The soft start approach to piling noise will also encourage those outside of the 500m zone to remain away from impacted zone.

6.7 Concluding Statement

As for the harbour porpoise interest of the Inner Hebrides and Minches cSAC, the likely interactions between the proposed activities to build and operate Kyleakin Fish Feed Plant and the Annex II species, harbour seal interest in Ascrib, Isay and Dunvegan SAC, were considered.

Despite harbour seal being screened out at Stage 1 HRA Assessment, owing to the range and mobility of the this species, the potential for LSEs due to effects from noise disturbance on seals from this SAC, a distance of 60km from the proposed development, could not be ruled and so have been considered as part of this HRA Stage 2 Assessment.

The purpose of this report is to ensure that adequate information is available to support Appropriate Assessment. A review of the baseline information was undertaken and included a review of baseline surveys, literature reviews and consultation with stakeholders. Modelling work was also undertaken to predict the behaviour of the source-receptor effect pathway in the wider environment and its transfer to harbour seals as potential receptors.

In light of the scale, frequency and intensity of the activities it is considered that there is sufficient information to conclude that no activities, or amalgamation of activities (those acting in-combination) would be inconsistent with the Conservation Objectives for the seal interest of the Ascrib, Isay and Dunvegan SAC, or lead to deterioration in the attributes of the habitats and species over time.

There are five Conservation Objectives for the harbour seal qualifying feature of the Ascrib, Isay and Dunvegan SAC. One is focused upon the distribution of the species within site. As the SAC is situated well outside the estimated zone of influence for direct noise effects and no significant connectivity between the SAC and proposed development was found to occur, the seal distribution within the SAC would not be influenced.

The distribution, extent, structure and function of habitats and supporting processes must also be maintained. No habitat within the SAC would be lost, or altered. However, harbour seal in the area of the proposed development would likely be disturbed for the temporary duration of the construction works, by the underwater noise arising from piling and dredging. There would likely be some localised disturbance to seals in the local area from vessel movements and other associated shore-based noise.

Since the RIAA was compiled, modifications to the design and methodology have included the addition of a long sea outfall and a temporary jetty. Consequently, the effects of these modifications on European designated sites and their conservation objectives have been considered within a memorandum in **Appendix E**, the results of which were that the no AEoI remained valid.

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Appendix A. Status of Cetaceans in the Vicinity of the Isle of Skye (Evans and James, 2016)

Appendix B. Data on Seal Haul-Out Sites and Distribution in Relation to the Marine Harvest Fish Feed Plant at Allt Anavig Quarry, Isle of Skye (Plunkett, 2016)

Appendix C. Predicted Sound Levels Associated with Construction Activities at Kyleakin (Harland *et al.*, 2016)

Appendix D. Modelling Outputs of Piling and Dredging off the Isle of Skye (Barham and Mason, 2016)

Appendix E. Memorandum to RIAA to assess implications of design variations