EXECUTIVE SUMMARY

EnviroCentre Limited has been commissioned by Stornoway Port Authority (SPA) to undertake an Environmental Impact Assessment (EIA) for the proposed development of Newton Marina, near Goat Island, Stornoway. The proposed works would include an area of land reclamation, construction of a retaining wall, break water, slipway and a boat lift structure. Pontoons, creating berthing for 75 boats, would be installed and a navigation channel dredged.

Due to the proximity of works to European designated sites, a Habitats Regulations Appraisal (HRA) is required to determine the effect of the proposed development on the qualifying features of the following designated sites:

- The Inner Hebrides and The Minches candidate Special Area of Conservation (cSAC);
- Lewis Peatlands Special Protection Area (SPA); and
- Lewis Peatlands Special Area of Conservation (SAC).

It was not possible to rule out Likely Significant Effects (LSEs) for The Inner Hebrides and the Minches cSAC, the Red-throated Diver qualifying feature of the Lewis Peatlands SPA, nor the otter qualifying feature of the Lewis Peatlands SAC, during the HRA screening process. The effects on the qualifying features for these sites were therefore taken forward for further consideration in the next HRA stage, an Appropriate Assessment.

The Appropriate Assessment concluded that if mitigation described within Technical Appendix 5.2: Marine Mammal Protection Plan and Technical Appendix 5.5: Otter Report, within Volume 3 of this EIA Report (EIAR) are adhered to, along with the pollution prevention mitigation described in section 8 of this report, then there will be no significant effects on the integrity of the designated sites with regard to the conservation objectives for the sites' qualifying features.

Contents

Appendices

Tables

1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre Limited has been commissioned by Stornoway Port Authority (SPA) to undertake an Environmental Impact Assessment (EIA) for the proposed development of Newton Marina, Stornoway, Isle of Lewis. The Scoping Opinion received from Comhairle nan Eilean Siar (CnES) (CnES, 2017) and Marine Scotland (Marine Scotland, 2018) highlighted that the proposed works could have Likely Significant Effects (LSEs) on The Inner Hebrides and The Minches candidate Special Area of Conservation (cSAC) and that a Habitats Regulations Appraisal (HRA) would be required to determine the effect of the proposal on the qualifying features of the designated site.

1.2 Scope of Report

It is the responsibility of the competent authority (in this case both CnES and Marine Scotland) to conduct the HRA, however, this document aims to provide the information necessary for them to undertake the appraisal by:

- Providing an outline of the proposed works and any integral mitigation;
- Identifying European designated sites which are connected to and/or could potentially be affected by the proposed works;
- Identifying how works may impact the qualifying features of the designated site(s), the test of LSE);
- Giving consideration to other projects which may have an 'in combination' effect on European designated sites;
- Recommending sites which need to be taken forward for further assessment if LSEs for the qualifying features of the European designated site cannot be ruled out;
- Conducting an 'Appropriate Assessment' for qualifying features of sites for which LSE cannot be ruled out; and
- Propose further mitigation which would be required to avoid adverse impacts on the qualifying features of the European designated sites.

1.3 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

EnviroCentre accept no liability for use of the report for purposes other than those for which it was originally provided, or where EnviroCentre have confirmed it is appropriate for the new context.

1.4 Legislative Context

The Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (hereafter called the Habitats Directive) requires 'appropriate assessment' of plans and projects that are likely to have a significant effect on European designated Natura 2000 sites.

Article 6(3) establishes the requirement for Appropriate Assessment (AA):

"Any plan or project not directly connected with or necessary to the management of the [Natura 2000] site but likely to have a significant effect thereon, either individually or in combination with other plans and projects, shall be subjected to appropriate assessment of its implications for the site in view of the site's conservation objectives. In light of the conclusions of the assessment of the implication for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public".

Article 6(4) goes on to discuss alternative solutions, the test of 'imperative reasons of overriding public interest' (IROPI) and compensatory measures:

"If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted".

Should a decision be reached to the effect that it cannot be said with sufficient certainty that the development will not have any significant effect on the Natura site, then, as stated above, it is necessary and appropriate to carry out an Appropriate Assessment of the implications of the development for the sites in view of their conservation objectives.

The EEC (2001) guidance for Appropriate Assessment states (Section 3.2 pg. 25):

"It is the competent authority's responsibility to carry out the Appropriate Assessment. However, the assessment process will include the gathering and consideration of information from many stakeholders, including the project or plan proponents, national, regional and local nature conservation authorities and relevant NGOs. As with the EIA process, the Appropriate Assessment will usually involve the submission of information by the project or plan proponent for consideration by the competent authority. The authority may use that information as the basis of consultation with internal and external experts and other stakeholders. The competent authority may also need to commission its own reports to ensure that the final assessment is as comprehensive and objective as possible.

In this stage, the impact of the project or plan (either alone or in combination with other projects or plans) on the integrity of the Natura 2000 site is considered with respect to the conservation objectives of the site and to its structure and function."

1.4.1 Special Areas of Conservation (SACs)

SACs are designated under Article 3 of the Habitats Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, as part of the Natura 2000 network. It is transposed into Scottish law through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). This network comprises Annex I habitats - *"natural habitat types of community interest whose conservation requires the designation of Special Areas of Conservation"* and the habitats of Annex II species - *"animal and plant species of community interest whose conservation requires the designation of Special Areas of Conservation"*. Candidate SACs (cSACs) are sites that have been submitted to the European Commission, but not yet formally adopted. They are given the same level of protection as SACs.

1.4.2 Special Protection Areas (SPAs)

SPAs are designated under Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (the Birds Directive), transposed into Scottish law through the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Under the Directive, Scotland is obliged to protect the habitats of birds which are vulnerable to habitat change or due to their low population numbers i.e. rarity, especially species on Annex 1 of the Directive. Aspects of habitat protection are in the context of pollution, deterioration of habitat and disturbance. SPAs, together with SACs, form what is known as the "*Natura 2000 Network*".

1.4.3 Conservation Objectives

The overriding objective of the Habitats Directive is to ensure that the habitats and species covered achieve 'Favourable Conservation Status' and that their long-term survival is secured across their entire natural range within the European Union (EU). In its broadest sense, favourable conservation status means that an ecological feature is being maintained in a satisfactory condition, and that this status is likely to continue into the future. Definitions as per the EU Habitats Directive are given below.

<u>Favourable Conservation Status as defined by Articles 1 (e) and 1(i) of the Habitats Directive</u>

The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when:

- its natural range and areas it covers within that range are stable or increasing; and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future; and
- the conservation status of its typical species is favourable'.

The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

- the population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitats; and
- the natural range of the species is neither being reduced nor is likely to be reduced for 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.

Site-specific conservation objectives define the desired condition or range of conditions that a habitat or species should be in, in order for these selected features within the site to be judged as favourable. At site level, this state is termed 'favourable conservation condition.' Site conservation objectives also contribute to

the achievement of the wider goal of biodiversity conservation at other geographic scales, and to the achievement of favourable conservation status at national level and across the Natura 2000 network.

2 METHODOLOGY

2.1 The Habitats Regulations Appraisal Process

The Habitats Regulations Appraisal is a four-stage process with specific issues and tests outlined at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required. The stages are summarised in Table 2-1.

Table 2-1 Key Stages in the HRA Process

Stage 1	
Screening for Likely Significant Effect (LSE)	- Identify international sites in and around the project area. - Examine conservation objectives of the interest feature(s) (where available). - Review plan policies and proposals and consider potential effects on Natura 2000 sites (magnitude, duration, location, extent). - Examine other plans and programmes that could contribute to 'in combination' effects.
	- If no effects likely – report no likely significant effect. - If effects are judged likely or uncertainty exists – the precautionary principle applies, proceed to Stage 2. - If following screening the project is reviewed and includes integral mitigation which will ensure no likely significant effects, then no further Appropriate Assessment needed.
Stage 2	
Appropriate Assessment (AA)	- Complete additional scoping work including the collation of further information on sites as necessary to evaluate impact in light of conservation objectives. - Agree scope and method of AA with the competent authority. - Consider how the project 'in combination' with other projects will interact when implemented (the Appropriate Assessment). - Consider how effects on integrity of the site could be avoided by changes to the project and the consideration of alternatives. - Develop mitigation measures (including timescale and mechanisms). - Report outcomes of AA including mitigation measures.
	- If the project will not adversely affect European site integrity proceed with plan. - If effects or uncertainty remain following the consideration of alternatives and development of mitigation proceed to Stage 3.
Stage 3	
Alternative Solutions	- Consider alternative solutions, delete from project or modify. - Consider if priority species/habitats affected - identify 'imperative reasons of overriding public interest' (IROPI), economic, social, environmental, human health, public safety (only applicable in highly exceptional circumstances).
Stage 4	
Imperative Reasons of Overriding Public Interest (IROPI)	- Stage 4 is the main derogation process of Article 6(4) which examines whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project that will have adverse effects on the integrity of a Natura 2000 site to proceed in cases where it has been established that no less damaging alternative solution exists. - The extra protection measures for Annex I priority habitats come into effect when making the IROPI case. Compensatory measures must be proposed and assessed. The Commission must be informed of the compensatory measures. Compensatory measures must be practical, implementable, likely to succeed, proportionate and enforceable, and they must be approved by the Minister.

2.2 Screening

With reference to the SNH Guidance (SNH, 2015) the screening stage determines whether Appropriate Assessment is required, by:

- Determining whether a project (or plan) is directly connected with or necessary to the conservation management of any European sites;
- Describing the details of the project (or plan) proposals and other projects that may cumulatively affect any European sites;
- Describing the characteristics of relevant European sites; and
- Appraising likely significant effects of the proposed project on relevant European sites.

The guidance (SNH, 2015) gives the following definition of LSE:

"The test of significance is where a plan or project could undermine the site's conservation objectives. The assessment of that risk (of 'significance') must be made in the light, amongst other things, of the characteristics and specific environmental conditions of the site concerned."

*"A likely effect is one that cannot be ruled out on the basis of objective information. The test is a 'likelihood' of effects rather than a 'certainty' of effects. Although some dictionary definitions define 'likely' as 'probable' or 'well might happen', in the Waddenzee case the European Court of Justice ruled that a project should be subject to Appropriate Assessment "**if it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site, either individually or in combination with other plans and projects**". Therefore, 'likely', in this context, should not simply be interpreted as 'probable' or 'more likely than not', but rather whether a significant effect can objectively be ruled out."*

2.3 Appropriate Assessment

The Appropriate Assessment establishes whether or not a project's LSE identified during the screening stage will have an adverse effect on the integrity of the affected site with regard to its conservation objectives. Based on the guidance provided by SNH (2015) the effects of the proposal on the designated sites' qualifying features will determined by:

- Gathering information required to assess impacts (from site documents, scientific literature, EU and UK guidance on impact assessment and impact assessments from similar projects);
- Predicting the type and nature of impacts e.g. direct or indirect, short or long term;
- Assessing whether there will be adverse effects on the integrity of the site as defined by the conservation objectives and the status of the site. The precautionary principle must be applied at this stage. If it cannot be demonstrated with supporting evidence that there will be no adverse effects then adverse effects will be assumed; and
- Ascertaining if it is possible to mitigate adverse effects.

3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 Site Location

The proposed development site is situated within Newton Basin, immediately to the south of Stornoway within the Stornoway Harbour embayment. Newton Basin is a small tidal bay partially enclosed by Goat Island.

The proposed development is concerned with the reclamation of land to form a new marina and associated infrastructure and facilities at Goat Island, which is situated at the southern end of Stornoway and centred on grid reference 142660, 93214 (eastings/northings) as demonstrated on Figure 1.1 within Volume 2 of this EIAR (hereafter known as 'the site'). The location of the proposed development is shown in Appendix A.

3.2 Development Description

The existing use of Goat Island is associated with industrial use, incorporating a seafood processing facility owned by Macduff and the current Macmillan Boat Yard. Macmillan Boat Yard currently operates as a boat repair and renovation workshop, with facilities existing to repair and renovate vessels via the existing slipway to the immediate west of the facility.

The existing marina, (i.e. the Stornoway Inner Harbour Marina at Cromwell Street), has been virtually full since it opened in 2014 years ago with 83 berths being occupied all year round. In response to the success of the existing marina, the proposed development has been proposed to provide berthing for an additional 75 vessels and relieve the pressure over the summer months for visiting yachts. It is proposed that up to 50 of the berthing spaces could be provided to meet local demand, with the remaining berths reserved for visiting use.

The development includes:

- Reclamation of land along the north side of Goat Island (approx. 2.28ha) behind a concrete retaining wall, and subsequent formation of a level development platform;
- Excavation of material won by a combination of cutter suction and backhoe dredging from both sea and land, dredged to up to 3m Chart Datum (CD);
- Formation of a new rock-armoured breakwater of up to 75m in length and 20m wide at its base;
- Formation of a proposed slipway structure of 50m in length and the width of its base varying between 10m and 25m with rock armouring on its side, for the launch of vessels from Goat Island;
- Formation of a marina structure from a 100m long floating access walkway of 3m width, with three walkway legs around 60m long and 2.5m wide, and finger piers on either side, and a 24m long and 1.5m wide access bridge connecting to the shore;
- Installation of a boat lift structure to facilitate boat repair and overwintering of vessels of up to 90 tonnes in weight;
- A new rock armoured passing place on the western side of Battery Point, with a surfaced area of 0.01ha;
- Service provision for the berths, including power, water, waste collection, toilets, showers and other ancillary services;
- Up to 20 boat storage bays of up to 10m long, and 15 boat storage bays of up to 10m long (on land);
- Provision for 40 car parking spaces for marina users (and 18 (future) spaces for boatyard building users); and
- Two boat sheds of 12.5m in length, 5m wide and 6m high, to replace the existing boat sheds.

3.3 In-Combination Effects

The EIA Scoping Opinions received from CnES and Marine Scotland requested that impacts from the proposed development be considered in-combination with impacts from the Deep Water Port proposed development. At the time of writing, the Deep Water Port proposed development is also at the EIA stage and has yet to be consented. The proposed Deep Water Port is located approximately 2km south of the proposed Newton Marina development, in Glumaig Bay. Both developments are part of SPAs Masterplan[1]. The Deep Water Port would provide alongside berthing for cruise liners, a freight ferry berth, linkspan and marshalling area, an extensive laydown and storage area with dedicated heavy lift area to service renewables and decommissioning projects). The proposed Deep Water Port development would involve dredging and vibro and impact piling.

Although not yet at the planning stage Scottish and Southern Energy (SSE) are currently consulting on a Western Isles network connection. This would consist of a subsea cable running from Arnish Point on Lewis to the Scottish mainland. The cable would come ashore at a converter station at Arnish Point, to the south of the proposed Deep Water Port[2]. The converter station has received Planning Permission in Principle. As details of the proposed sub-sea works are not yet known in-combination effects are difficult to quantify but in general the environmental impacts of subsea cable installation and operation may include; seabed disturbance, an increase in suspended sediment concentrations and deposition, potential contaminant release from sediment, electromagnetic fields, thermal radiation, and underwater noise and disturbance from vessel and installation activity (NIRAS, 2015).

[1] http://www.stornowayportauthority.com/wp-content/uploads/2014/12/Stornoway-Port-Authority-Port-Masterplan.pdf
[2] https://www.ssen-transmission.co.uk/media/1240/1445_4579-sse-western-isles-panels_final.pdf

4 SCREENING FOR APPROPRIATE ASSESSMENT

For LSE to arise there must be a risk enabled by having a 'source' (e.g. construction works at a proposed development site), a 'receptor' (e.g. a European site or its qualifying interests), and a pathway between the source and the receptor (e.g. mobile species travelling between the proposed development site and a European site). The identification of a pathway does not automatically mean that LSE will arise. The likelihood of LSE will depend upon the characteristics of the source (e.g. duration of construction works), the characteristics of the pathway (e.g. what species and the number individuals travelling between the two sites) and the characteristics of the receptor (e.g. the sensitivities of the European site and its qualifying interests).

SNH (2015) guidance states that sites with mobile species should be considered within the screening process where there is a significant ecological link between the designated site and the proposed development site. It also states that for developments which could increase recreational pressures on designated sites, all sites within reasonable travel distance of the development should be considered for screening. It is also necessary to consider sites which are part of the same coastal ecosystem, where the proposed development may affect coastal processes.

The following sites were identified in the EIA Scoping Report (EnviroCentre, 2017) as being present within proximity of the development site and have therefore been considered within the screening for Appropriate Assessment. The location of the designated sites in relation to the proposed development is shown in Appendix A.

4.1 Designated Sites

4.1.1 The Inner Hebrides and The Minches cSAC

The Inner Hebrides and The Minches cSAC comprises an area of 13,500 km^2. It is situated to the east of the Outer Hebrides and encompasses the sea between the Outer Hebrides and the west coast of the Scottish mainland. It spans from Jura in the south east to Tolsta Head, on the Isle of Lewis, in the north west. The site supports approximately 30% of the harbour porpoises (*Phonoena phocoena*) within the West Scotland management unit. Harbour porpoises are present within the site throughout the year.

4.1.2 Lewis Peatlands SPA

The Lewis Peatlands SPA encompasses much of the upland interior of the Isle of Lewis and covers an area of 59,000 ha. The habitat largely consists of blanket bog, heath and freshwater lochans. The site is designated as it supports nationally important breeding populations of five Annex 1 bird species. There are also important breeding populations of two migratory bird species. It should be noted that birds have been scoped out of the EIA as the effects on birds within the SPA were considered to be not significant. This approach was agreed by CnES (CnES, 2017). Due to the mobile nature of the qualifying species and the presence of suitable habitat for birds that are qualifying features within and in close proximity the proposed development site it is necessary to consider the SPA within the HRA, in line with SNH (2015) guidance.

4.1.3 Lewis Peatlands SAC

The Lewis Peatlands SAC covers an area of 27,955 ha and overlaps with part of the Lewis Peatlands SPA. The site is designated for its freshwater and upland habitats, which support many of the bird species the SPA is designated for, as well as otter (*Lutra lutra*). Similar to the Lewis Peatlands SPA, the qualifying features of the

SAC have not been considered within the EIA. The scoping report (EnviroCentre, 2017) ruled out significant effects on otter and the habitats within the SAC due to the distance between the designated site and the proposed development site. The SAC has been considered within the HRA due to the mobile nature of the species which are qualifying features of the site, in line with SNH (2015) guidance.

4.2 Screening Assessment

The screening assessments for likely significant effects of the proposed development on the qualifying features of the sites are shown in Table 4-1 below.

Table 4-1 Screening Assessment for Likely Significant Effects of the Proposed Development

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
The Inner Hebrides and The Minches cSAC Approximately 2 km south east	(Draft Conservation Objectives) 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. To maintain the habitat and prey of harbour porpoise in favourable condition.	Harbour porpoise (*Phocoena phocoena*)	Pathway identified. During the construction phase of the proposed development, harbour porpoise may be impacted by underwater noise as a result of vibration and impact piling, rock armour placement, vessel movements and dredging. The possible effects of underwater noise on harbour porpoise include temporary or permanent threshold shifts in hearing, disturbance (masking and/or habitat avoidance) and in extreme cases intense noises can lead to injury or death of individuals. These impacts may increase in magnitude and/or duration when considered in-combination with the proposed Deep Water Port development and the proposed SSE subsea cable installation. During the construction and operation phases pollutants released into the water (as a result of dredged sediments, spilled material from vessels and spillage from onshore storage of fuel and chemicals) could have temporary impacts on harbour porpoise either directly, or indirectly, if prey items are affected. Toxic pollutants could result in habitat avoidance, injury or death of individuals and/or reduced prey availability leading to loss of condition. An increased number of vessels travelling through the cSAC, both during construction and once the marina is in operation, could increase the risk	Screened in

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
			of collision, resulting in death or injury to individuals. This impact may increase in magnitude and duration when the in-combination effects from the proposed Deep Water Port development and the proposed SSE subsea cable are considered. An increase in the number of vessels could also lead to an increase in continuous low level underwater noise throughout the operational life of the proposed development. This is unlikely to result in physical trauma but could lead to habitat displacement if individuals avoid areas with higher noise levels. An increase in continuous low level noise could also affect harbour porpoise indirectly if their prey are affected. The effects of these impacts may increase in magnitude when in-combination effects of the proposed Deep Water Port development are considered. There are unlikely to be increased vessels associated with the proposed SSE subsea cable once it is installed. Habitat for harbour porpoise and their prey within the cSAC is not predicted to be impacted by the works during construction or operation due to the distance between the proposed development and the cSAC. LSE cannot be ruled out for harbour porpoise.	
Lewis Peatlands SPA Approximately 4.5 km north and south west	To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and	Black-throated Diver (*Gavia arctica*), breeding	Pathway identified. No potential impacts to Black-throated Diver or their habitat within the SPA are predicted due to the distance between the SPA and the proposed development. According to Pendlebury *et al.* (2011) Black-throated Diver can range up to 10 km from their nests during the breeding season. The report also	Screened out

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
	To ensure for the qualifying species that the following are maintained in the long term: • 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.		states that foraging "mainly occurs on the breeding loch, occasionally on surrounding lochs and exceptionally at nearby coastal sites". Whilst the proposed development site is within the foraging range of Black-throated Diver within the SPA, it is not considered to be a key foraging habitat. No LSE is predicted.	
		Dunlin (*Calidris alpina schinzii*), breeding	Pathway not identified. No potential impacts to Dunlin or their on habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is 3km for Dunlin. It is therefore considered unlikely that birds breeding within the SPA will be present within the development site. No LSE is predicted.	Screened out
		Golden Eagle (*Aquila chrysaetos*), breeding	Pathway identified. No potential impacts to Golden Eagle or their on habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is 9km for Golden Eagle, although the core range is 2-3km. The development site is therefore within the foraging range of Golden Eagle present within the SPA. However, the low lying rocky coastal habitat is considered to be sub-optimal for Golden Eagle,	Screened out

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
			which generally hunt for prey items such as rabbits and hares, or scavenge deer and sheep carcases, on open moorland (Whitfield, 2000). No LSE is predicted.	
		Golden Plover (*Pluvialis apricaria*), breeding	Pathway identified. No potential impacts to Golden Plover or their on habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is 11km for Golden Plover, although the core range is 3km. It is possible that birds breeding within the SPA could be present within the proposed development site, however the habitat is considered to be sub-optimal for foraging. No LSE is predicted.	Screened out
		Greenshank (*Tringa nebularia*), breeding	Pathway not identified. No potential impacts to Greenshank or their on habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is 3km for Greenshank. It is therefore considered unlikely that birds breeding within the SPA will be present within the proposed development site.	Screened out

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
			No LSE is predicted.	
		Merlin (*Falco columbarius*), breeding	Pathway identified. No potential impacts to Merlin or their on habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is 5km for Merlin. It is possible that birds breeding within the SPA could be present within the proposed development site. However, the lowland rocky coastal habitat is considered to be sub-optimal for breeding birds present within the SPA. No LSE is predicted.	Screened out
		Red-throated Diver (*Gavia stellata*), breeding	Pathway identified. No potential impacts to Red-throated Diver or their habitat within the SPA are predicted due to the distance between the SPA and the proposed development. Pendlebury *et al.* (2011) state that the maximum foraging range from nests during the breeding season is generally 8km for Red-throated Diver but can be up to 13.5km in the Western Isles. It is possible that birds breeding within the SPA could utilise the water within the proposed development site and the wider Stornoway bay for foraging. Black *et al* (2015) identified the outer Stornoway bay as a potentially important marine area for Red-throated Divers during the breeding season. During the construction phase of the proposed development foraging Red-throated Divers could be impacted temporarily by noise from	Screened in

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
			vibration and impact piling, dredging and vessel movements. This could result in displacement from the habitat. This impact could increase in magnitude and/or duration when considered in-combination with the proposed Deep Water Port and SSE subsea cable developments. During the construction and operation phases pollutants released into the water (as a result of sediments released during dredging, spilled material from vessels and spillage from onshore storage of fuel and chemicals) could have temporary impacts on Red-throated Diver either directly, or indirectly, if prey items are affected. Toxic pollutants could result in habitat avoidance, injury or death of individuals and/or reduced prey availability leading to loss of condition. This impact may increase in magnitude and/or duration when considered in-combination with the proposed Deep Water Port and SSE subsea cable developments. Increased numbers of vessels in the water once the marina is in operation could also lead to displacement from the habitat in the longer term due to visual and noise disturbance. The magnitude of this impact is likely to increase when in-combination effects from the proposed Deep Water Port are considered. No increase in vessel movements are associated with the SSE subsea cable developments. LSE cannot be ruled out for Red-throated Diver.	
Lewis Peatlands SAC approximately 8km north and south west	To avoid deterioration of the qualifying habitats thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving	Habitats include: • Acid peat-stained lakes and ponds • Blanket bog	Pathway not identified. The proposed development site is bounded on the landward side by the urban habitat of Stornoway town and infrastructure, meaning there are limited terrestrial habitat connections with the site. The River Creed and Glen River form hydrological connections between the SAC and	Screened out

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
	favourable conservation status for each of the qualifying features; and To ensure for the qualifying habitats that the following are maintained in the long term: • Extent of the habitat on site; • Distribution of the habitat within site; • Structure and function of the habitat; • Processes supporting the habitat; • Distribution of typical species of the habitat; • Viability of typical species as components of the habitat; and • No significant disturbance of typical species of the habitat.	• Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels • Depressions on peat substrates • Wet heathland with cross-leaved heath	Stornoway Bay, however, as the proposed development is downstream of the SAC these are not considered to form significant habitat links. No LSE is predicted.	

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
	To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and To ensure for the qualifying species that the following are maintained in the long term: • Population of the species 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	Otter	Pathway identified. Otters are mobile animals and can range over 50km (Chanin, 2003). It is therefore feasible that otters within the SAC could utilise the habitats within and adjacent to the proposed development for foraging, commuting and resting. During the construction phase of the proposed development otters could be impacted temporarily by noise from impact piling, dredging, vessel and onshore vehicle movements. Increased vessel movements once the marina is in operation could also result in disturbance. Given the location of the proposed development, in close proximity to the existing harbour and marina, roads, residential areas and industrial units, any otter utilising the site will be accustomed to anthropogenic noise and vessel movements. Any disturbance as a result of the development is therefore predicted to have a negligible effect. During the construction and operation phases pollutants released into the water or on land (as a result of sediments released during dredging, spilled material from vessels and spillage from onshore storage of fuel and/or chemicals) could have temporary impacts on otter either directly, or indirectly, if prey items are affected. Toxic pollutants could result in avoidance of supporting habitat outwith the SAC, injury or death of individuals and/or reduced prey availability outside of the SAC, leading to loss of condition. This impact may increase in magnitude and/or duration when considered in-combination with the proposed Deep Water Port and the proposed SSE subsea cable developments.	Screened in

Site Name and Distance to Proposed Development	Conservation Objectives	Qualifying Features	Likely Significant Effect (LSE)	Screening Assessment
	• No significant disturbance of the species.		No impacts on the structure, function or supporting processes of habitats within the SAC are predicted due to the distance between the proposed development and the designated site. LSE cannot be ruled out for otter.	

4.3 Screening Conclusion

The outcome of screening for Appropriate Assessment is to reach one of the following determinations:

a) A stage 2 AA of the proposed development is required if it is concluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site.
b) A stage 2 AA of the proposed development is not required if it can be concluded, on the basis of objective information, that the proposed development, individually or in combination with other plans or projects, will not have a significant effect on a European site.

Following an examination, analysis and evaluation of the relevant information including, in particular, the nature of the proposed development and the likelihood of significant effects on The Inner Hebrides and The Minches cSAC, Lewis Peatlands SPA, Lewis Peatlands SAC and applying the precautionary principle, it is the professional opinion of the authors that at present there is insufficient information to rule out likely (or possible) significant effects to one or more of the qualifying features within all of the designated sites. An AA for the proposed project will therefore be required to ascertain whether or not the proposed works will adversely impact on the integrity of The Inner Hebrides and The Minches cSAC, Lewis Peatlands SPA and Lewis Peatlands SAC qualifying features. For the Lewis Peatlands SPA, an AA is only required for the Red-throated Diver qualifying feature as there is either no connection and/or no LSE arising from the proposed development on the other qualifying features. Similarly, an AA is only required for the otter qualifying feature of the Lewis Peatlands SAC as there is no pathway for LSE identified for the other features.

5 APPROPRIATE ASSESSMENT FOR THE INNER HEBRIDES AND THE MINCHES CSAC

5.1 Harbour Porpoise

The harbour porpoise is a small cetacean that lives predominantly in coastal waters. Its diet consists of small pelagic fish such as whiting and sand eel, as well as squid and octopus. Harbour porpoises mate and rear young during the summer months, May to August, and typically live in small family groups of two to three animals but may form groups of between 10 and 20. They are present within The Inner Hebrides and The Minches cSAC throughout the year.

The Inner Hebrides and The Minches cSAC sits within the Western Management Unit (MU) for harbour porpoise. The total population within the MU is 21,462 (JNCC, 2015), of which the cSAC supports about 30%, equating to c. 6,500 individuals. The main sensitivities for harbour porpoise as identified in the site designation consultation document (SNH, no date) are as follows:

- Removal of non-target and target species (i.e. entanglement of harbour porpoises in fishing gear and removal of their prey species);
- Contaminants (e.g. through effects on water quality and bioaccumulation of contaminants that in turn affect the survival and productivity rates of harbour porpoises);
- Underwater noise (e.g. from acoustic surveys); and
- Death or injury by collision (predominantly in relation to collision with various types of fast moving vessels from commercial shipping to personal leisure craft and potentially from tidal turbines).

Due to recognised declines and threats to the species within the North and Celtic seas all harbour porpoise are European Protected Species (EPS), protected under the Conservation (Natural Habitats, &c.) Regulations 1994.

5.2 Assessment of Potential Impacts on Draft Conservation Objectives

Conservation Objective 1 - 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 proposed works are approximately 2km outside The Inner Hebrides and The Minches cSAC boundary. The majority of the potential impacts listed in Table 4.2 are therefore not expected to impact on harbour porpoise nor the habitat supporting them within the designated site.

With regards to the main sensitivities for harbour porpoise within the designated site identified in SNH (no date), the proposed development is not predicted to result in alterations to fishing activity in the site or surrounding area and therefore will not cause the removal of harbour porpoise or their prey as target or non-target species. Contaminants, underwater noise and death or injury as a result of collision are considered in full under Conservation Objective 2 but are not predicted to affect the integrity of the site or its contribution to maintaining the favourable conservation status of harbour porpoise in UK waters.

Conservation Objective 2 - To avoid significant killing, injury, or disturbance of harbour porpoise.

There is the potential for harbour porpoise to be disturbed, injured or, in extreme circumstances, killed as a result of underwater noise generated during impact piling and dredging, increased vessel movements both during the construction and operational phases of the proposed development and in the case of a pollution event. There is the potential for in-combination effects with both the proposed Deep Water Port and SSE cable developments.

Marine Scotland (2014) defines disturbance as:

'*Changes in behaviour which may not appear detrimental in the short-term, but may have significant long-term consequences. Additionally the effects may be minor in isolation, but may become more significant in accumulation*'.

Disturbance may be identified via the following behaviour:

- Changes in (direction or speed of) swimming or diving behaviour;
- Bunching together or females shielding calves;
- Certain surface behaviours such as tail splashes and trumpet blows; and
- Moving out of a previously occupied area.

The following negative effects are linked to disturbance:

- Displacement from important feeding areas;
- Disruption of feeding;
- Disruption of social behaviours such as communication, calving, breeding, nursing, resting and feeding; and
- Increased risk of injury or mortality;
- Increased vulnerability of an individual or population to predators or physical stress; and
- Changes to regular migration pathways to avoid human interaction.

A JNCC report (2008) providing guidance on disturbance of European protected marine mammals suggests that 2% of the estimated harbour porpoise would need to be impacted for disturbance to be considered significant. Given a rough population estimate of 6,500 individuals within the Inner Hebrides and Minches cSAC, approximately 128 individuals would need to be affected before the disturbance is considered significant at the population level. The report further goes on to specify that for an activity to disturb a significant number of porpoise it would have to continue for a considerably long period of time.

The underwater noise modelling detailed in Technical Appendix 5.4: Underwater Noise Study, presented in Volume 3 of the EIAR, considered the effects of dredging and impact piling on marine mammals. Due to the presence of the breakwater to the east and south east of the proposed development site the Newton Marina basin represents an acoustically confined area, meaning that noise impacts would be localised (see Figures 10, 11 and 12, Technical Appendix 5.4: Underwater Noise Study, presented in Volume 3 of the EIAR), with noise outside of the proposed development site being directed to the north and west of the site only. For a single impact strike there is a risk of temporary threshold shift (TTS) in hearing to harbour porpoise up to c. 800m from the source, however, permanent threshold shift (PTS) is predicted to be a risk up to c.200m from the source. The impact zones for Odex piling and dredging are much smaller. The employment of a soft start methodology coupled with a 500m mitigation zone would allow harbour porpoise to leave the area before noise levels reach the point that permanent injury could occur. Full details of the proposed mitigation in relation to underwater noise is provided in Technical Appendix 5.2: Marine Mammal Protection Plan, presented in Volume 3 of the EIAR. In-combination affects with piling as part of the proposed Deep Water Port are possible, however work is currently scheduled so that piling is not carried out concurrently. Works at the two sites are scheduled so that whilst piling is occurring at Newton Marina, dredging will occur at the proposed Deep Water Port and vice versa. The noise modelling detailed in Technical Appendix 5.4: Underwater Noise Study, presented in Volume 3 of the EIAR was carried out on this assumption.

Given the mitigation which will be employed and the short term nature of the works producing underwater noise, the number of individuals affected is predicted to be negligible and any disturbance which may occur would not fall under the JNCC (2008) definition of significant disturbance.

Increased vessel movements during the construction and operational phases may lead to increased levels of disturbance and increased risk of injury or death as a result of collision. Vessel movements during construction will predominantly be outwith the cSAC and temporary so are not predicted to result in significant injury or disturbance. During the operation of the marina there may be an increase in the number of vessels traveling through The Inner Hebrides and The Minches cSAC as well as the waters within and adjacent to the proposed development. There may be an in-combination effect arising from increased vessel capacity as part of the proposed Deep Water Port development. The total number of vessel movements for Stornoway Harbour in the last three years was 768 in 2015, 833 in 2016 and 908 in 2017 (Stornoway Port Authority, 2017). There is a range of vessels utilising the existing harbour including cruise ships, a twice daily passenger ferry from Ullapool, as well as yachts, cargo ships and fishing vessels. The proposed Newton Marina development would provide berthing for a further 75 boats, which would double the capacity for small boats and yachts within Stornoway Harbour. It is not currently known what the predicted increase in vessel movements would be as a result of the proposed Deep Water Port development.

JNCC (2015) state that numbers of harbour porpoise corpses recovered with injuries consistent with ship strikes are low (5 out of 1041 necropsies over a 10 year period). SNH (no date) indicate that as harbour porpoise are naturally shy of boats, they will for the most part avoid them, and so for most types of marine traffic the risk of collision is minimal. There is more potential for collision with fast-moving engine-powered vessels due to their speed and ability to change direction quickly. If a wildlife code of conduct is promoted by SPA and adhered to by Marina users, the risk of injury or death via ship collision would be negligible and would not have population level effects for harbour porpoise within the cSAC. Full details of the mitigation relating to marine traffic can be found in Technical Appendix 5.2: Marine Mammal Protection Plan, presented in Volume 3 of the EIAR.

The risk of death or injury to individuals as a result of a pollution event (due to dredging, spilled material from vessels and spillage from onshore storage of fuel and chemicals) would be minimised to negligible if the mitigation outlined in section 8 is adhered to.

The significant killing, injury or disturbance of harbour porpoise as a result of the proposed development is therefore not predicted.

Conservation Objective 3 - To maintain the habitat and prey of harbour porpoise in favourable condition.

There is the potential for the habitat and prey of harbour porpoise within the cSAC to be impacted by the proposed development if sediments released during dredging, or chemical pollutants are released into the water (as a result of dredging, spilled material from vessels or spillage from onshore storage of fuel and chemicals). In-combination effects from the proposed Deep Water Port and SSE connection developments are possible.

The results from the hydraulic modelling of dredging for both the proposed Newton Marina and Deep Water Port developments concluded that the sediment loading of the water outside of the dredged areas would be minimal and that neither would impact on coastal processes within the area. Full details of the modelling results can be found in Technical Appendix 8.2: Hydraulic Assessment, in Volume 3 of the EIAR. Sediments released during dredging are therefore not predicted to have impacts on harbour porpoise habitats or prey within the cSAC.

Adherence to the pollution prevention mitigation outlined in section 8 will minimise the risk of a pollution event occurring either during construction or whilst the proposed marina is in operation.

No effects on the habitat or prey of harbour porpoise within The Inner Hebrides and The Minches cSAC are predicted from the proposed development and they will be maintained in favourable condition.

5.3 Appropriate Assessment Conclusion

If the mitigation described in Technical Appendix 5.2: Marine Mammal Protection Plan, presented in Volume 3 of the EIAR and in section 8 of this report are adhered to then no significant effects on the integrity of The Inner Hebrides and The Minches cSAC are predicted in relation to the conservation objectives for harbour porpoise.

6 APPROPRIATE ASSESSMENT FOR LEWIS PEATLANDS SPA

6.1 Red-throated Diver

Red-throated Divers breed on fresh water lochs, which can range from small upland lochans in moorland to large lowland lochs. Nests are usually close to the water's edge or on islands within the water body. Adults continue to forage at sea during the breeding season and bring fish (predominantly sand eel) back for the chicks. Foraging habitat at sea during the breeding season typically includes shallow and sheltered bays, sea lochs and sounds (Black *et al*. 2015). During winter the birds are almost exclusively maritime, favouring coastal waters with some shelter and soft substrate. Whilst breeding sites are predominantly in the north and west of Scotland, the east coast of Scotland is favoured in the winter months. Forrester *et al.* (2012) state that there are no large wintering numbers in the Outer Hebrides.

The total estimated UK population of Red-throated Diver is 17,000 individuals (Stroud *et al.* 2016) with an estimated 935 – 1500 breeding pairs in Scotland and approximately 2270 over wintering birds (Forrester *et al.* 2012). Stroud *et al.* (2016) state that the short term population trend, 1999/2000 – 2010/11, increased by 20%. The Lewis Peatlands SPA citation document (SNH, 2000) estimates that there are 80 breeding pairs present within the SPA. The population within the SPA is currently assessed as being in unfavourable declining condition (SNH, 2018). There is currently no data available on the numbers of Red-throated Diver which may utilise the habitats within Stornoway Bay, however, the outer bay has been identified as a potentially important marine area for Red-throated Diver foraging during the breeding season (Black *et al*, 2015)

The Red-throated Diver is listed under Schedule 1 of the Wildlife and Countryside Act, which recognises its rarity as a breeding species in the UK and affords it extra protection during the nesting period. The Red-throated Diver is also an Annex I migratory species under the EU Birds Directive (2009/147/EC).

6.2 Assessment of Potential Impacts on Conservation Objectives

Conservation Objective 1: To ensure for the qualifying species that the following is maintained in the long term; population of the species as a viable component of the site.

No potential impacts to Red-throated Diver breeding sites within the SPA have been identified. The potential impacts identified in Table 4-1 are all related to breeding birds foraging in Stornoway Bay and the surrounding waters. The majority of the potential impacts are of a temporary nature and would not affect population numbers in the long term. The only long-term potential impact identified is displacement from the foraging habitat within the proposed development area and the surrounding waters due to noise and visual disturbance. There would be an in-combination effect with the proposed Deep Water Port development which would further increase the capacity for visiting boats in the long term. It is possible that any Red-throated Divers utilising this habitat would become habituated to the increased vessel movements in time. If this is not the case it is considered that there is sufficient alternative foraging habitat for breeding birds such that there would be no loss in individual condition, breeding success or long term population viability as a result of displacement.

Conservation Objective 2: To ensure for the qualifying species that the following is maintained in the long term; distribution of the species within the site.

Due to the distance between the proposed development and the SPA (c. 4.5km) there are no potential impacts to Red-throated Diver within the designated site. The distribution of species within the site is therefore not predicted to change as a result of the proposed development.

Conservation Objective 3: To ensure for the qualifying species that the following is maintained in the long term; distribution and extent of habitats supporting the species.

No changes to the distribution or extent of habitats supporting Red-throated Diver within or outwith the SPA are predicted as a result of the proposed development.

Conservation Objective 4: To ensure for the qualifying species that the following is maintained in the long term; structure, function and supporting processes of habitats supporting the species.

No impacts to the structure, function and processes of habitats supporting Red-throated Diver are predicted within the designated site.

During construction and operation of the proposed development there is the potential for chemical pollutants to be released into the water. This could have temporary impacts on the function and supporting processes of Red-throated Diver foraging habitat outwith the SPA, which could lead to reduced prey availability in the short term. It is predicted that the risk of such an event occurring is minimal if the mitigation and relevant Guidance for Pollution Prevention (GPP), detailed in section 8 of this report, are adhered to.

No significant long term alterations to the structure, function or supporting processes for Red-throated Diver habitat outside of the designated site are therefore predicted.

Conservation Objective 5: To ensure for the qualifying species that the following is maintained in the long term; no significant disturbance of the species.

Red-throated Divers are particularly sensitive to disturbance in comparison to other seabirds and may display signs of disturbance when encountering vessels at a distance of 1km (MacArthur Green, 2012). Activities such as impact piling, movement of rock armour and increased vessel movements may result in short term disturbance during the construction phase of the project. Due to the temporary nature these activities are not predicted to result in significant disturbance in the long term.

Longer term disturbance may occur due to increased vessel movements once the proposed development is in operation. There is likely to be an in-combination effect with the proposed Deep Water Port development, which will increase the capacity for visiting boats, which may increase the magnitude of impact to Red-throated-Diver. However, there is already a variety of marine traffic associated with the existing harbour, as detailed in section 5.2 of this report. It is not currently known what the predicted vessel movements would be once the proposed Deep Water Port and Newton Marina developments are operational, but it is likely that, if any Red-throated Diver are currently utilising the habitats around Stornoway Bay and the current shipping lanes, they will be at least partly habituated to the presence of vessels. It is also considered that there is ample alternative foraging habitat available around the Lewis coastline to support breeding Red-throated Divers. No significant long term disturbance is therefore anticipated as a result of increased vessel movements in the area.

6.3 Appropriate Assessment Conclusion

Due to the availability of alternative foraging habitats, pollution prevention mitigation outlined in section 8 and the likelihood that any individuals utilising the habitat will be somewhat accustomed to vessel movements, no significant long term effects on the integrity of the Lewis Peatlands SPA are predicted with regard to the conservation objectives for Red-throated Diver.

7 APPROPRIATE ASSESMENT FOR LEWIS PEATLANDS SAC

7.1 Otter

Otters are semi-aquatic solitary mammals. They hold large territories that can cover up to 50km in range (Chanin, 2003), with males tending to have larger territories than females. They are predominantly active at dusk and dawn. Otters have a varied diet which consists mainly of fish but also amphibians, crabs, small birds and mammals. Their varied diet is reflected in the diverse habitats in which they can be found including freshwater streams, rivers and lochs, scrub, moorland and coastal areas.

The otter population within the Lewis Peatlands SAC is assessed as being in favourable condition (SNH, 2018). There are habitat connections between the SAC and the proposed development via the River Creed and Glen River, which meet the coast to the north and west of the proposed Newton Marina. Otter surveys have been carried out within the proposed development site and the surrounding area which established that suitable habitat for otter is present. No evidence of otter activity or resting places were identified and the closest otter record was located at the confluence of the River Creed, approximately 1km west of the proposed development. Further details of the otter survey methodology and results can be found in Technical Appendix 5.5: Otter Report, presented in Volume 3 of the EIAR.

The otter is an EPS.

7.2 Assessment of Potential Impacts on Conservation Objectives

Conservation Objective 1: To ensure for the qualifying species that the following is maintained in the long term; population of the species as a viable component of the site.

No potential impacts to otter within the SAC have been identified. The potential impacts listed in Table 4-1 may affect otter foraging or commuting outside the SAC, within or near the proposed development area. The survey results detailed in Technical Appendix 5.5: Otter Report, presented in Volume 3 of the EIAR, show that whilst the proposed development site is suitable for use by otters, no evidence of activity was identified and the importance of the site for otter is considered to be low. If the pollution prevention guidance outlined in section 8 of this report and the mitigation specific to otter detailed in Technical Appendix 5.5: Otter Report, presented in Volume 3 of the EIAR, are adhered to, then there is not predicted to be any effect on the long term viability of otter within the Lewis Peatlands SAC.

Conservation Objective 2: To ensure for the qualifying species that the following is maintained in the long term; distribution of the species within the site.

No impacts are predicted on otter or their habitats within the Lewis Peatlands SAC as a result of the proposed development due to the distance between the two sites. No alterations to the long term distribution of the species within the site are therefore anticipated.

Conservation Objective 3: To ensure for the qualifying species that the following is maintained in the long term; distribution and extent of habitats supporting the species.

No changes to the distribution or extent of habitats supporting otter within or outwith the SAC are predicted as a result of the proposed development.

Conservation Objective 4: To ensure for the qualifying species that the following is maintained in the long term; structure, function and supporting processes of habitats supporting the species.

No impacts to the structure, function and processes of habitats supporting otter are predicted within the Lewis Peatlands SAC.

During construction and operation of the proposed development there is the potential for chemical pollutants to be released into the water. This could have temporary impacts on the function and supporting processes of otter foraging habitat outwith the SAC which could lead to reduced prey availability in the short term. It is predicted that the risk of such an event occurring will be minimal if the mitigation and relevant Guidance for Pollution Prevention (GPP), detailed in section 8 of this report, is adhered to.

The structure of a small area of supporting habitat within the proposed Newton Marina development site would be altered as the current rocky shore line present along Goat Island is built up with infrastructure associated with the Marina. The open water within the site would also be altered by the presence of the pontoons and berthed boats. The change in structure is not predicted to change the function of the available habitat though as otter will still be able to use the area for foraging, commuting and resting. The area of supporting habitat which will change structurally is considered to be negligible.

No significant long term alterations to the structure, function or supporting processes for otter habitat outside the designated site are therefore predicted.

Conservation Objective 5: To ensure for the qualifying species that the following is maintained in the long term; no significant disturbance of the species.

There is the potential for otter utilising the habitats within and adjacent to the proposed development site to experience disturbance during both the construction and operational phases. Any disturbance arising from construction would be temporary and the risk minimised to negligible by adherence to the mitigation outlined in Technical Appendix 5-5: Otter Report, presented in Volume 3 of the EIAR.

There is also the potential for disturbance to occur in the longer term as a result of increased vessel movements once the proposed Newton Marina is in operation. However, due to the location of the proposed Newton Marina in close proximity to the existing harbour and marina, roads, residential areas and industrial units, any otter utilising the site will be accustomed to anthropogenic noise and vessel movements. Any disturbance as a result of the proposed development is therefore predicted to have a negligible effect.

No significant disturbance to otter in the long term is therefore predicted as a result of the proposed development.

7.3 Appropriate Assessment Conclusion

Due to the availability of alternative habitats, the employment of the pollution prevention mitigation outlined in section 8, otter specific mitigation outlined in Technical Appendix 5.5: Otter Report, presented in Volume 3 of the EIAR, and the likelihood that any individuals utilising the habitat will already be habituated to human activity, no significant effects on the integrity of the Lewis Peatlands SAC are predicted with regard to the conservation objectives for otter.

8 MITIGATION

The following mitigation will be employed to avoid and minimise the risk of a pollution event occurring both during the construction and operational phases of the proposed development:

- A Construction Environment Management Plan (CEMP) detailing pollution prevention measures will be agreed with the regulatory authority prior to works commencing;
- The following good practice guidelines will be adhered to and incorporated into the CMS:
    - GGP5: Works and maintenance in or near water;
    - PPG 6: Working at construction and demolition sites;
    - PPG 7: Safe Storage – The safe operation of refuelling facilities;
    - GPP21: Pollution and incident response planning; and
    - PPG22: Incident response – dealing with spills.
- An Ecological Clerk of Works (ECoW) will be employed throughout the construction phase to audit adherence to the mitigation outlined in the CMS.

The mitigation measures specific to harbour porpoise and otter are detailed in Technical Appendix 5.2: Marine Mammal Protection Plan and Technical Appendix 5.5: Otter Report, both presented in Volume 3 of the EIAR.

REFERENCES

Black, J., Dean B.J., Webb A., Lewis, M., Okill D. and Reid J.B. (2015) *Identification of important marine areas in the UK for red-throated divers (Gavia stellata) during the breeding season*. JNCC Report No 541

Channin, P. (2003) *Ecology of the European Otter.* Conserving Natura 2000 Rivers Ecology Series No 10. English Nature, Peterborough.

CNeS (2017) *Environmental Impact Assessment – Scoping Opinion.* Comhaile Nan Eilean Siar. Application reference 17/00452.

Forrester, R.W., Andrews, I/J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. and Grundy, D.S. (eds) (2012) *The Digital Birds of Scotland*. The Scottish Ornithologists' Club, Aberlady.

JNCC (2008) *The Deliberate Disturbance of Marine European Protected Species – Guidance for English and Welsh Territorial Waters and the UK Offshore Marine Area.* Accessed online at: http://jncc.defra.gov.uk/PDF/consultation_epsGuidanceDisturbance_all.pdf] accessed on 25/07/2018.

JNCC (2015) A Conservation Literature Review for the Harbour Porpoise (Phocoena phocoena). Joint Nature Conservation Committee Report No: 566. Available online at: http://jncc.defra.gov.uk/pdf/JNCCReport566_AConservationLiteratureReviewForTheHarbourPorpoise.pdf accessed on 15th June 2018.

JNCC (2015) Management Units for Cetaceans in UK Waters. Joint Nature Conservation Committee, Peterborough. Report Number: 547. Accessed online at: [http://jncc.defra.gov.uk/pdf/Report_547_webv2.pdf] on 10/05/2018.

MacArthur Green (2012) *Vulnerability of Scottish Seabirds to offshore Wind Turbines.*

Marine Scotland (2014) *The Protection of Marine European Protected Species from Injury and Disturbance. Guidance for Scottish Inshore Waters.* Marine Scotland. Accessed online at [http://www.gov.scot/Resource/0044/00446679.pdf] on 25/07/2018.

Marine Scotland (2018) *Marine Scotland – Licensing Operations Team Scoping Opinion*. Marine Scotland.

NIRAS (2015) *Subsea Cable Interactions with the Marine Environment, Expert Review and Recommendations Review*. NIRAS Consulting. Cambridge Accessed online [https://renewables-grid.eu/fileadmin/user_upload/Files_RGI/RGI_Publications/RGI_Subsea_cables_report.pdf] on 03/03/2018.

Pendlebury, C., Zisman, S., Walls, R., Sweeney, J., McLoughlin, E., Robinson, C., Turner, L. & Loughrey, J. (2011). *Literature review to assess bird species connectivity to Special Protection Areas*. Scottish Natural Heritage Commissioned Report No. 390

RPS (2018) *Newton Basin Stornoway Marina Development – Hydraulic Modelling Report.*

Scottish Natural Heritage (2000) *EC Directive 79/409 on the Conservation of Wild Birds. Citation for Special Protection Area (SPA) The Lewis Peatlands, Western Isles (UK9001571).* Accessed online [http://www.snh.org.uk/pdfs/strategy/GEConsult/4.5.1-LEWISPEATLANDS-B440413.pdf] on 09/02/2018.

Scottish Natural Heritage (2015) *Habitat Regulations Appraisal of Plans. Guidance for Plan Making Bodies in Scotland. V3.0.* Accessed online [https://www.nature.scot/sites/default/files/2017-06/A1500925%20-

%20Habitats%20Regulations%20Appraisal%20of%20Plans%20-%20Guidance%20for%20plan-making%20bodies%20in%20Scotland%20-%20Jan%202015.pdf] on 26/03/2018.

Scottish Natural Heritage (2018) *Sitelink, Site Details for Lewis Peatlands SPA*. Published online 02/05/2018. Accessed online at: [http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8524] on 29/05/2018.

Scottish Natural Heritage (2018) *Sitelink, Site Details for Lewis Peatlands SAC*. Published online 02/05/2018. Accessed online at: [http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8289] on 29/05/2018.

Scottish Natural Heritage (No date) *Inner Hebrides and the Minches Proposed SAC Advice to Support Management.* Available online at: [https://www.nature.scot/sites/default/files/2017-10/Consultation%20-%20Harbour%20Porpoise%20-%20Inner%20Hebrides%20and%20the%20Minches%20pSAC%20-%20Combined%20Reg%2033%20%20MOP%20-%20A1918723.pdf] on 10/05/2018.

Stornoway Port Authority (2017) Annual Report 2017. Available Online at: [http://www.stornowayportauthority.com/wp-content/uploads/2014/12/2017-ANNUAL-REPORT.pdf] on 29/05/2018

Stroud, D.A., Bainbridge, I.P., Maddock, A., Anthony, S., Baker, H., Buxton, N., Chambers, D., Enlander, I., Hearn, R.D., Jennings, K.R, Mavor, R., Whitehead, S. & Wilson, J.D. - on behalf of the UK SPA & Ramsar Scientific Working Group (eds.) (2016). *The status of UK SPAs in the 2000s: the Third Network Review*. JNCC, Peterborough.

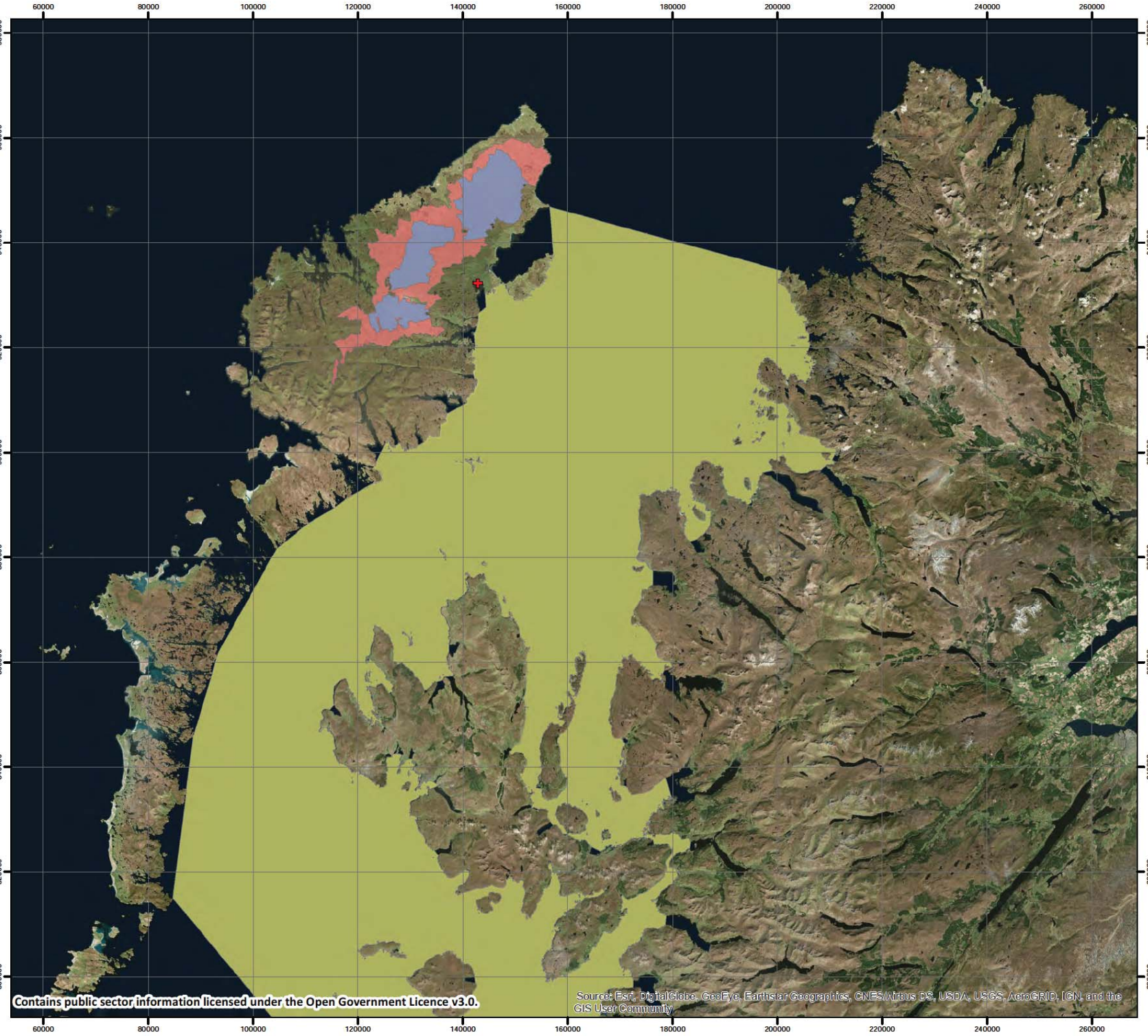
Wallace Stone (2018) *Stornoway Port Authority, Proposed Deep Water Port, Outline Description (Rev B)*.

Whitfield, P. (2000) *Golden Eagle Aquila chrysaetos Ecology and Conservation Issues.* Scottish Natural Heritage Review No 132

Wallace Stone (2018) *Stornoway Port Authority Newton Basin Marina Outline Description (Revision D).*

APPENDICES

A DESIGNATED SITE LOCATION



Legend

- Newton Marina Site Location
- Inner Hebrides and the Minches cSAC
- Lewis Peatlands SAC
- Lewis Peatlands SPA

Do not scale this map

Client: Stornoway Port Authority

Project: Newton Marina

Title: Newton Marina European Designated Sites

Status: FINAL

Drawing No.: 670526-025

Revision:

Scale: 1:700,000

A3

Date: 27 June 2018

Drawn: [Redacted]

Checked:

Approved:

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

IRWIN CARR
CONSULTING

Technical Appendix 5.4: Underwater Noise Report

Rp002 2018062 (Technical Appendix 5.4: Underwater Noise Report)

15 October 2018

PROJECT:	TECHNICAL APPENDIX 5.4: UNDERWATER NOISE REPORT, NEWTON MARINA
PREPARED FOR:	ENVIROCENTRE LTD. CRAIGHALL BUSINESS PARK 8 EAGLE STREET GLASGOW G4 9XA.
ATTENTION:	ENVIROCENTRE LTD.
REPORT NO.:	Rp 003 2018062

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Final	3.0		15 October 2018	[Redacted] [Redact [Redacted]	[Redacte

Table of Contents

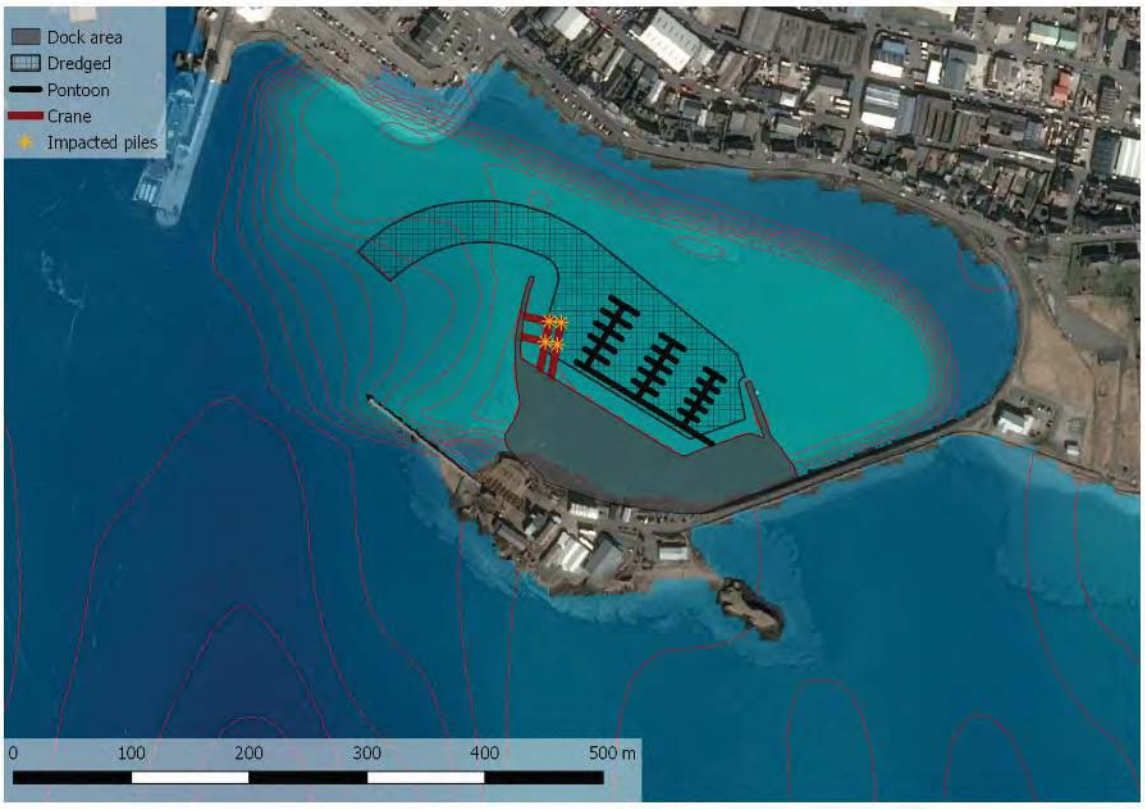
1 INTRODUCTION

Irwin Carr Ltd. have been commissioned to undertake underwater noise modelling as part of an impact assessment for EnviroCentre Ltd. regarding the construction of a pier, a floating walkway and dredging for the proposed Newton Marina.

As part of an impact assessment the noise generated by both impact piling, vibratory/odex piling and dredging will be of concern considering the marine life in the area. To better assess the potential impact of construction noise on the marine animals it is useful to model representative scenarios taking into account environmental variables and animals' hearing capabilities.

During the operations in the Newton Marina, similar concurrent activities will take place in the site of the proposed Deep Water Port, south of the marina, the noise from these activities are included and considered here.

Figure 1. Overview of Stornoway harbour. Depth is coded in shades of blue, darker is deeper, lighter is shallower. Map data from (UKHO , 2018; Google Inc., 2000-2018; Bing Maps, 2018). Yellow stars denote representative locations of partially impact driven piles.



1.1 Underwater noise

Several activities will contribute to elevated noise level during the construction, with the three below identified as the most significant:

1. Impact piling.
   Some impact piling will take place in the marina in the construction of the dock and the associated crane. This impact piling will follow vibration piling and is used to ensure the that the piles are structurally sound. This impact piling is estimated to take no longer that 3 days, with a maximum of 6000 strikes during any 24-hour period.
2. Dredging.
   The removal of sediment either by cutting or lifting material from the seabed.
   One or both of the following methods might be used:
   Backhoe dredgers that are basically diggers on barges and are suitable for removing soft sediment at shallow depths.
   Cutter suction dredging that involves a cutter which can break/loosen harder sediments and removed them via suction.

This last dredging type is considerably noisier due to the amount of moving parts under water and the impact of the cutter head with hard sediment.

3. Drilling.
   All/most holes for piles will be pre-drilled were possible/necessary. This drilling is done by the "odex-drilling" method that is suitable for softer sediments, as it can be used to line the drilled hole while drilling, thus avoiding soft sediment flowing into the drilled hole. Even though this is in essence an impact method, the strike rate is so high that the noise is continuous (>20/second). In this document odex drilling and odex piling are interchangeable.

1.2 Assessment Criteria for underwater noise

A number of species of concern either occur regularly at the site or the habitat is suitable for them. While the population-wide impact of noise can be very hard to estimate, we can assess the expected impact on hearing abilities, as well as possible damage due to noisy activities.

Aside from hearing impact, underwater noise can also impact a population by either masking important sounds or by inducing behavioural changes to individuals or groups, potentially affecting the fecundity of the population.

When assessing impacts of underwater noise, knowledge of protected and important sites should be included and taken into account. For the activity related to the deep water port, the closest designated protection area ("Inner Hebrides and the Minches") lies 1.4 km south-east of the most eastern dredged area (Figure 2, below). For the Marina there is no direct line of noise propagation, and the closest point is 1.8 km NNW of the protected sites.

Figure 2. The "Inner Hebrides and the Minches" SPA/OSPAR protected area lies 1.4 km SE of the closest point of activity (dredging at the Deep Water Port) and North-East Lewis pMPA (proposed MPA) 900 m SSE. Closest point of activity at Newton Marina is 1.8 km SSE of the Marina.

1.2.1 UNITS

All references to sound pressure levels, peak pressure levels and sound exposure levels refer to a logarithmic ratio between a pressure/exposure and a reference pressure/exposure.
As an example, a level of 220 $dB_{z\text{-}p}$ is equal to a peak pressure of 100,000 Pascals (Pa) over ambient pressure, while 120 $dB_{z\text{-}p}$ is equal to 1 Pa over ambient pressure. To avoid dealing with these large numbers as pascals, they are converted to a decibel ratio (Table 1). Besides compressing large numbers to smaller ratio this also corresponds better to how animals perceive sound. Animals in general perceive sound as relative steps, meaing that an increase from 1 to 2 pascals sounds like the same increase as from 100 to 200 Pa, even though the first step was only 1 Pa, while the second was 100 Pa. This is better reflected in a logarithmic scale where both steps are equal, here 6 dB.

However, while dB *are* practical, they can be hard to compare between studies due to vague definitions, and so we have adopted the standards set by ISO 18405-2017.

For ease of reference please see following overview for unit definition.

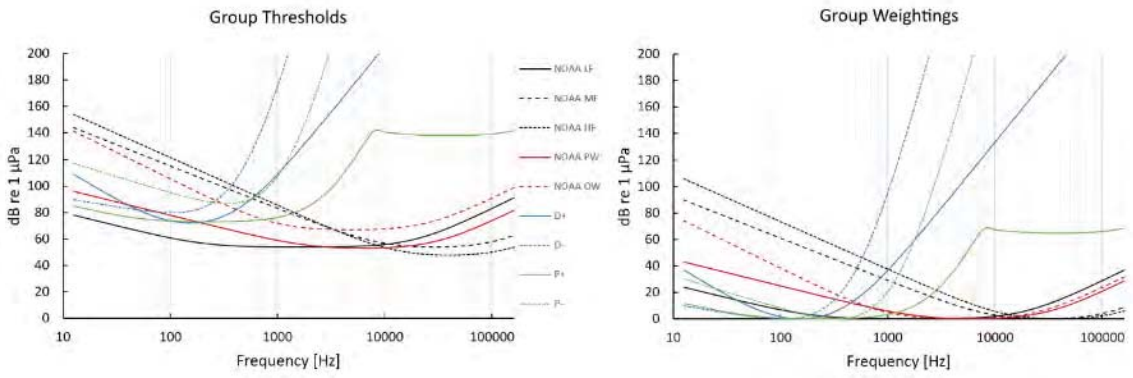
Table 1: Definitions

Unit	Definition	Comments
dB_{RMS} ISO 18405-2017: 3.2.1.1	$dB_{RMS} = 10 \cdot Log_{10}\left(\frac{\frac{1}{t_2 - t_1} \cdot \int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	Functionally equivalent to deprecated $20 \cdot Log_{10}\left(\frac{RMS}{1 \cdot 10^{-6} Pa}\right)$
$dB_{z\text{-}p}$ ISO 18405-2017: 3.2.2.1	$dB_{z-p} = 20 \cdot Log_{10}\left(\frac{Pa_{max}}{1 \cdot 10^{-6} Pa}\right)$	This assumes that Pa_{max} is equal or greater than $\sqrt{Pa_{min}{}^2}$
$dB_{p\text{-}p}$ ISO 18405-2017: 3.1.2.8	$dB_{p-p} = 20 \cdot Log_{10}\left(\frac{Pa_{max} - Pa_{min}}{1 \cdot 10^{-6} Pa}\right)$	Often[1] equivalent to $dB_{z-p} + 6.02\ dB$
dB_{SEL} ISO 18405-2017: 3.2.1.5	$dB_{SEL} = 10 \cdot Log_{10}\left(\frac{\int_{t_1}^{t_2} p(t)^2 dt}{1 \cdot 10^{-12} Pa}\right)$	For continuous sound this is equivalent to $dB_{RMS} + 10 \cdot Log_{10}(t_2 - t_1)$

Unless otherwise stated dB_{RMS} has an averaging period of 1 second, and dB_{SEL} for the duration of the specified event, sometimes indicated as $dB_{SEL\text{-}\text{“time”}}$.

For exposure (SEL), the noise levels are weighted according to a generalised hearing sensitivity profile for 9 different hearing groups. Further explanation in sections below.

Figure 3. Generalised hearing thresholds (left) for the specified hearing groups are converted into weightings (right). For non-impulsive sounds the weightings are subtracted from the noise level to give the weighted noise level (similar to dB(A) or dB(C)-weighted noise for humans).



[1] If pulse is below ambient pressure and compression and rarefaction phases are of equal size.

1.2.2 MAMMALS

A number of marine/aquatic mammals are known to use the area around Stornoway Harbour. All of them have good hearing and this sense is vital to their fecundity, either directly for foraging or for navigation and mating.

For the marine/aquatic mammals present we will adhere to the approach described in "Guidance for Assesing the Effects of Anthropogenic Sound on Marine Mammal Hearing" (NOAA, 2016), which determines impact from an assessment of area wherein the noise will induce either "Temporary Threshold Shift" (TTS) or "Permanent Threshold Shift" (PTS)[2], as judged by the weighted[3] SEL level (dB_{SEL-24}) over a typical 24-hour period, or by dB_{z-p} levels, for different "hearing groups".

These hearing groups are specified by collating all available information on marine mammal hearing available and generalising their hearing sensitivity into representative groups. This grouping represents a significant research effort and are reviewed by the leading experts (academic, industrial and conservation) on the topic. Because of the large amount of work represented, the thresholds and the methodology associated, have become de-facto standards for assessing noise impact on marine mammals and represent best available knowledge and practise.

Along with weighting curves, similar in function to the human dB(C) curves, a set of impact thresholds for hearing impact and injury is associated with the framework and allows for assessments to be made on the basis of best available evidence.

All marine mammal species are covered by the hearing groups and a full list of species in the different groups can be found in the "Guidance for Assesing the Effects of Anthropogenic Sound on Marine Mammal Hearing" (NOAA, 2016), but in general the groups cover the following species:

1. LF (Low Frequency): All baleen whales, e.g. Fin whale and minke whale.
2. MF (Middle Frequency): Sperm whales, most dolphins (incl. risso's dolphin), beaked whales and killer whales.
3. HF (High Frequency): Porpoises, a sperm whale sub-species and few high frequency specialist dolphins.
4. PW (Phocidae, under water): True seals, e.g. harbour seal and grey seal.
5. OW (Otariidae, under water): Walruses, leopard seals, fur seals and remaining amphibious mammals[4].

Table 2. Summary of NOAA[5] thresholds and groups for each of the prioritised species.

NOAA Hearing group	Species examples	Non-impulsive TTS/PTS threshold [dB_{SEL-24}]	Impulsive TTS/PTS threshold [dB_{SEL-24}]	Impulsive TTS/PTS threshold [dB_{z-p}]
PW	Harbour seal, grey seal	181/201	170/185	212/218
OW	Eurasian otter	199/219	188/203	226/232
LF	Minke whale, humpback whale	179/199	168/183	213/219
MF	Common dolphin, killer whale, risso's dolphin, bottlenose dolphin	178/198	170/185	224/230
HF	Harbour Porpoise	153/173	140/155	196/202

[2] TTS/PTS. A temporary/permanent change in hearing sensitivity caused by acoustic stimuli.

[3] Weightings are not applied for impulsive noises.

[4] The current framework does not include otter and polar bear, but research shows that the threshold associated with this group is applicable to these and further unpublished material suggest that an inclusion will happen in future revisions.

[5] National Oceanic and Atmospheric Administration, US Department of Commerce.

1.2.2.1 *Threshold meaning and interpretation*

The three thresholds refer to different ways that noise can affect the hearing of a marine animal and are *important to keep in mind* when evaluating the results of this report:

1. **Non-impulsive dB_{SEL-24}**
   The threshold over which an effect (TTS/PTS) occurs, taking into account *continuous*[6] noise received by the animal over a typical 24-hour period as noise exposure level, dB_{SEL}.
   When presented as an impact zone, this refers to the area, within which, an animal would suffer the effect if it stayed there for 24 hours. We thus identify areas given by this limit as areas of TTS-risk or PTS-risk respectively, i.e. and animal within the area has a risk of suffering from either TTS or PTS within this zone.
   Weightings are applied for non-impulsive dB_{SEL}.

2. **Impulsive dB_{SEL-24}**
   The threshold over which an effect (TTS/PTS) occurs, taking into account *impulsive* noise received by the animal over a typical 24-hour period as noise exposure level, SEL.
   When presented as an impact zone, this refers to the area, within which, an animal would suffer the effect if it stayed there for 24 hours. We thus identify areas given by this limit as areas of TTS-risk or PTS-risk respectively, i.e. and animal within the area has a risk of suffering from either TTS or PTS within this zone.
   - **Impulsive dB_{SEL} "Single-impulse"**
     It is sometimes useful to assess the impact of a single impulse. When we do this, we will refer to it as "Single-impulse SEL" or "$SEL_{single-impulse}$".
     Like for the dB_{z-p}, when single-impulse SEL is presented as an impact zone, this refers to the area, within which, an animal would suffer the effect acutely/instantly.

   Weightings are applied for Impulsive dB_{SEL}.

3. **Impulsive dB_{z-p}**
   The threshold over which an effect (TTS/PTS) occurs, taking into account *impulsive* noise received by the animal at any instant as maximal peak pressure.
   When presented as an impact zone, this refers to the area, within which, an animal would suffer the effect acutely/instantly.
   No weightings are applied for Impulsive dB_{z-p}.

1.2.3 FISH

The basking shark (*Cetorhinus maximus*) is protected under UK law (Nature Conservation (Scotland) Act , 2004) and has been included for assessment as this species has been observed close to the site (Hebridian Whale and Dolphin Trust, 2018). Due to local importance and interest, Atlantic salmon (*Salmo salar*) and European brown trout (*Salmo trutta*), have also been included.

While the hearing capabilities for the *Salmo* species are derived from experimental data, the hearing of the basking shark is inferred from other elasmobranch species that are possible to keep in a tank for tests.

There is very little information available on the acoustic sensitivity of fish in general (and even less so for sharks), this is true for both accurate audiograms as well as noise impact on behaviour and physical impact. We here use a composite hearing threshold as well as information on TTS and PTS from a range of studies (Ketten, 1995; Mann, et al., 2001; Subacoustec, 2004; DFO Canada, 2006; Brandon M. Casper, 2007; Southall, et al., 2007; Carlson, et al., 2007)

While it is clear that all of the species can detect sound (either by detecting pressure or particle motion), there is no evidence to suggest that sound is especially important for their population fecundity.

As there is a lack of systematic reviews to establish exposure thresholds for fish, we have used thresholds based principally on three large reviews (DFO Canada, 2006; Carlson, et al., 2007; Southall, et al., 2007) and the method from "Guidance for Assesing the Effects of Anthropogenic Sound on Marine Mammal Hearing" (NOAA, 2016) to generate the proposed TTS and PTS

[6] Please see (NOAA, 2016) for definitions of "non-impulsive" and "impulsive". For quick reference, if a noise is shorter than 1 second and is clearly intermittent in nature, it is impulsive.

thresholds for fish as per Table 3, p.9. In summary, this entailed collating information from exposure experiments and categorising it according to observed effects (i.e. death, injury, PTS, TTS, behavioural change and no observed effect) and use this to model exposure functions (as in Figure 3, p.6) and exposure limits (Table 3, p.9.).

Table 3. Summary of thresholds used for fish[7]. Note that Impulsive thresholds are equal for all groups. This was an effect of limited available data, making separation infeasible.

Species	Hearing group	Non-impulsive TTS/PTS threshold [dB_{SEL-24}]	Impulsive TTS/PTS threshold [dB_{SEL-24}]	Impulsive TTS/PTS threshold [dB_{z-p}]
Demersal, swim-bladder assisted hearing. (e.g. Cod, haddock)	D+	185/213	185/213	197/206
Demersal, no swim-bladder assisted hearing. (e.g. Plaice, sole)	D-	192/220	185/213	197/206
Pelagic, swim-bladder assisted hearing (e.g. Herring, sprat)	P+	186/214	185/213	197/206
Pelagic, no swim-bladder assisted hearing (e.g. *Salmo*, sharks)	P-	200/228	185/213	197/206

1.2.4 APPLICATION OF HEARING THRESHOLDS

For the vibratory piling and dredging, which are continuous noise sources and therefore less acutely dangerous to the hearing than impulsive noises, weightings[8], dependent on the hearing capabilities of the species are considered, as the mechanism of injury is auditory stress and fatigue, rather than acute trauma. This means that animals have a chance to evade the noise without suffering hearing impact or injury.

For impulsive noise, the mechanism of impact is total pressure of the signal along with the "suddenness" of its onset. This is frequency independent, and weightings are therefore not applicable.

There are in principle six different exclusion zones for each hearing group, each relating to a particular limit. These limits are given in Table 2, p.7. and Table 3, p.9.
We will not present all these zones (54) in the results section as some zones will be too small to meaningfully represent on a map or will be fully within impact zones of other common species in the area.

[7] Note that we adopt these thresholds in the absence of a widely accepted threshold framework for fish. The thresholds thus do not reflect a peer-reviewed process, but rather a summary of available information.

[8] Weightings are not equivalent to the presented thresholds in the same way that A-weighting for humans is equivalent to the human hearing threshold. Rather they are based on the same shape, and most sensitive regions. See (NOAA, 2016) for details.

2 MODELLING OF NOISE

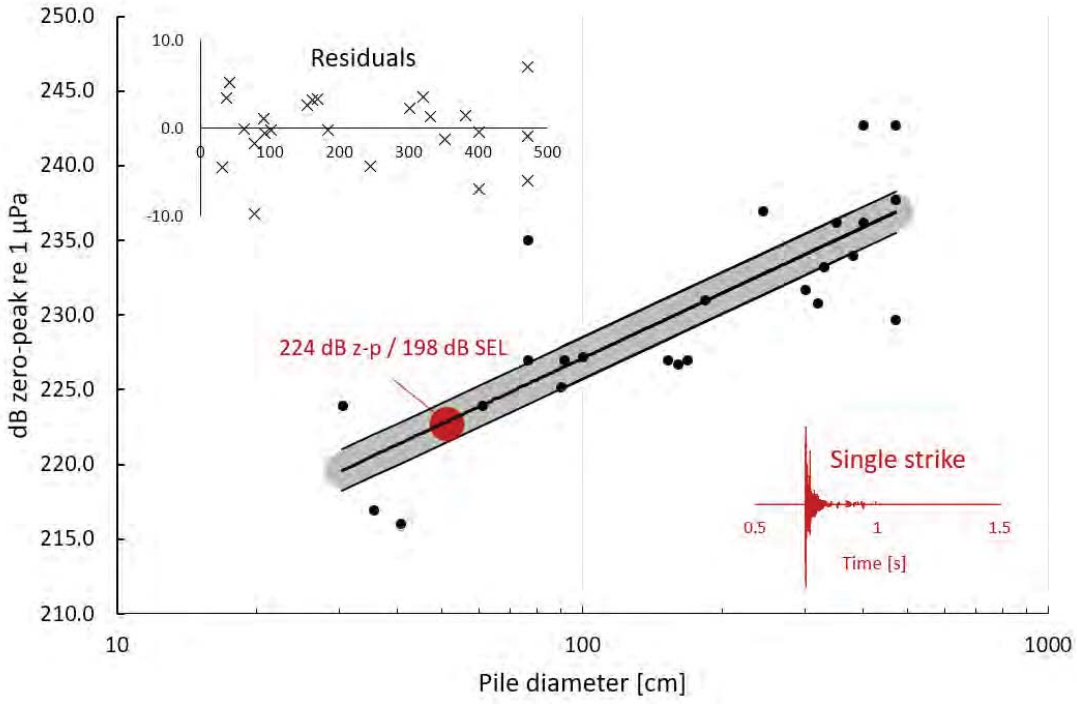
2.1 Noise source

At this stage the precise detail of the equipment to be used during the construction is yet to be confirmed, and no site specific recordings of the emitted noise exists. As a result, we have interpolated source levels from similar construction projects. Data for this interpolation is partly from reviews (Washinton State Department of Transportation, n.d.; Reine, et al., 2012; Reine, et al., 2014; Robinson, 2015; Santos-Dominguez, et al., 2015; Wittekind, 2014) and earlier in-house work. This means that all results are based on a presumption that the work will be carried out with equipment of similar noise levels.

2.1.1 IMPACT PILING

This type of activity will likely be the loudest activity to take place during the construction. Impact piling has a higher chance of causing injury than other noise types of similar energy due to the very fast "rise time" for the sound impulse[9]. This leaves no time for the animal to react/adapt and consequently increases the risk of acute injury to the species' hearing.

Figure 4. Graphic representation of data used to characterise the impact piling. dB_{z-p} for a single strike in this scenario is 224 dB re 1 µPa (198 dB_{SEL}). Bold solid line is modelled interpolation. Grey area is 95 % confidence interval (± 1.4 dB) of the linear model. Residuals of model included to show lack of systematic error. The bottom right graph is the timeseries used as representative for calculations of single strike dB_{SEL}.



A 50.8 cm diameter steel pile has formed the basis of the modelling.
The contractor has informed us that up to 6000 strikes can happen within one 24-hour period and that the impact piling should happen within one 3-day period.

A soft start (JNCC, 2010) for impact piling is assumed and will give animals a chance to vacate the area before the highest noise levels are reached.

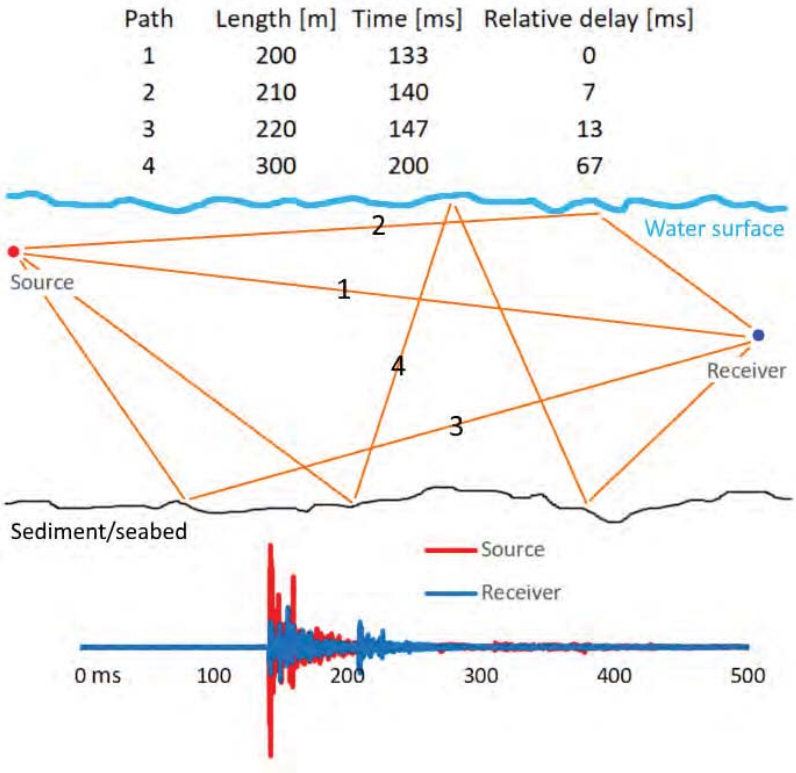
2.1.2 ODEX PILING

The majority of the remaining piling noise will be from "Odex" piling, a pneumatic impact drilling method suitable for softer sediments as it allows for simultaneous lining and drilling, to mitigate

[9] "Rise-time" is a measure of how quickly an acoustic impulse "rises" from the background noise. A fast rise-time means that a high intensity is reached very quickly and without a slow increase in amplitude.

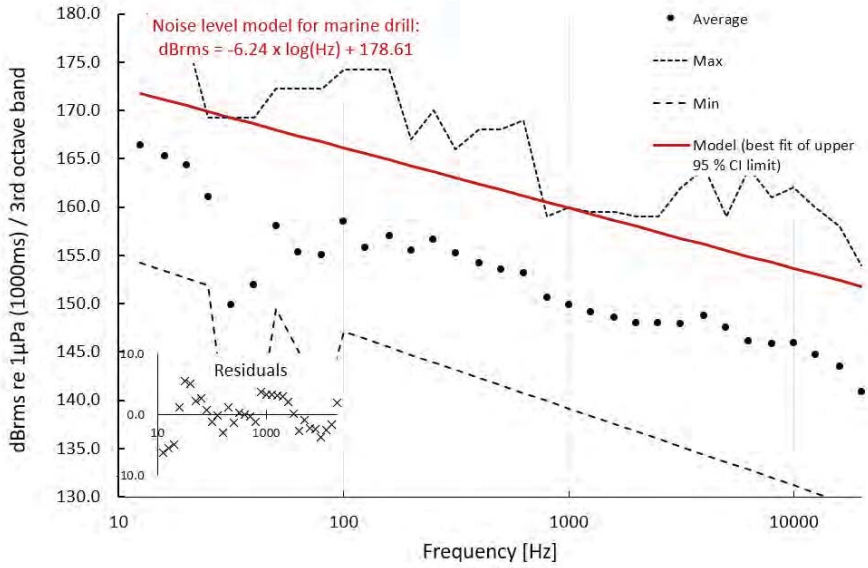
loose sediment filling the hole as it's made. While Odex piling is in fact a series of impacts, the impact rate is over 1200/min (20/sec), meaning that the noise is better describes as continuous. This is especially true as the distance from the source increases, and the noise will have bounced of several surfaces and thus be "smeared out", to become more continuous in nature (Figure 5 below). This effect is more pronounced in shallower water due to the increased number of surface interactions.

Figure 5. Example of "smearing out" of an impulsive noise because of repeated boundary reflections and resulting multipath.



For the Odex piling we collected noise examples from several marine drilling operations of similar size. Due to scarcity of good data we have chosen to use the upper 95 % confidence interval boundary as a reasonable worst-case scenario for the noise of the Odex piling machinery.

Figure 6. The red line indicates the band levels model we chose as representative for the Odex piling. The model is a result of the average (black dots) of similar marine drills and the associated upper limit for the 95 % confidence interval for those. The dashed lines are the highest and lowest values found for similar marine drilling equipment. Residual of model in lower left corner.

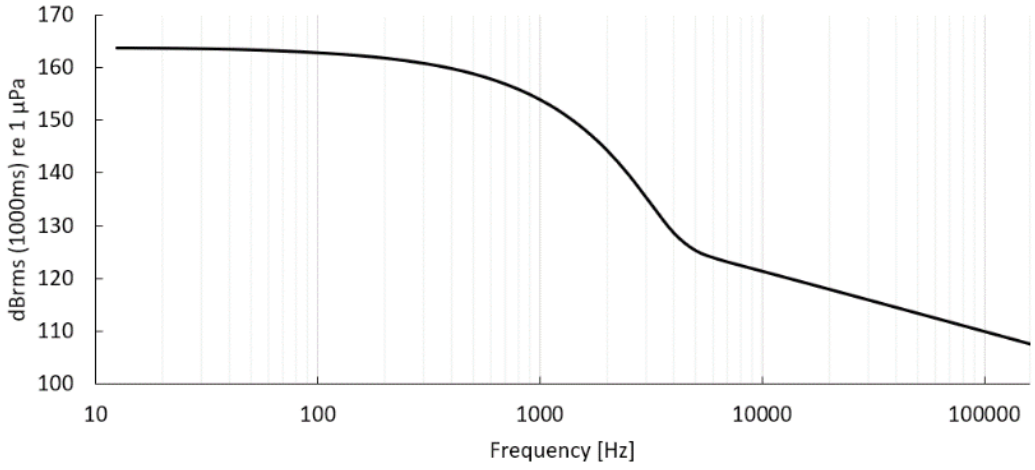


2.1.3 DREDGING

Two types of dredging are proposed to be potentially used, cutter suction and backhoe dredging. Of the two, cutter suction dredging is the noisiest, and as we cannot know in advance the actual dredging pattern we will here only deal with the cutter suction dredger, to represent a worst-case scenario.

The noise from the dredger proved hard to estimate as only one published recording of a cutter suction dredger could be found (Reine, et al., 2012), and this did not include a spectrum, but rather broad band levels only. Our approach was to generate a noise spectrum for similar vessel types based on earlier modelling work (Wittekind, 2014) and recordings from similar vessels, and then adjust the level to correspond to the broadband levels given by (Reine, et al., 2012). We justify this approach based on the lack of available information and the presumption that the continuous noise from a cutter section dredger conforms to general spectra for vessels of this type.

Figure 7. Spectrum of representative vessel used as noise level for the cutter suction dredging. Broadband level is 175 dB_{RMS} (1000 ms) re 1 µPa.



2.2 Modelling Software

We use the software package "dBSea[10]" for underwater noise propagation modelling. We have included sediment (British Geological Survey, 2018) as well as bathymetry. A combination of three modelling methods were combined for this scenario:

- **dBSea Ray**: A ray tracing method that is especially suited to calculation of impulsive sources as it can accurately calculate the interference patterns important for estimation of dB_{z-p} values.
- **dBSeaModes**: A normal modes approach suited especially to lower frequencies and shallower scenarios.
- **dBseaPE**: Based on a wide-angle adaptation of the parabolic equation method, this method excels in most conditions, and is especially suited for lower frequencies.

2.3 Work Schedule

The dredging and piling work is organised so that piling is carried out in Newton Marina while dredging is carried out in the Deep Water Port area and vice versa. In an effort to characterise this in the noise modelling we have run the scenarios in a way that reflect this tandem operation.

Table 4. Overview of dredging and piling works as estimated at project start.

Year	Month	Newton Marina		Deep Water Port	
		Dredging	Odex piling	Dredging	Odex piling
2018	November				
	December				
2019	January				
	February				
	March				
	April				
	May				
	June				
	July				
	August				
	September				
	October				
	November				

[10] A simpler version of this software can be obtained for free from www.dBSea.co.uk/download

3 RESULTS

Note that all results are only valid for vibration and odex piling with piles of diameter 220 cm, impact piling with 50.8 cm piles and for methods as described in section 2.1, p.10.

Models are representative of the mean to high tide (CD + 2.7 m to 5.4 m), with lower tide levels leading to smaller risk zones.

3.1 General Comments

The impact area maps below are showing acute impacts or short-term impacts. Exceeding the limits mean that there is either a risk to *temporarily* worsen the hearing of the relevant animal group (TTS-limits), or a risk to *permanently* worsen the hearing of an animal group (PTS-limits).

Please ensure that you keep the points from section 1.2.2.1 *Threshold meaning and interpretation*, p.8, fresh in memory when evaluating the results.

Temporarily worsening the hearing of an animal has the potential to limit is reproductive success, by inhibiting navigation, foraging, mating, communication and evasion of threats – generally longer-term impacts that must be assessed in a population-wide view.

Permanently worsening an animals' hearing is a hearing *injury* and risks having lethal consequences for the individual in the short term.

Noise not exceeding the limits can still have an impact on local populations if it displaces significant numbers over significant time from important areas, either directly (noise overlaps important area), or indirectly (noise "blocks" access to important area) or disperses prey. Other effects include masking, where the noise limits the effective range of acoustic cues for the animal, making communication, foraging, evasion and navigation harder. These effects are much harder to estimate the impact of, but the vibratory piling will arguably cause more masking than impact piling, due to the continuous noise from this source. Masking effects are thought to have its greatest impact in increasing the risk of separation of mother-offspring pairs, especially in murky waters or during night time where vision cannot be used for navigation. This means that during critical periods where the offspring is not yet sufficiently adept at surviving alone (Table 5, p.22) even masking can have a significant short-term impact on reproduction.

While we show all significant impact areas, we've focussed the text on species groups that determine the impact zone size.
E.g.: Harbour porpoise and harbour seal both are present, but as harbour porpoise is far more sensitive to noise than harbour seal, the impact zone is determined by the harbour porpoise limit (Figure 8, p.14).

Note that impact areas look "jagged" of "pixelated", this reflects the spatial scale of the input data, and thus the highest possible resolution. We choose to show this to clearer communicate the limits of spatial accuracy.

Figure 8. Due to the higher sensitivity of the harbour porpoise the impact zone associated with its TTS limit for continuous noise, is larger than that of harbour seal. As both species are present, we will only present/focus on the larger impact zone. Colours correspond to risk zones associated with the odex piling.

For rarer species, such as minke whale, belonging to the LF (low frequency) group, we will not use its impact zone alone, even if it's the largest, as it would not be representative of the impact of the activity. This means than even though the LF group has the largest impact zone for dredging (owing to the high noise levels at low frequencies), this group alone will not form the basis of the acoustic impact assessment for the dredging activities (also, we do not expect minke whale in Newton Marina). We do however suggest that if baleen whales are observed in the harbour, stark increases in noise levels are avoided if possible to avoid stressing these large animals in such a small volume of water.

We ask the reader to remember that $dB_{SEL\text{-}24}$ is a limit that assumes that the animal is exposed to the noise for 24 hours and stays within the area. Animals can be exposed to higher levels for shorter periods with the same cumulative effect if they are not within the area for the total duration. In practise the animals are assumed to swim away from areas of loud noise, limiting their exposure significantly (JNCC, 2010).

3.2 Impact Maps

Impact maps are split into sets in three categories, based on the activity they're representing.

Notice that the impact from activity in the Deep Water Port are included, this will show up as coloured risk zones south of the proposed Newton Marina.

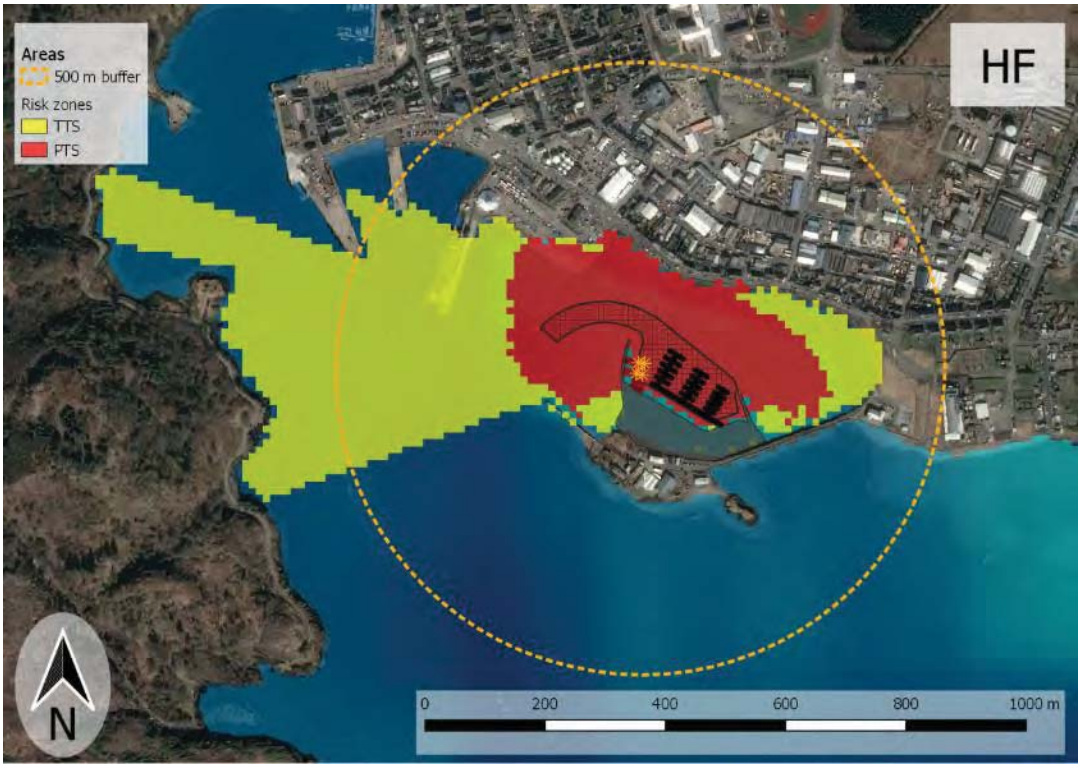
3.2.1 IMPACT PILING

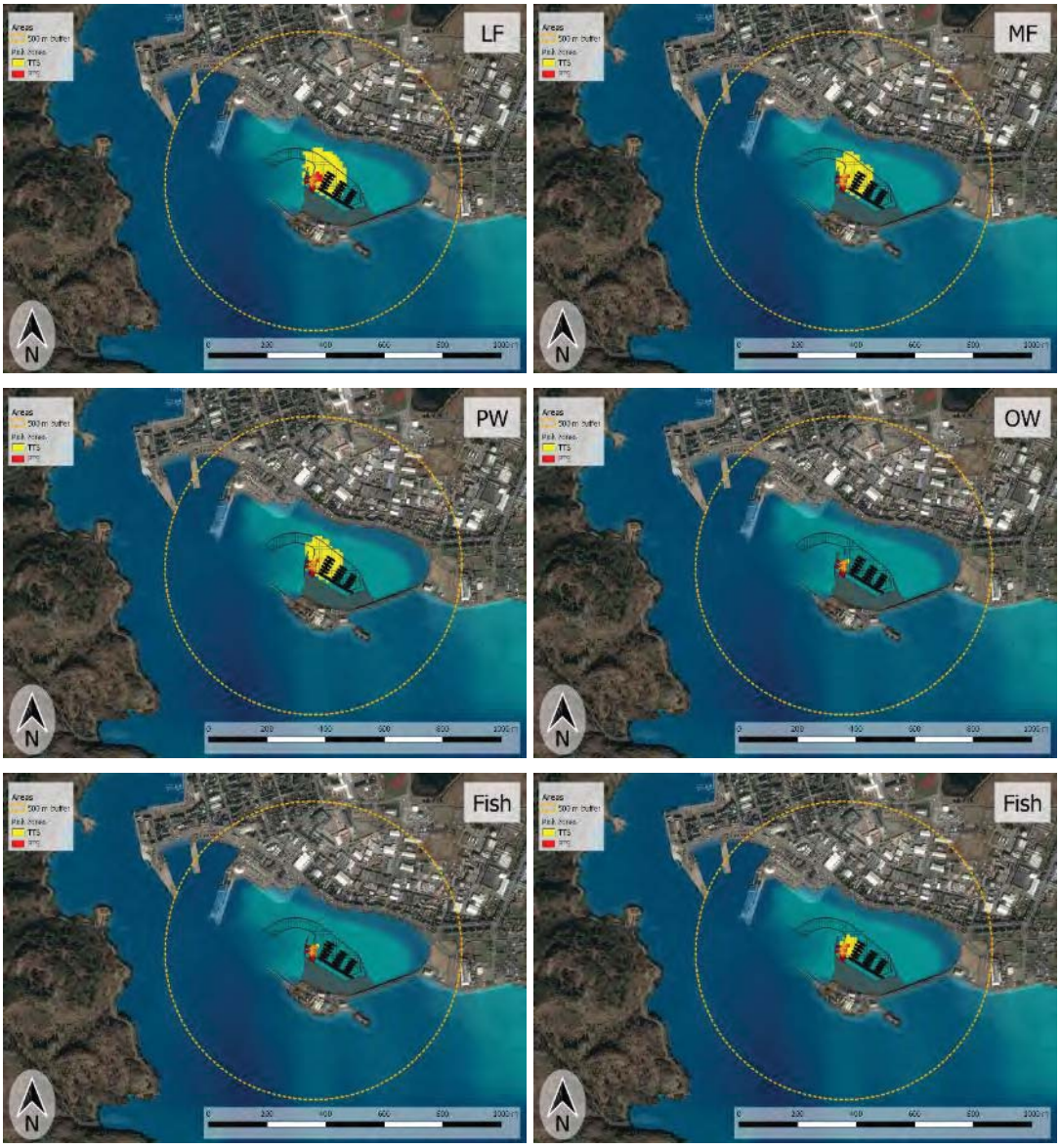
Impact piling noise risk is measured using two criteria, namely thresholds for impulsive $dB_{SEL\text{-}24}$ and $dB_{z\text{-}p}$. The threshold yielding the largest risk zone dictates the impact. For all species in this case the $dB_{SEL\text{-}24}$ yields the largest impact and is thus used here.

First presented are maps showing risk zones given *a single strike.*

Only one impact zone exists for all fish groups as impulsive noise is unweighted and thresholds are equal for impulsive noises for fish.

Figure 9. Impact piling and associated risk zones for *single strikes* for the hearing groups. Group "fish" has two maps as their risk zone for $dB_{z\text{-}p}$ (bottom right) is larger than for $dB_{SEL\text{-single strike}}$ (bottom left). These maps thus represent acute risk of injury, as there is no change to swim away prior to exposure. (figure continues on next page). Orange stars are representative impact piling locations.

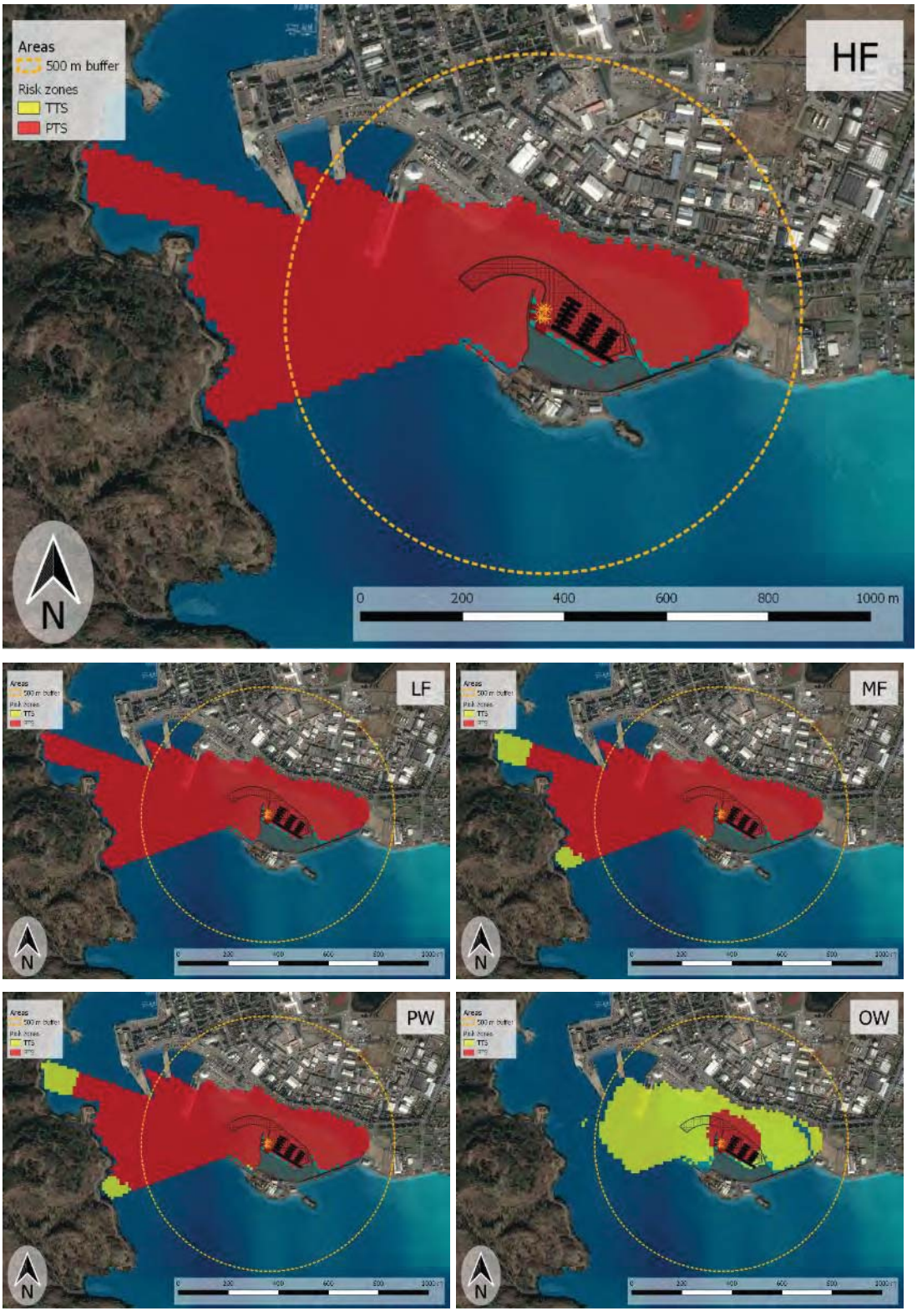




Note that a relatively limited area is in the PTS risk zone and it will be straightforward to verify that no harbour porpoises are within the red area in the top map in figure 9 above.

For the impact piling a worst case scenario of 6000 strikes per day is assumed. This will not be typical for a 24-hour period, and the majority of the impact piling associated with Newton Marina will be over in less than 4 days. This means that while the impact piling carries the greatest acute risk, it is only over a short time, and in a rather small area.

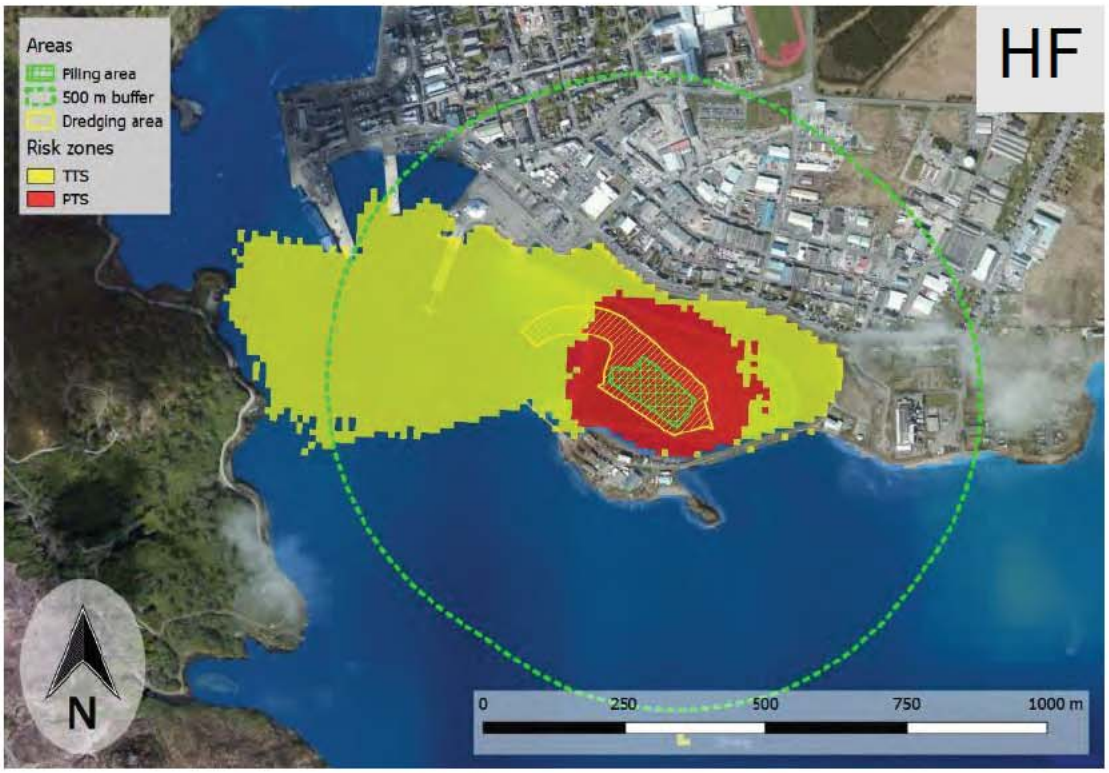
Figure 10. Impact piling and associated risk zones for *all strikes* over a worst case 24-hour period. These maps represent the risk if an animal stays in the area throughout 6000 strikes. (figure continues on next page).

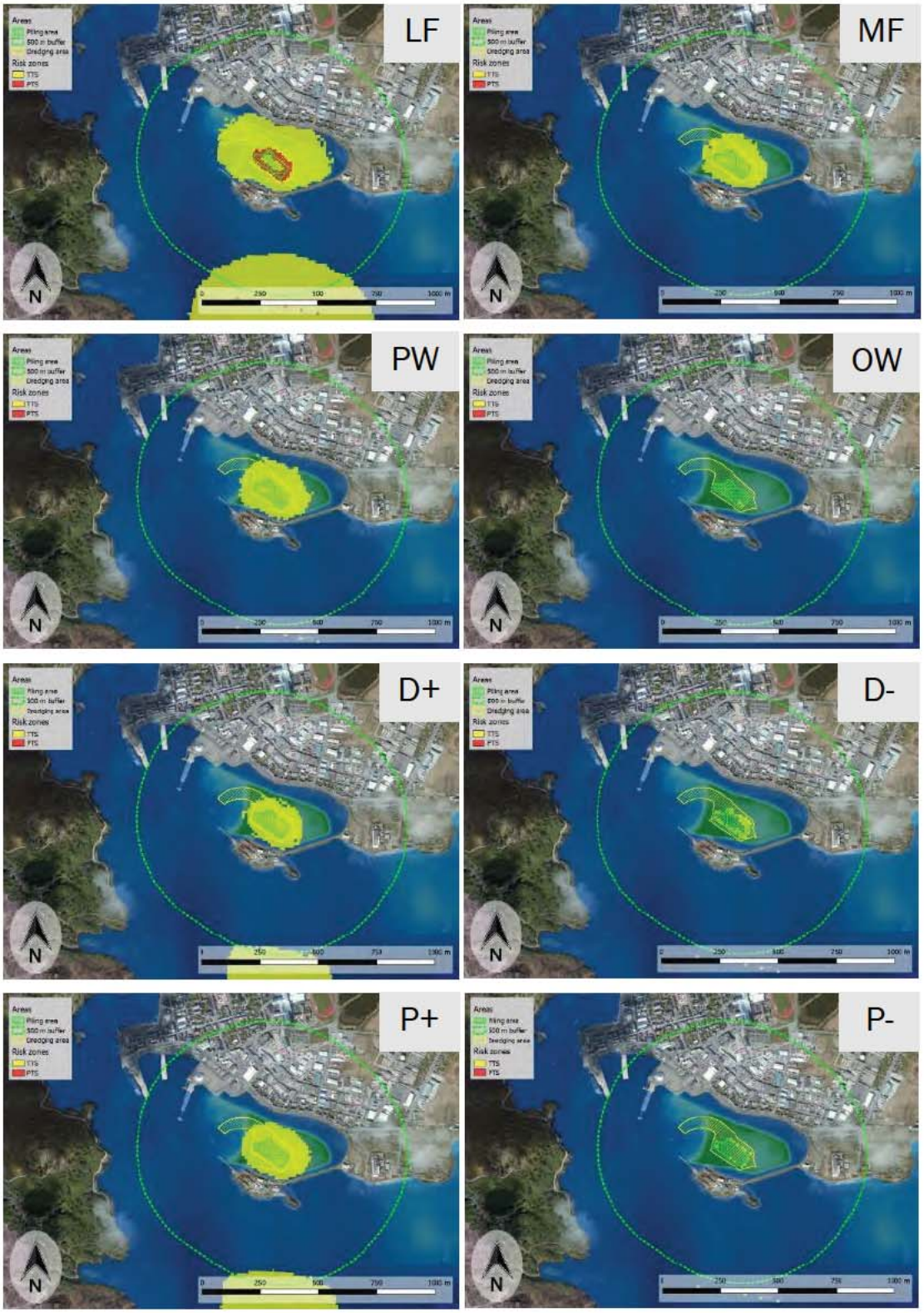


3.2.2 ODEX PILING

Harbour porpoises are, again, the most sensitive of the species considered, with a TTS risk zone extending to 700 metres from the area of piling activity (Figure 9 below). All other hearing groups have significantly smaller impact zones.

Figure 11. Odex piling with no impact piling. These are the impact zones associated with the limits from the HF hearing group (harbour porpoise). All other hearing groups experience smaller acoustic impact. See smaller maps below with hearing group in upper right corner. Keep Table 2, p. 7 & Table 3, p. 8 in mind for reference. (figure continues on next page).





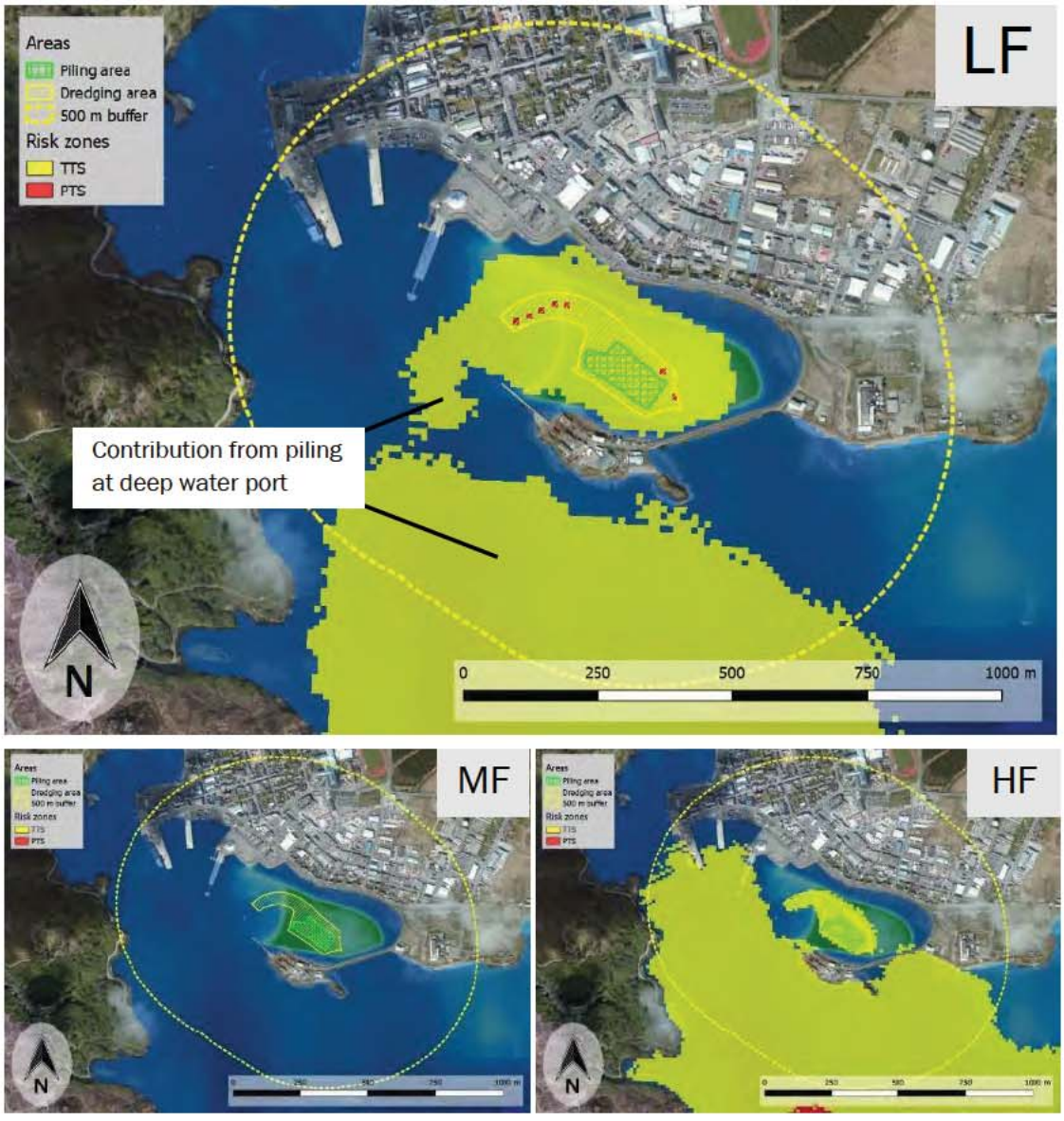
Notice that while the "HF" group has the largest impact zones from activity in the proposed Newton Marina, groups with good low frequency hearing; LF, D+ and P+, have more risk associated with the simultaneous dredging happening in the proposed deep water port to the south[11] (refer to that report for fuller description).

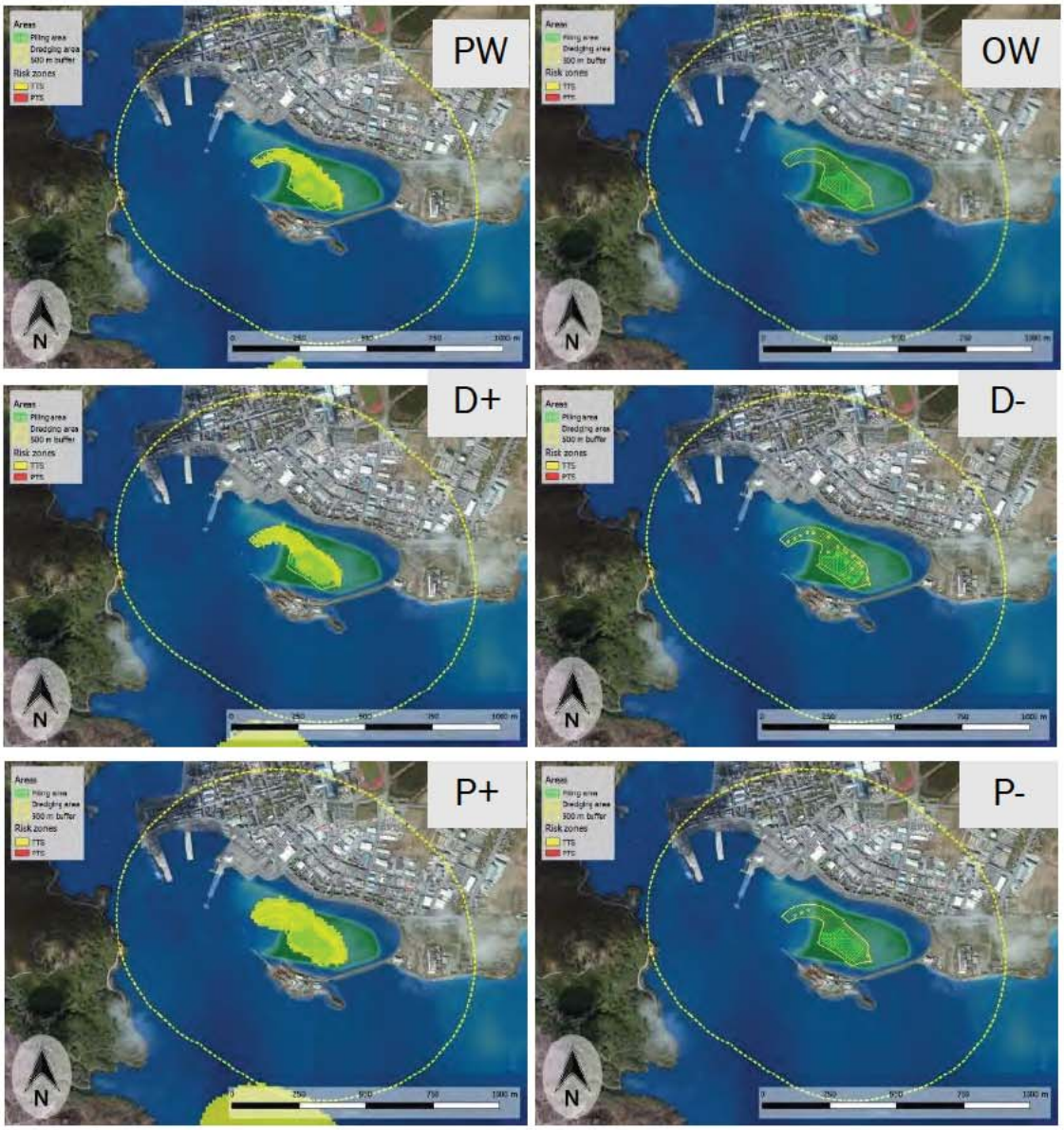
[11] This is assuming the schedule holds (Table 4, p. 12).

3.2.3 DREDGING

The noise from dredging will have lower impact that the piling due to the trend to be of lower frequency and lower source level. The exception might be the LF group that, given its sensitivity to lower frequencies has a larger risk zone associated with dredging than piling. Also notice that the HF group has little sensitivity to dredging, but the piling activity at the deep water port site represents a significant acoustic impact at the Newton Marina site (Figure 14, "HF" below).

Figure 12. The "LF" group (mostly minke whale in this area) experiences the larges acoustic impact from dredging in the Newton Marine Basin. Notice that the HF group experiences a large impact from the piling at the deep water port site. This is due to the higher frequencies in the piling noise. (figure continues on next page)





3.3 Long Term Impacts

The activities here assessed are projected to run over ten months (Jan – Oct 2019, Table 4, p.13). The summer and autumn months especially overlap with breeding times for at least three local species (Table 5, p.22). While the area of Stornoway harbour is not itself designated as a protected area, we have no reason to doubt that the habitat is suitable general foraging for most of the species of concern here. From the information we could find there are no breeding colonies of seals, nor is the area important as nursery grounds for cetaceans. While there are frequent sightings outside the harbour, they are infrequent[12] within the harbour (Hebridian Whale and Dolphin Trust, 2018). Given the presence of an MMO we do not see any significant risk to the local population of marine mammals from the noise from this activity. If no MMO is present we suggest that a soft start[13] is implemented to alert and disperse animals prior to work commencing.

Given the low acoustic sensitivity of the *Salmo* species and basking shark (hearing group "P-"), the noise from the activities will have very little or no effect on this group (Table 3, p.9).

[12] Over the last year there was 2 reported sightings in the harbour and 40 within 5 km outside the harbour.

[13] Given the small area in question, we here suggest 10 min duration of a soft start will be enough to let animals swim to their desired distance.

Table 5. Breeding and/or important time periods for some of the local fauna. Only selected species presented here, according to perceived threat, based on presence information (sea watch foundation, 2018; The Mammal Society, 2018; Scottish National Heritage, 2018) & local NGOs.

Species		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Harbour seal (Phoca vitulina)	Birth												
	Lactation												
	Weaning												
Grey seal (Halichoerus grypus)	Birth												
	Lactation												
	Weaning												
Harbour porpoise (Phocoena phocoena)	Birth												
	Lactation												
	Weaning												
Atlantic salmon	Migration upriver												
	Migration to sea (smolt)												
European trout	Migration upriver												
	Migration to sea (smolt)												
Basking Shark	Presence												

4 CONCLUSION

We find no reason to conclude that the noise from the proposed activity, as described to Irwin Carr Consulting Ltd., will have a significant negative impact on the local population of any of the prioritised species.

We base this assessment on the combination of four factors:

1. The Newton Marina Basin represents an acoustically confined area, leading to a comparably small area being impacted acoustically.

2. The short time span, and the presence of a harbor wall/breakwater means that the impact piling will have little risk of any acute or prolonged impacts on fauna.

3. The Stornoway Harbour has a low density of cetaceans, no seal colonies, and is not designated as a protected site and therefore not thought to be a high-importance site for the animals. This means that a temporary dispersal away from the area has very little risk of having population impacts.

4. The three fish species of focus; salmon, trout and basking shark have comparably poor hearing and while they will likely sense the activity, there is little or no risk of any impact from the noise on these species.

5 REFERENCES

Bing Maps, 2018. *bing maps.* [Online]
Available at: https://www.bing.com/maps/aerial
[Accessed 27 March 2018].

BOEM, 2012. *Auditory Sensitivity in Sea Otters (Enhydra lutris),* Santa Cruz: BOEM.

Brandon M. Casper, D. A. M., 2007. Dipole hearing measurements in elasmobranch fishes. *Journal of Experimental Biology,* pp. 75-81.

British Geological Survey, 2018. *Geology of Britain Viewer.* [Online]
Available at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Carlson, T., Hastings, M. & Popper, A., 2007. *Update on recommendations for revised interim sound exposure criteria for fish during pile driving activities,* Olympia: Washington Department of Transportation.

DFO Canada, 2006. *Effects of Seismic Energy on Fish: A Literature Review,* Dartmouth: Department of Fisheries and Oceans.

Google Inc., 2000-2018. *Google Maps.* [Online]
Available at: https://www.google.ie/maps

Graham, I. et al., 2017. Responses of bottlenose dolphins and harbor porpoises to impactand vibration piling noise during harbor construction. *Ecosphere,* pp. 0-16.

Hebridian Whale and Dolphin Trust, 2018. *Hebridian Whale and Dolphin Trust.* [Online]
Available at: https://whaletrack.hwdt.org/sightings-map/

JNCC, 2010. *Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise,* Aberdeen: http://jncc.defra.gov.uk/page-4274.

Kastelein, R. A., Voorde, S. V. d. & Jennings, N., 2018. Swimming Speed of a Harbor Porpoise (Phocoena phocoena) During Playbacks of Offshore Pile Driving Sounds. *Aquatic Mammals,* pp. 92-99.

Ketten, D. R., 1995. Estimates of blast injury and acoustic trauma zones for marine mammals from underwater explosions. *Sensory Systems of Aquatic Mammals,* pp. 391-407.

Mann, D. et al., 2001. Ultrasound detection by clupeiform fishes. *Journal of the Acoustical society of America,* pp. 3048-3054.

Marine Management Organisation, 2015. *Gov.uk.* [Online]
Available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486651/Underwater_noise_source_literature_review_references_and_value_table_for_anthropogenic_sources__MMO_1097_.csv/preview

Nature Conservation (Scotland) Act , 2004. *Nature Conservation (Scotland) Act 2004,* s.l.: Scottish Government.

NOAA, 2016. *Guidance for Assesing the Effects of Anthropogenic Sound on Marine Mammal Hearing,* s.l.: National Oceanic and Atmospheric Administration.

Otani, S., Naito, Y., Kato, A. & Kawamura, A., 2002. Oxygen consumption and swim speed of the harbor porpoise Phocoena phocoena. *Fisheries Science,* pp. 894-898.

Reine, K. J., Clarke, D. & Dickenson, C., 2012. *Characterization of Underwater Sounds Produced by a Hydraulic Cutterhead Dredge Fracturing Limestone Rock,* New York: US Army Corps of Engineers.

Reine, K. J., Clarke, D. & Dickerson, C., 2014. Characterization of underwater sounds produced by hydraulic and mechanical dredging operations. *The Journal of the Acoustical Society of America,* pp. 3280-3294.

Robinson, S. P., 2015. *Dredging Sound Measurements.* Paris(France): National Physics Laboratory.

Santos-Dominguez, D., Torres-Guijarro, S. & Pena-Gimenez, A., 2015. Analyis of Dredger Noise Based on Experimental and Simulated Source Level Calculation.

Scottish National Heritage, 2018. *Scottish National Heritage.* [Online]
Available at: https://www.nature.scot/plants-and-animals/fish/freshwater-fish/

sea watch foundation, 2018. *sea watch foundation.* [Online]
Available at: http://seawatchfoundation.org.uk

Smith, M. E., Kane, A. S. & Popper, A. N., 2004. Acoustical stress and hearing sensitivity in fishes: does the linear threshold shift hypothesis hold water?. *The Journal of Experimental Biology,* pp. 3591-3602.

Southall, B. L. et al., 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals,* pp. i-509.

Subacoustec, 2004. *Fish and Marine Mammal Audiograms: A summary of available information,* Hampshire: Subacoustech Ltd.

The Mammal Society, 2018. *The Mammal Society.* [Online]
Available at: http://www.mammal.org.uk/

UKHO , 2018. *United Kingdom Hydrographic Office INSPIRE Portal & Bathymetry DAC.* [Online]
Available at: http://aws2.caris.com/ukho/mapViewer/map.action

Washinton State Department of Transportation, n.d. *Washinton State Department of Transportation.* [Online]
Available at: https://www.wsdot.wa.gov/NR/rdonlyres/AF4933DD-46D6-4B8A-8644-487D45B19F6E/0/ImpactPileNoise7_12.pdf

Wittekind, D. K., 2014. A Simple Model for the Underwater Noise Source Level of Ships. *Journal of Ship Production and Design,* pp. 1-8.

Newton Marina
Technical Appendix 5.5: Otter Report

March 2018

Newton Marina
Technical Appendix 5.5: Otter Report

Client:	Stornoway Port Authority
Document number:	8216
Project number:	670526
Status:	Final
Author:	Various
Reviewer:	[Redacted]
Date of issue:	29 March 2018

Glasgow

Craighall Business Park
8 Eagle Street
Glasgow
G4 9XA
0141 341 5040
info@envirocentre.co.uk
www.envirocentre.co.uk

Aberdeen

Banchory Business Centre
Burn O'Bennie Road
Banchory
AB31 5ZU
01330 826 596

Inverness

Alder House
Cradlehall Business Park
Inverness
IV2 5GH
01463 794 212

Edinburgh

Suite 114
Gyleview House
3 Redheughs Rigg
Edinburgh
EH12 9DQ
0131 516 9530

EXECUTIVE SUMMARY

EnviroCentre Limited was commissioned, on behalf of Stornoway Port Authority (SPA), to undertake otter (*Lutra lutra*) surveys to inform an Environmental Impact Assessment (EIA) in relation to the proposed development of Newton Marina, Stornoway, Isle of Lewis. The survey was requested to inform a planning application with an associated marine licence and Harbour Revision Order.

The European otter is the only native UK otter species. It is a European protected species (EPS) and is also fully protected in Scotland under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and under Schedule 5 of the Wildlife and Countryside Act 1981.

Otter surveys were conducted in May 2017 and February 2018 extending within and around the perimeter of the site and from within a boat circumnavigating the site boundary.

No direct evidence of otter was noted during the field survey and no otter resting sites were identified during the survey of the area surrounding Newton Marina. Based on nearby habitat types and desk study results for the wider area it is likely that otter are active within the area, utilising the coastal habitats.

Based on the results of this study, no EPS licensing, in relation to otter, is required to proceed with the project. Good practice recommendations regarding works in proximity to otter, should this species frequent the site during works, occurrences of otter frequenting the site in the future have been included in this report.

Contents

Appendices

Tables

1 INTRODUCTION

1.1 Remit

EnviroCentre Limited was commissioned, on behalf of Stornoway Port Authority (SPA), to undertake otter (*Lutra lutra*) surveys to inform an Environmental Impact Assessment (EIA) in relation to the proposed development of Newton Marina, Stornoway, Isle of Lewis.

The Newton Marina 'site' is demarcated by the red line boundary as shown in Appendix A. The 'survey area' is shown in as a purple dashed line in the same document.

1.2 Site Description

The Newton Marina site is an existing bay feature, to the south east of Stornoway Port. It comprises a causeway-type feature linking the shore to an outcrop of rock where an access road and industrial units are located.

To the north, the coast line is dominated by the built environment and Newton Street. To the east the built environment begins to fragment towards agricultural land adjacent to Sandwick Bay. To the west and south is the marine environment leading eventually to the coastline and woodland habitats associated with Cnoc na Croich rising to 66m above sea level.

Freshwater habitats meet the marine environment from the Glen River which enters the sea between Lewis Castle and Stornoway; the River Creed (Allt Chlisgro); and the Poll a' Choire to the south west of the site. The wider landscape, particularly to the south west of the site, features a number of lochs many of which are interconnected by burns.

1.3 Legal Status: Otter

The European otter (*Lutra lutra*) is the only native UK otter species. It is a European protected species (EPS) and is also fully protected in Scotland under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and under Schedule 5 of the Wildlife and Countryside Act 1981.

It is a breach of legislation to:

- capture, kill, disturb or injure otters (on purpose or by not taking enough care);
- damage or destroy a breeding or resting place (deliberately or by not taking enough care);
- obstruct access to their resting or sheltering places (deliberately or by not taking enough care); and
- possess, sell, control or transport live or dead otters, or parts of otters[1].

1.4 Consultation

It was agreed, at the scoping stage of the EIA process for Newton Marina that terrestrial mammals would be scoped out. This study for otter at Newton Marina, was conducted as part of a survey of a wider area and as such has been reported separately via this document.

[1] https://www.gov.uk/guidance/otters-protection-surveys-and-licences

1.5 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

2 METHOD

2.1 Desk Study

A search for pre-existing information on otter from the Outer Hebrides Biological Records[2] data set was included in a desk based study conducted for a 5km radius of the site.

2.2 Otter Survey

Survey for otter was conducted on two occasions, by suitable qualified and experienced ecologists:

- 5th of May 2017 by [Redacted] MSc MCIEEM; and
- 27th of February 2018 by [Redacted]

The otter survey was conducted along the coastline of the site and from within a boat circumnavigating the site boundary. There are no watercourses associated with the site to extend the survey upstream. The survey area is depicted in Appendix A.

The survey followed standard guidelines[3, 4] and aimed to identify suitable otter habitat and field signs, including:

- Spraints (otter faeces/droppings used as territorial signposts. Often located in prominent positions and can be placed on deliberate piles of soil or sand). Three categories are used for describing otter spraint: Dried fragmented (Df); Dried intact (Di); and Not fully dry (Nd);
- Footprints;
- Feeding remains (can often be a useful indication of otter presence);
- Paths/slides (otter can often leave a distinctive path from and into the watercourse);
- Holts (underground shelter) are generally found:
    - Within trees roots at the edge of the bank of a river;
    - Within hollowed out trees;
    - In naturally formed holes in the river banks (or shoreline) that can be easily extended;
    - Or preferably in ready-made holes created by other large mammals such as badger setts, rabbit burrows or outlet pipes; and
- Couches/lay-ups (couches or lay-ups are places for lying up above ground are usually located near a watercourse, between rocks or boulders, under dense vegetation).

In order to assess their importance, and thus determine the likely impact of any proposed development, the status of otter resting sites was assigned from Low to High according to Table 2.1below[5].

[2] Outer Hebrides Biological Records. Available at: https://www.ohbr.org.uk/
[3] Chanin, P. (2003). Monitoring the Otter *Lutra Lutra*. Conserving Natura 2000 Rivers, Monitoring Series (No. 10). Peterborough: EN, CCW, EA, SEPA, SNH & SNIFFER. Available from: http://www.snh.gov.uk/docs/B359156.pdf
[4] SNH Otter survey guidance. Available from: http://www.snh.gov.uk/about-scotlands-nature/wildlife-and-you/otters/assessing/
[5] Bassett, S., & Wynn, J. (2010). Otters in Scotland: How Vulnerable Are They to Disturbance? *CIEEM In Practice*, (70), 19–22. Retrieved from file:///M:/Library/_By%20author/CIEEM/In-Practice-IP70_Dec_2010.pdf

Table 2.1: Guidance for Assigning Status of Otter Resting Sites

Resting Site Status	Definition
Low	Feature with limited evidence of otter activity – low number of spraints, not all age classes present. Insufficient seclusion to be a breeding site or key resting site, unlikely to have links to the key otter requirements. Most likely to provide a temporary 'stop off' for otters when moving through their territory. Loss/disturbance of such a feature is unlikely to be significant in terms of the individual or population.
Moderate	Feature containing sprainting with a range of age classes, but not in significant quantities. Availability may be limited by season, tides or flow. Unlikely to be suitable as a breeding/natal site but will be a key resting site and may be linked to other important features within the territory. The impact arising from a loss or disturbance of such a feature will be determined by the availability of more suitable or well used sites within the otter's territory.
High	Feature has a high level of otter activity, including an abundance of sprainting of all age classes, large spraint mounds, well used grooming hollows, paths and slides. Affords a high degree of cover and is linked to key features such as fresh water and abundance of prey. May be suitable as a breeding area (spraints may be absent from natal holts). The site is usually available at all times of year and at high and low tide/flow. The loss/ disturbance of such as feature will often be considered significant in terms of the individual or population.

2.3 Survey Limitations

The survey findings represent a snapshot of field evidence and potential observations on the given survey dates in May 2017 and February 2018. Tidal action can regularly remove field evidence such as spraints and foot prints. Therefore coastal survey is usually reliant on obvious signs above the high water mark, or direct observations.

3 RESULTS

3.1 Desk Study

A total of 17 records of otter within 5km of the site were returned from the biological records data set over a period dating back to the early 20th Century.

Three recent records (2010 onwards) indicate sightings of single adult otters greater than 3.5km from the site, two of which are inland locations. There is an additional record of a single adult otter located at the confluence of River Creed approximately 1km west of the Newton Marina site.

From this desk study it can be deduced that otter have been present in nearby habitats and the wider landscape for a number of years.

3.2 Field Survey

No direct evidence of otter (sightings, spraint, prints etc.) was noted during the field survey and no otter resting sites were identified during the survey of the area surrounding Newton Marina. Otter could utilise features along the coastline particularly; isolated rock pools, rocky outcrops, the boulder-heavy shoreline and natural alcoves in the rocks for foraging, commuting through the landscape and resting. A general perspective of the coastal habitat can be understood from photos in Appendix B.

It is likely that otter are active within the area regularly and utilise the coastal habitats in a range of ways. The marine environment constitutes a typical hunting area and is likely to provide a reliable range of prey items from crustaceans to small and medium sized fish. Coastal bird's eggs may also feature in their diet. It is likely that adolescent otters will use the marine environment to socialise and hone their hunting skills.

Otter are most active between dusk and dawn. However, in this habitat, they are likely to adapt their behaviour to maximise the benefits of hunting during optimal tide times, including the shoreline. Otter can become accustomed to regular human behaviour, therefore sightings may be recorded at locations often visited by people.

Otter, utilising marine environments, require a source of fresh water in order to maintain good fur condition. The Newton Marina site is not directly associated with a fresh water source, however these habitat types are present within 1km of the site to the north, west and south west of Newton Marina (as described in Section 1.2) and, as such, the habitat of Newton Marina is likely to be frequented by otter which reside in the wider landscape.

4 FURTHER SURVEY AND LICENSING

As no resting site for otter have been discovered and no direct evidence of otter observed within the Newton Marina site during this study, it is considered that no European Protected Species licensing for otter is required to proceed with the project.

Ecological data is generally valid for a 12 month period from the date of field survey. It is suggested that the baseline data for otter is updated, including a search for any new data records, at least annually in order to maintain validity.

Prior to works commencing, a pre-works check in the form of a site-walkover to search for any newly created resting sites, should be undertaken.

Should future survey or monitoring highlight a constraint posed by otter in relation to this site, then the need for species licensing should be reviewed.

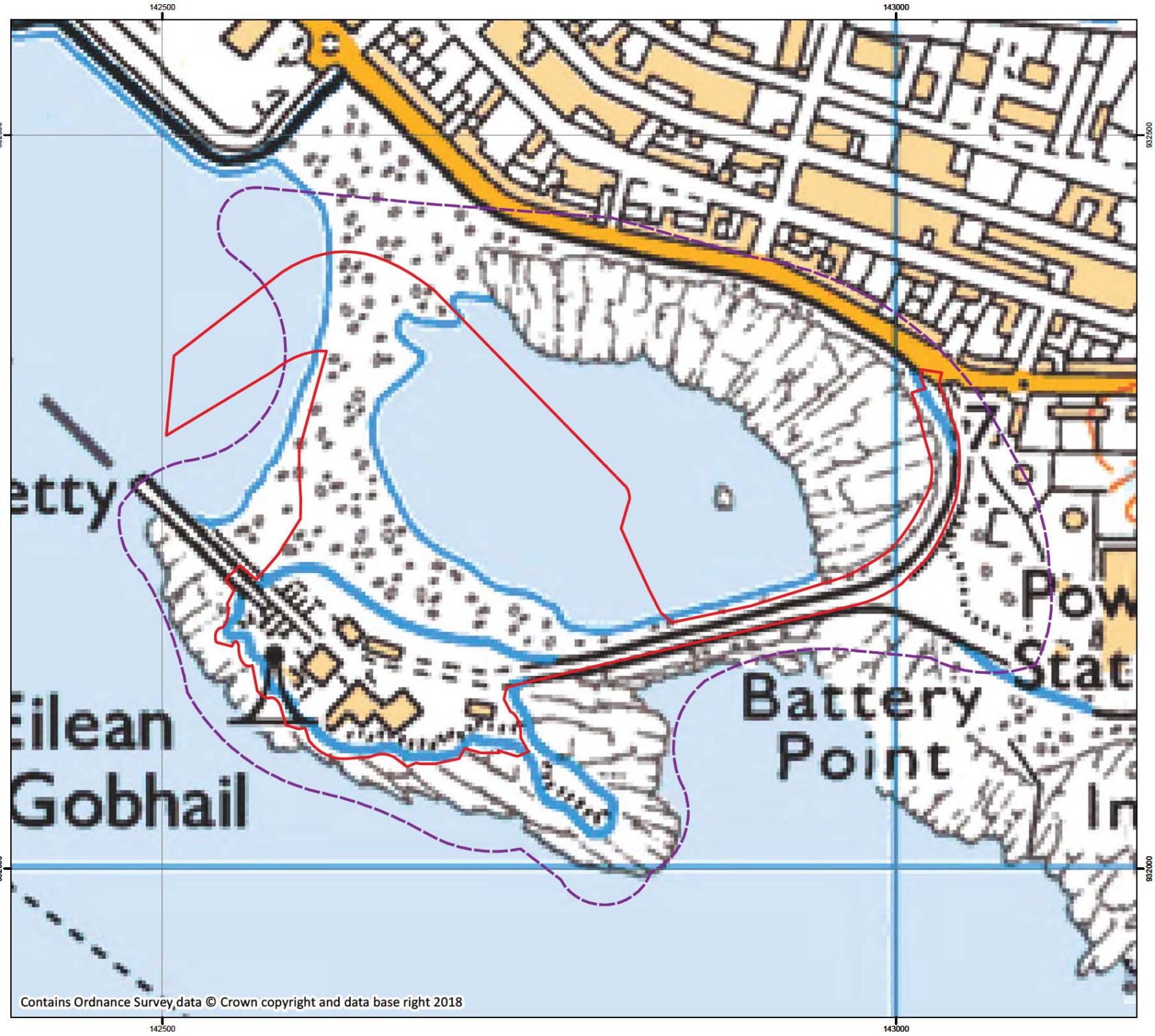
5 GOOD PRACTICE MITIGATION

Despite no field signs or direct observations of otter during the field surveys, it is assumed that otter are present in the wider landscape, utilising the marine environment and coastline in the wider landscape associated with Newton Marina for foraging and commuting purposes. This is supported by the records of otter highlighted in the desk study. Therefore the following good practice is recommended in order to minimise effects on otter which may frequent the area:

- The possible presence of otter on site and in the wider landscape should be included in tool box talks and site induction for construction staff operating in this area;
- Works associated with land above the high water mark should be preceded by a pre-works check for otter resting sites as described in Section 4;
- If an otter is observed within the proposed working areas, seek guidance from an Ecological Clerk of Works (ECOW) and do not commence works until the otter has dispersed;
- Should an otter resting site be discovered, prior to or during works, said works should be assessed with regards to the need for additional mitigation species disturbance licensing;
- Monitoring for otter activity within the marine environment could be encapsulated within the Marine Mammal Observations (MMO) prior to dredging and piling works with associated noise considerations;
  Artificial lighting should be directed towards working areas only and not illuminate extensive stretches of coastline that have the potential to be utilised by commuting or foraging otter, which can be more active between dusk and dawn;
- Pollution of the marine environment should be prevented in order to safeguard water quality and marine life which may be a source of prey for otter.

APPENDICES

A SITE BOUNDARY AND OTTER SURVEY AREA



Legend

Newton Marina Site Boundary 7.55 hectares

Otter Survey Area

Do not scale this map

Client: Stornoway Port Authority

Project: Newton Marina

Title: Otter Survey Area

Status: FINAL

Drawing No.: 670526-012

Revision:

Scale: 1:2,500

A3

Date: 5 April 2018

Drawn: [Redacted]

Checked:

Approved:

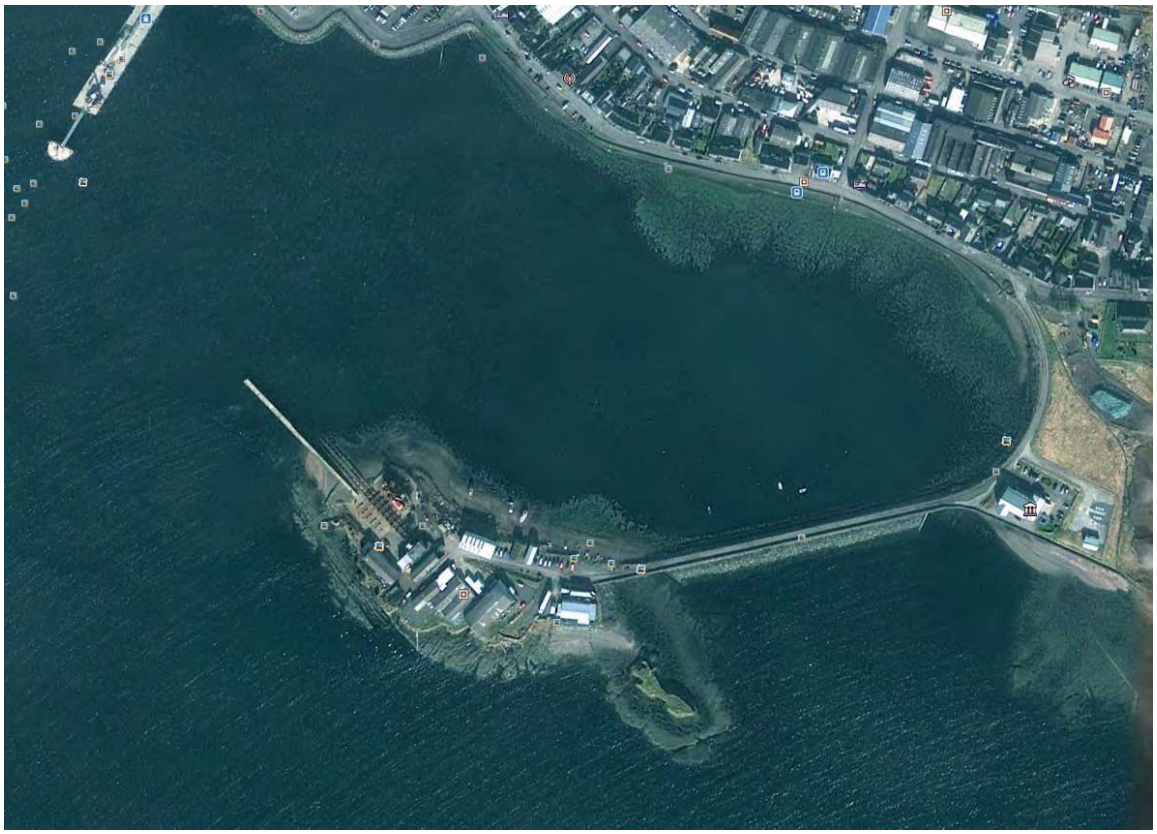
ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

B PHOTOGRAPHIC RECORD

Photo 1: Coastal Otter habitat adjacent to the Newton Marina development (Stornoway).

Photo 2: Coastal habitat around Goatfell Island

Stornoway Newton Marina Development
Technical Appendix 5.6: Fisheries Baseline Report



March 2018

Stornoway Newton Marina Development
Technical Appendix 5.6: Fisheries Baseline Report

Client:	Stornoway Port Authority
Document number:	8059
Project number:	670526
Status:	Final
Author:	[Redacted]
Reviewer:	[Redacted]
Date of issue:	14 March 2018
Filename:	Stornoway Newton Marina Fisheries Baseline Report (Final)

Glasgow

Craighall Business Park
8 Eagle Street
Glasgow
G4 9XA
0141 341 5040
info@envirocentre.co.uk
www.envirocentre.co.uk

Aberdeen

Banchory Business Centre
Burn O'Bennie Road
Banchory
AB31 5ZU
01330 826 596

Inverness

Alder House
Cradlehall Business Park
Inverness
IV2 5GH
01463 794 212

Edinburgh

Suite 114
Gyleview House
3 Redheughs Rigg
Edinburgh
EH12 9DQ
0131 516 9530

EXECUTIVE SUMMARY

The Fisheries Baseline Report for the proposed Newton Marina (hereafter referred to as the "proposed development") covers baseline conditions of the anadromous populations of Atlantic Salmon (*Salmo salar*) that return annually to the River Creed (the migratory path to which lies in direct line through the proposed development area) and Sea Trout (*Salmo trutta*) that return annually to both the River Creed and nearby Glen River. In addition, this report also includes full consideration of baseline conditions of the other migratory species shown to populate the development area, the European Eel (*Anguilla anguilla*). Site visits to Stornoway were made in both May 2017 and February 2018 to verify baseline conditions and liaise with the Outer Hebrides Fisheries Trust (OHFT), Stornoway Angling Association (SAA) and Stornoway Port Authority (SPA). Desk study information was used to support the existing data.

The River Creed catchment has a high substrate percentage of good spawning gravels, suitable for use by both Salmon and Sea Trout. Similar substrate can also be found in the lower reaches of the Glen River. The primary limiting factors to access of spawning gravels within the River Creed catchment is the impassable weir downstream of Loch an Ois and the obstruction at Hatchery Pool. Similarly, on the Glen River, the 2011 Habitat Survey, commissioned by the OHFT, identifies the presence of several pipes and a fence line that crossed the Glen River, accumulating waste build-up during high water conditions and forming unnatural obstacles to fish passage.

According to the most recent available fully-quantitative electro-fishing survey data, the River Creed supports large numbers of both juvenile Salmon and Trout. The same data set also showed juvenile Trout populations on the Glen River, no juvenile Salmon were found on the Glen River. Juvenile Salmon from the River Creed that have undergone Smoltification will migrate to sea between May and August.

Both the River Creed and the Glen River support populations of European Eel and 3-Spined Sticklebacks. The 2010 electro-fishing survey report showed the most overwhelmingly significant numbers of European Eel were found in the lower River Creed.

Prior to the introduction of the initial Conservation of Salmon (Scotland) Regulations in 2016, the River Creed held a Category 1 conservation status. The River Creed has now seen its conservation status fall from Category 1 in 2017 to Category 2 in 2018. It is anticipated that the downgrading of the River Creed Conservation Status will result in reduced angling pressure and a potential reduction in revenue generated from angling within the local economy. With no known Salmon population within it, the Glen River is not affected by the aforementioned Regulations and therefore is uncategorised.

The overwhelming majority of Salmon and Sea Trout run into the River Creed between July and August, with the majority of the angling catch from the Creed occurring between July and October. Sea Trout will also migrate into the Glen River during July and August, however there is no recorded angling catch from the Glen River as this water is not recreationally fished.

Contents

Appendices

Figures

Tables

1 INTRODUCTION

1.1 Remit

EnviroCentre Limited was commissioned on behalf of Stornoway Port Authority (SPA) to undertake a Baseline Report for Fish to inform an Environmental Impact Assessment (EIA) in relation to the proposed development of Newton Marina, Stornoway, Isle of Lewis. The survey was requested to inform a planning application with associated marine licences and Harbour Revision Order (HRO).

The 'site' is defined as the area demarcated by the red line boundary as shown in Appendix A. The 'study area' constitutes the area of the 'site' plus appropriate buffer zones (shown in blue).

1.2 Aims and Objectives

The aim of this report is to provide an ecological baseline of migratory fish populations to be referred to in terms of the proposed development. The main objectives were as follows:

- Identify and describe the baseline existing migratory fish populations;
- Identify and describe the baseline habitats of existing migratory fish populations;
- Identify and describe the baseline juvenile Salmonid conditions of those populations residing within watercourses;
- Identify and describe any existing obstacles to fish migration within watercourse;
- Identify and describe, where applicable, the Conservation Status of any watercourses potentially impacted upon by the proposed development; and
- Identify and describe current angling pressure on all water courses potentially impacted upon by the proposed development.

1.3 Project Overview

The proposed development site is situated within Newton Basin, immediately to the south of Stornoway within the Stornoway Harbour embayment. Newton Basin is a small tidal bay partially enclosed by Goat Island.

The proposed development is concerned with the reclamation of land to form a new marina and associated infrastructure and facilities at Goat Island, which is situated at the southern end of Stornoway and centred on grid reference 142660, 93214 (eastings/northings) as demonstrated on Figure 1.1 within Volume 2 of this EIAR (hereafter known as 'the site'). The existing use of Goat Island is associated with industrial use, incorporating a seafood processing facility owned by Macduff and the current Macmillan Boat Yard. Macmillan Boat Yard currently operates as a boat repair and renovation workshop, with facilities existing to repair and renovate vessels via the existing slipway to the immediate west of the facility.

The existing marina, (i.e. the Stornoway Inner Harbour Marina at Cromwell Street), has been virtually full since it opened in 2014 years ago with 83 berths being occupied all year round. In response to the success of the existing marina, the proposed development has been proposed to provide berthing for an additional 75 vessels and relieve the pressure over the summer months for visiting yachts. It is proposed that up to 50 of the berthing spaces could be provided to meet local demand, with the remaining berths reserved for visiting use.

The development includes:

- Reclamation of land along the north side of Goat Island (approx. 2.28ha) behind a concrete retaining wall, and subsequent formation of a level development platform;
- Excavation of material won by a combination of cutter suction and backhoe dredging from both sea and land, dredged to up to 3m Chart Datum (CD);
- Formation of a new rock-armoured breakwater of up to 75m in length and 20m wide at its base;
- Formation of a proposed slipway structure of 50m in length and the width of its base varying between 10m and 25m with rock armouring on its side, for the launch of vessels from Goat Island;
- Formation of a marina structure from a 100m long floating access walkway of 3m width, with three walkway legs around 60m long and 2.5m wide, and finger piers on either side, and a 24m long and 1.5m wide access bridge connecting to the shore;
- Installation of a boat lift structure to facilitate boat repair and overwintering of vessels of up to 90 tonnes in weight;
- A new rock armoured passing place on the western side of Battery Point, with a surfaced area of 0.01ha;
- Service provision for the berths, including power, water, waste collection, toilets, showers and other ancillary services;
- Up to 20 boat storage bays of up to 10m long, and 15 boat storage bays of up to 10m long (on land);
- Provision for 40 car parking spaces for marina users (and 18 (future) spaces for boatyard building users); and
- Two boat sheds of 12.5m in length, 5m wide and 6m high, to replace the existing boat sheds.

1.4 Policy, Legislation and Guidance

The compilation of this report has taken cognisance of the following Policy, Legislation and Guidance:

- WFD111 Phase 2a Coarse Resolution Rapid-assessment Methodology to Assess Obstacles to Fish Migration 2010;
- United Kingdom Technical Advisory Group (UKTAG) River Assessment Method River Continuity Barrier to Fish Migration Method (Scotland) WFD-UKTAG 2015;
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (The Habitats Directive);
- The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003;
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Nature Conservation (Scotland) Act 2004 (NCA);
- The Conservation of Salmon (Amendment) Scotland Regulations 2018;
- The Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- The Conservation (Natural Habitats, &c.) Amendments (Scotland) Regulations 2007 (The Habitats Regulations);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR);
- The Salmon (Fish Passes and Screens) (Scotland) Regulations 1994;
- The Outer Hebrides Local Development Plan (2012);
- The Outer Hebrides Local Development Plan 2 (Under Examination by Scottish Ministers);
- River Crossings and Migratory Fish: Design Guidance by the Scottish Executive (2000);
- Guidance for Pollution Prevention (GPPs) 2017 by Scottish Environmental Protection Agency (SEPA).

1.5 Assessment Limitations

Understandably, having availability of electro-fishing survey data more recent than 2010 would have been preferable from a perspective of ensuring the total validity of the conclusions drawn. However, such was the quality of both the methodology and reporting from the Stornoway Wind Farm (2010) Fisheries Baseline Survey

Report, it is considered that the slight age of the data is not enough of a limitation to this report to be of sufficient need to undertake a full raft of new surveys. It is unfortunate that the 2017 semi-quantitative Glen River electro-fishing surveys were not undertaken to the same methodology as the fully quantitative 2010 surveys, making their results less conclusive and essentially incomparable to the prior study.

Angling catch return data from the last 5 years was made available by the OHFT. Historic data beyond this period was not available from Stornoway Angling Association (SAA), however this is not considered a major limitation to this report. It goes without saying though that the larger the data set that would have been available, the more accurate the long term averages relating to returns of Salmon and Sea Trout would have been.

2 METHODOLOGY

2.1 Desk Study

A detailed desk study was undertaken in order to gather any relevant existing information pertaining to the natural fish populations and fishing interests within the study area. As part of this data collation exercise the following sources of information were used:

- 2010 electro-fishing survey data from the River Creed and Glen River;
- 2011 Glen River Catchment Action Plan;
- http://syangling.com/ (accessed March 2018);
- Records from the OHFT http://www.outerhebridesfisheriestrust.org.uk/ (accessed February 2018);
- UK Biodiversity Action Plan (UKBAP) http://jncc.defra.gov.uk/page-5164 (accessed March 2018); and
- International Union for Conservation of Nature (IUCN) Red List of Threatened Species http://www.iucnredlist.org/details/60344/0 (accessed March 2018).
- https://www.nature.scot/plants-animals-and-fungi/fish/freshwater-fish/european-eel (accessed March 2018).

2.2 Importance of Key Species

The Atlantic Salmon is listed as a priority species under the UK Biodiversity Action Plan (BAP) and is therefore of National (UK) Importance. Similarly, Sea Trout are listed as priority species under the UK BAP and, as a result, their populations of both the River Creed and Glen River are also of National (UK) Importance. The European Eel is classified as both a UK BAP priority species and Critically Endangered on the International Union for the Conservation of Nature (IUCN) Red List, making the populations of these fish in both of the aforementioned watercourses of International importance.

With regard to the watercourses potentially impacted upon by the proposed development, the River Creed and the Glen River, there are currently no designations applied to any of the above mentioned species.

2.3 Fisheries Habitat

EnviroCentre ecologists made site visits to the proposed development, the River Creed, Glen River and surrounding area in May 2017 and February 2018. As part of those visits, meetings were held with representatives of the OHFT, Stornoway Angling Association (SAA) and SPA, to discuss their collective concerns and collect all available relevant data to contribute towards the desk study elements of this report. Specific site visits were made to both the River Creed, Glen River and adjacent coastline around the proposed development to observe and identify the habitat of those fish species potentially impacted.

In 2011, the OHFT commissioned a full Habitat Survey as part of the Glen River Catchment Action Plan. This report was made available to EnviroCentre and reviewed as part of the desk study. The current status of the findings and recommendations of the report were then verified during the February 2018 site meeting with OHFT biologist, Paul Hopper and OHFT Angling Promotion Officer, Donnie MacIver.

2.4 Juvenile Salmonid and Trout Density

In order to obtain baseline data on the status of fish populations in watercourses within the area potentially affected by the proposed development, the juvenile salmonid population surveys undertaken in the summer of

2010 for the Stornoway Wind Farm development, that used fully quantitative electro-fishing techniques, were reviewed. These surveys were carried out in accordance with Scottish Fisheries Coordination Centre (SFCC) standards, by a team of accredited staff from the OHFT. Further electro-fishing surveys of the Glen River, undertaken to the same SFCC standards by the same accredited OHFT staff, were undertaken in 2017, as part of a three year review of the health of the Glen River, which is due to end in 2019. Due to time constraints on OHFT staff however, these surveys were undertaken on a quantitative (one run) basis as opposed to the fully quantitative (three run depletion) method utilised in 2010. As such, the results from the 2017 surveys cannot reliably be compared to those from 2010 and have been omitted from the study.

For the purposes of assessment via electro-fishing, juvenile salmonids are classified under four headings. Table 2.1 (below) outlines this classification system.

Table 2.1: Juvenile Salmonid Classification System

Juvenile Salmonid	Age	Definition
Salmon Fry	0+	Young Salmon, <1 year old
Salmon Parr	1+ and older, known as 1++ fish	Young Salmon >1 year old (Inc. 2+ and 3+ year old fish)
Trout Fry	0+	Young Trout, <1 year old
Trout Parr	1+ and older, known as 1++ fish	Young Trout, >1 year old (Inc. 2+ and 3+ year old fish)

In order to put the 2010 survey results into context, the data was divided into categories, which have had their parameters set by historic local fish population information, gathered by the SFCC between 1997 and 2002. The categories, explained in Table 2.2, were inevitably subject to regional conditions at the time of data collection so, with this in mind, confidence in their robustness from which to draw accurate conclusions cannot be absolute, however they do provide as strong a relative guide as is available at this time. It is also important to note that the differentiation between juvenile Fry and Parr stages of Brown Trout and Sea Trout is, in practical terms, impossible. Where both Brown Trout and Sea Trout populate a watercourse, as is the case in the River Creed and Glen River, the assessment of 0+ and 1++ numbers of Trout is therefore undertaken on the assumption that the surveyed population is of a potentially mixed reproductive background.

Table 2.2: Categorisation Ranges for Juvenile Salmonids in the Outer Hebrides (per 100m^2) as Determined by the SFCC (2006).

Fish Density Quintile	Salmon 0+	Salmon 1++	Trout 0+	Trout 1++
Minimum (Very Low)	0.50	0.71	0.16	0.17
20th Percentile (Low)	2.86	2.37	1.74	1.00
40th Percentile (Moderate)	5.58	5.33	3.22	2.14
60th Percentile (High)	9.53	9.26	6.55	3.75
80th Percentile (Very High)	15.55	14.15	11.89	7.07

2.5 Conservation Status Assessment

The Conservation of Salmon (Scotland) Regulations 2016 outlined for the first time a system whereby the killing of Atlantic Salmon within inland waters is managed on an annual basis by categorising the conservation status of their stocks. In general terms, these Regulations achieve the following;

- Prohibit the retention of Salmon caught in coastal waters;
- Permit the killing of Salmon within those inland waters in which the stocks are identified as above a defined conservation limit (i.e. those designated as Category 1 or 2 status for the fishing season); and

- A requirement for mandatory catch and release of Salmon from within inland waters which fell below their defined conservation limit following the stock assessment (i.e. those rivers designated as Category 3 status for the fishing season).

The Scottish Government have recently completed an updated assessment of the conservation status of Salmon and have now made Regulations to set out detailed provisions to control the retention of Salmon for the 2018 fishing season. Under the Regulations, the conservation status of any given watercourse is defined by the probability of the stock meeting its conservation limit over a five year period. Based upon its stocks, a watercourse is then allocated one of the three grades that can be seen in Table 2.3 (below), with accompanying appropriate management actions.

Table 2.3: Conservation Status Categories (Conservation of Salmon (Amendment) Scotland Regulations (2018).

Category	Probability of Meeting Conservation Limit	Management Advice
1	At Least 80%	Exploitation is sustainable therefore no additional management action is currently required. This recognises the effectiveness of existing non-statutory local management interventions.
2	60-80%	Management action is necessary to reduce exploitation; mandatory catch and release will not be required in the first instance, but this will be reviewed annually.
3	<60%	Exploitation is unsustainable therefore management actions required to reduce exploitation for 1 year i.e. mandatory catch and release (all methods).

2.6 Angling Pressure and Catch Returns

According to the SAA, angling on the River Creed commences each spring on the 1st of April, with the season running through until the 15th of October annually. As is law in Scotland, fishing is permissible for six days each week, with no angling occurring on Sundays. Fishing rights on the Creed are managed by the SAA, who have a membership system for local residents of Harris and Lewis, and then offer additional fishing to visitors on a day ticket basis. During meetings with the OHFT and the SAA, it was stated that fishing pressure on the river varies annually and is primarily dependent on the conservation status of the Creed at that time. It is an established fact within Scottish angling that a large percentage of travelling recreational rod and line Salmon anglers prefer to target Category 1 Rivers, from which they are more likely to be able to take a fish home for personal consumption, as opposed to Category 2 and 3 Rivers, which will likely to be subject to strict conservation (catch and release) measures.

The annual catch returns for the River Creed are logged by the SAA, who hold records going back over several decades. Data relating to catches of Salmon and Sea Trout from the River Creed for the last five years has been made available for the purposes of this report, and is presented in Appendix B. No rod and line angling occurs on the Glen River.

3 BASELINE CONDITIONS

3.1 River Creed

3.1.1 Existing Information on Migratory Fish Populations

The River Creed (Abhainn Ghrìoda) is the primary watercourse within the area of potential impact from the proposed development. The Creed is known to support populations of both the Atlantic Salmon and Sea Trout, as well as European Eel (*Anguilla anguilla*). Electro-fishing data from the OHFT provides no evidence to suggest that there are any known populations of River Lamprey (*Lampetra fluviatilis*) or Sea Lamprey (*Petromyzon marinus*) within the river. General fisheries management of the River Creed falls under the care of the OHFT, with angling permits on the river issued by the SAA. Historic SAA records clearly illustrate that the majority of the Salmon, Grilse and Sea Trout that run into the Creed annually do so between the months of July and August, with then-resident fish being caught right up until the end of the season in October.

3.1.2 Fisheries Habitat

As is apparent from the electro-fishing results and the broad geographical spread of sites holding high numbers of juvenile salmonids within the system, the River Creed catchment is broadly characterised by good spawning gravels, suitable for use by both Salmon and Sea Trout. The availability of spawning substrate can certainly not be described as a limiting factor to all species of salmonids in the River Creed. As the system sits, the OHFT identify that the largest limiting factor to increased availability of spawning gravels within the Creed is the impassable weir downstream of Loch an Ois. This weir has an existing pool and drop style chamber fish pass engineered on to it, however errors were made during the engineering and construction of the fish pass which, as a result, have left the upstream edge of the pass too high to allow suitable water flow into it to ensure correct functionality, as can be seen in the photos below.

Figure 1: Impassable Weir (River Creed Catchment) at Loch an Ois (Upstream View)

Figure 2: Impassable Weir (River Creed Catchment) at Loch an Ois (Downstream View)

A second obstacle exists within the River Creed catchment, in the form of a partially impassable dam at the Hatchery Pool (SO405325). As can be seen in Figure 3, the dam is passable at regular flow rates and, although it is not known to dry up, it becomes more of an obstruction to upstream migration during low flow conditions. As with the dam below Loch an Ois, the potential for migratory salmonids to access additional spawning gravels would only be increased by easement or removal of these obstructions.

Figure 3: Weir (River Creed) at Hatchery Pool (Upstream View)

3.1.3 Existing Information on Juvenile Salmond Density

For the Stornoway Wind Farm Baseline Fisheries Assessment, a total of 11 sites were subject to electro-fishing survey on the River Creed between 30th June and 30th September 2010. The results of these surveys are shown in Table 3.1, classified accordingly as per the ranges detailed in Table 2.2. The locations of the sites are provided in Appendix C.

Table 3.1: Baseline Fisheries Report (2010) Electro-Fishing Survey Results (River Creed).

Catchment Name	Site NGR	Site Code	Juvenile Salmon Density (per 100m²)		Juvenile Trout Density (per 100m²)		Non-Salmonid Species Present
			0+	1++	0+	1++	
River Creed	140250 932480	CRE01	44.68 ± 2.53 (V.High)	24.68 ± 1.07 (V.High)	>0.20 (Low)	>0.39 (Low)	Eel, 3-Spine Stickleback
River Creed	138730 932260	CRE03	109.27 ± 15.91 (V.High)	16.27 ± 11.69 (V.High)	0	0	Eel, 3-Spine Stickleback
River Creed	136800 932135	CRE05	144.14 ± 6.26 (V.High)	25.17 ± 1.25 (V.High)	0	>0.60 (V.Low)	Eel
River Creed	136170 932170	CRE06	13.58 ± 1.14 (High)	10.56 ± 0.46 (High)	>5.60 (Mod)	4.10 ± 2.93 (High)	N/A
River Creed	135600 931250	CRE08	0	0	>0.69 (Low)	>2.75 (Mod)	Eel, 3-Spine Stickleback
River Creed	137560 931470	CRE09	28.80 ± 4.18 (V.High)	>4.20 (Low)	55.66 ± 3.30 (V.High)	15.06 ± 5.77 (V.High)	Eel, 3-Spine Stickleback
River Creed	137625 931140	CRE10	55.13 ± 11.15 (V.High)	7.20 ± 3.73 (Mod)	33.28 ± 6.99 (V.High)	3.64 ± 0.44 (Mod)	Eel, 3-Spine Stickleback
River Creed	136800 930900	CRE13	21.08 ± 0.43 (V.High)	5.75 ± 1.46 (Mod)	285.61 ± 3.73 (V.High)	4.69 ± 0.24 (High)	N/A
River Creed	137565 930805	CRE14	247.54 ± 9.4 (V.High)	8.70 ± 0.91 (Mod)	47.53 ± 13.06 (V.High)	>1.71 (Low)	Eel
River Creed	135450 930605	CRE16	>7.72 (Mod)	8.41 ± 2.56 (Mod)	22.97 ± 4.68 (V.High)	>0.77 (V.Low)	N/A
River Creed	137525 930220	CRE17	>0.76 (V.Low)	>0.76 (V.Low)	31.32 ± 2.19 (V.High)	4.58 ± 0.24 (V.High)	Eel, 3-Spine Stickleback

3.1.4 Interpretation of the 2010 Juvenile Salmonid Population Assessments

Of the 11 sites surveyed on the River Creed in 2010, a total of eight showed densities of juvenile 0+ Salmon (Fry), 1++ (Parr) or both categorised as either "High" or "Very High". Of the remaining three sites, one exhibited a density of both Fry and Parr categorized as "Moderate", one held densities of both Fry and Parr noted as "Very Low" and results from one final site (CRE08) showed a total absence of juvenile Salmon. Notes made

during the surveys however indicated that CRE08 had poor in-stream habitat for juvenile Salmonid development, being essentially a deep peat-lined ditch.

The results of the surveys in relation to the presence/absence of juvenile Trout were almost as positive, with seven of the 11 sites recording a rating of "High" or "Very High" for either 0+, 1++, or both. Of the remaining four sites, one (CRE08) exhibited a mixed density of 0+ (Low) and 1++ (Moderate), one (CRE01) exhibited a density categorisation of Low for both 0+ and 1++ Trout. Juvenile 0+ Trout were absent at CRE05, which also held a "Low" rating for 1++ fish, and at one final site (CRE03) both 0+ and 1++ Trout were noted as absent.

3-Spine Sticklebacks were also found in significant numbers at six sites during the course of the surveys.

3.1.5 European Eel (River Creed)

European Eel were found at a total of seven of the surveyed sites on the River Creed, being present in the most significant numbers at the closest survey site to the coast (CRE01), where counts reached a total of 147 individuals. Numbers at the other six sites varied between 1 and 11 individuals.

Comparatively little is known with regard to the reproductive cycle of the European Eel. It is however widely accepted that mature adult Eels migrate to the Sargasso Sea to reproduce, with the juvenile Elvers returning to mature within UK Rivers between the months of April and May annually. Unlike in some rivers of southern England, the Elvers of the River Creed are not commercially fished for, and there is no evidence of any targeted recreational angling for the species occurring.

3.2 Glen River

3.2.1 Existing Information on Migratory Fish Populations

The Glen River (Abhainn á Ghlinn Mhōir) is the second watercourse within the area of the proposed development that has the potential to be impacted upon from a fisheries perspective. The Glen River is known to support a population of Sea Trout, as well as European Eel. Electro-fishing data from the OHFT provides no evidence to suggest that there are any known populations of River Lamprey (*Lampetra fluviatilis*) or Sea Lamprey (*Petromyzon marinus*) within the river. General fisheries management of the Glen River falls under the care of the OHFT. No rod and line angling is permitted on the Glen River.

3.2.2 Fisheries Habitat

In 2011 the OHFT undertook a detailed Habitat Survey as part of the Glen River Catchment Action Plan, with the aim of detailing the current status of the instream and riparian habitat, and identifying any issues that may have been impacting on environmental quality. The survey found that the catchment held a variety of substrate types, with the lower reaches being dominated by gravels and pebbles, with boulder and bedrock becoming more prevalent further upstream. The survey also identified that good areas of spawning gravels, potentially suitable for use by both Salmon and Trout are present throughout the catchment. As with the River Creed, it is the ability of fish to be able to access these gravels that may be limited by various obstacles present throughout the catchment.

The 2011 Habitat Survey identified the presence of several pipes that crossed the Glen River, accumulating waste build-up during high water conditions and forming unnatural obstacles to fish passage. The report recommended that the functionality of these pipes be established and, where appropriate, steps be taken towards their possible removal. The site visit to the Glen River by Envirocentre, accompanied by a representative of the OHFT on 27th February 2018, confirmed that these pipes remained as they were in 2011

(see images in Figure 4, below), with functionality still not fully established, and no further action taken towards their removal.

Figure 4: Pipes (Left and Right Images) Across the lower Glen River

The report went further, identifying two locations within the catchment where the fence line had been taken across the Glen River, without the appropriate installation of a water gate. At time of writing, one of the fence lines has since been removed, however the other remains and does not permit the correct function of the river, accumulating debris and impeding fish passage.

The Glen River also has a higher propensity to accumulate natural debris than other Outer Hebridean rivers, as it flows directly through an area of woodland. This, historically, has led to formation of natural debris dams. Under the right circumstances, fallen trees and large woodland debris can be beneficial to the system, providing natural shelter and habitat to fish and invertebrates. In the wrong scenario however, these can also accumulate unnatural debris and impede fish passage.

There are two man made dams on the Glen River, one at the waterwheel within the grounds of Stornoway Castle, and an associated boulder dam immediately downstream of it. Both the waterwheel dam and the boulder dam have been modified in recent years, to ensure they do not impede fish passage either upstream or downstream. The second man made structure is a small croft dam below Loch Airigh na Lic, which has been identified as a potential obstruction to fish passage at certain flows. The 2011 report recommended the identification of the purpose of this dam and, if possible, its modification or removal. At time of writing, no change to this structure has been made by the OHFT.

3.2.3 Existing Information on Juvenile Salmond Density

For the Stornoway Wind Farm Baseline Fisheries Assessment, a total of three sites were subject to electro-fishing survey on the Glen River between 30th June and 30th September 2010. The results of these surveys are shown in Table 3.2, classified accordingly as per the ranges detailed in Table 2.2. The locations of the sites are provided in Appendix C.

Table 3.2: Baseline Fisheries Report (2010) Electro-Fishing Survey Results (Glen River).

Catchment Name	Site NGR	Site Code	Juvenile Salmon Density (per 100m²)		Juvenile Trout Density (per 100m²)		Non-Salmond Species Present
			0+	1++	0+	1++	
Glen River	139265 933925	GLE01	0	0	55.00 ± 11.4 (V.High)	9.14 ± 1.03 (V.High)	Eel, 3-Spine Stickleback
Glen River	136050 933805	GLE02	0	0	10.48 ± 5.05 (High)	>9.62 (V.High)	N/A
Glen River	140520 934305	GLE03	0	0	22.14 ± 3.22 (V.High)	6.20 ± 3.98 (High)	Eel, 3-Spine Stickleback

3.2.4 Interpretation of the 2010 Juvenile Salmonid Population Assessments

None of the three sites surveyed on the Glen River in 2010 exhibited any presence of juvenile Salmon 0+ Fry or 1++ Parr.

Juvenile Trout populations, in contrast to Salmon, were categorised as "Very High" or "High" across all three sites for both 0+ and 1++ Trout.

3-Spine Sticklebacks were also found at two of the three sites, GLE01 and GLE03.

3.2.5 European Eels

European Eel were found at two of the surveyed sites on the Glen River, being present at GLE01 (5 individuals) and GLE03 (6 individuals).

The Elvers of the River Creed are not commercially fished for, and there is no evidence of any targeted recreational angling for the species occurring.

3.3 Conservation Status Assessment

The River Creed has seen its conservation status fall from Category 1 in 2017 to Category 2 in 2018. Prior to the introduction of the initial Conservation of Salmon (Scotland) Regulations in 2016, the River Creed held a Category 1 conservation status. For the 2016 fishing season however, this was downgraded and the Creed became a Category 3 river. It is common for a downgraded water course to experience an accompanying reduction in fishing pressure, as many anglers will choose to concentrate their efforts on rivers maintaining Category 1 conservation status that as such, offer them the opportunity to retain a fish to eat, should they so wish. Reduced angling pressure brings with it an inevitable reduction in revenue generated from angling within the local economy. In 2016, the OHFT, who issue the angling permits to fish the River Creed, reported a 40% reduction in income generated from sales of permits for that year. The SAA currently enforce the following conservation policy upon its members and all those who fish the River Creed on a day ticket basis;

- Spring season (1st April – 31st May inclusive) – Strictly "catch and release" for all Salmon, Grilse and Sea Trout;

- Summer season (1st June – 15th September inclusive) – one Salmon or Grilse and two Sea Trout per angler/per day may be retained, with a maximum limit of three Salmon or Grilse per season/per angler; and
- Autumn season – (15th September – 15th October inclusive) - Strictly "catch and release" for all Salmon, Grilse and Sea Trout.

Having no population of migratory Salmon within it, the Glen River is not affected by the Regulations and as such, remains uncategorised. The Scottish Government however are currently giving further consideration to the potential assessment of Sea Trout stocks to inform a decision on whether similar conservation measures to those introduced for Salmon may be necessary in the future.

3.4 Angling Pressure and Catch Returns

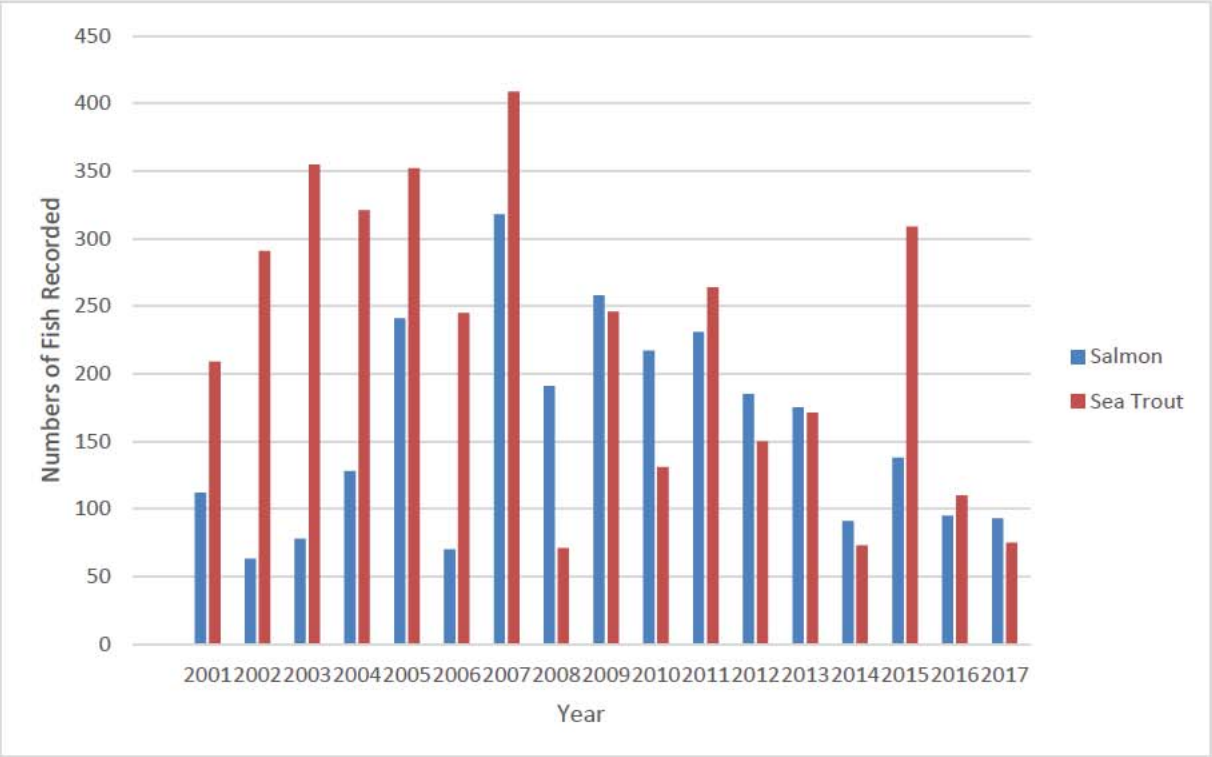
Angling catch return data from the OHFT shows conclusively that the majority of the Salmon caught on the River Creed annually are taken between the months of July and October. Due to the nature and timing of Salmon runs however, the vast majority of fresh Salmon will only migrate into the river during a smaller window of time within this period, with between July and Mid-August being the accepted normality. After this time, virtually all Salmon catches made within the River Creed system will be of fish that have been resident in the river for an extended period of time.

Likewise, it is a very similar situation for catches of Sea Trout on the River Creed. Data provided by the OHFT shows an almost identical timing of the catches of Sea Trout to those of Salmon and again, the vast majority of fish captured after late August will have been resident for a period of time as opposed to freshly migrating fish into the Creed system. Catch Return figures for both Salmon and Sea Trout from the OHFT for the period (2013 – 2017) are presented in Appendix B.

In terms of total numbers of fish caught annually, 2017 saw a total of 93 Salmon recorded as captured from the River Creed, with a further 75 Sea Trout being landed. These figures are substantially below the River Creed's average annual catch return for both species for the period from 2001 – 2016, which stand at 162 p/a for Salmon and 232 p/a for Sea Trout. Annual catch return figures for the River Creed for both Salmon and Sea Trout for the period from 2001 – 2017 are presented in Figure 5 below.

Due to the River Creed being designated Category 2 status for 2018, the expectation of the SAA is that this will result in a subsequent reduction in angling pressure, as was seen during the 2016 season when a Category 3 status led to a 40% reduction in day permits issued for the Creed in comparison to the previous year.

Figure 5: Catch Return Figures for Salmon and Sea Trout (River Creed) 2001 - 2017



APPENDICES

A SITE LOCATION PLAN

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

B CATCH RETURN FIGURES FOR SALMON AND SEA TROUT ON THE RIVER CREED (2013 – 2017)

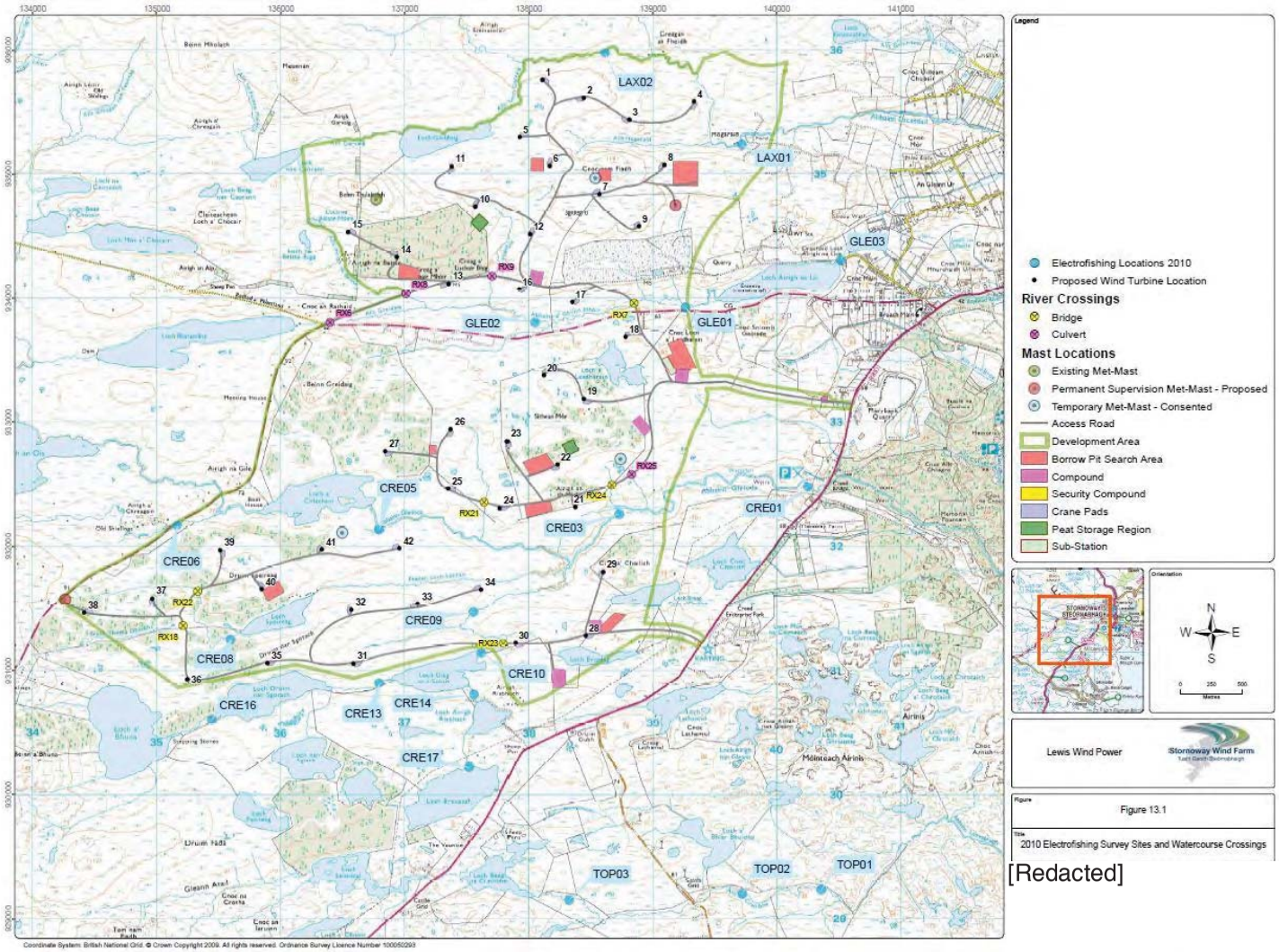
Salmon Catches (River Creed) 2013 – 2017.

Year	'13	'14	'15	'16	'17	Avg
Jan	0	0	0	0	0	0.0
Feb	0	0	0	0	0	0.0
Mar	0	0	0	0	0	0.0
Apr	1	0	0	0	0	0.2
May	0	0	1	1	0	0.4
Jun	0	0	3	1	2	1.2
Jul	2	12	45	45	9	22.6
Aug	84	49	58	22	30	48.6
Sep	53	8	21	20	17	23.8
Oct	35	22	10	6	35	21.6
Nov	0	0	0	0	0	0.0
Dec	0	0	0	0	0	0.0
Total	175	91	138	95	93	118.4

Sea Trout Catches (River Creed) 2013 – 2017.

Year	'13	'14	'15	'16	'17	Avg
Jan	0	0	0	0	0	0.0
Feb	0	0	0	0	0	0.0
Mar	0	0	0	0	0	0.0
Apr	1	4	4	3	0	2.4
May	0	0	8	2	0	2.0
Jun	4	3	2	3	0	2.4
Jul	17	8	54	39	13	26.2
Aug	87	39	138	20	34	63.6
Sep	43	16	69	31	4	32.6
Oct	19	3	34	12	24	18.4
Nov	0	0	0	0	0	0.0
Dec	0	0	0	0	0	0.0
Total	171	73	309	110	75	147.6

C LOCATIONS OF ELECTRO-FISHING SURVEY SITES FOR THE RIVER CREED AND GLEN RIVER



[Redacted]

Technical Appendix 6.1

TECHNICAL APPENDIX 6.1: CULTURAL HERITAGE BASELINE AND GAZETTEER

Archaeological and historical overview of the Inner Study Area

Previous investigations

The CneS HER does not record any previous archaeological investigations within the ISA, but there have been a number of marine surveys within Stornoway Bay. Both the HER and the Canmore database record details of dives by RAF Brize Norton Sub Aqua Club in 1976, undertaken in order to confirm the locations, condition and extent of a number of known wrecks within the bay. In 1964, the Ordnance Survey undertook a visit to inspect the site of the Cromwellian fort (MWE4313) and in 1997 a Historic Scotland-commissioned survey of coastal erosion on Lewis included the shoreline within the ISA (Burgess and Church, 1997). Stornoway has also been the subject of a Historic Burgh survey, commissioned by Historic Scotland and undertaken by the Centre for Scottish Urban History (Dennison and Coleman, 1997).

Stornoway's development can be traced on historical maps, extracts of some of which are included as Technical Appendix 6.2 in this Volume and reveal that the ISA was largely undeveloped until the building of the causeway in the 1940s.

Geology and geomorphology

According to BGS data, solid geology in the ISA comprises conglomerate of the Stornoway formation, it can be seen on the shoreline around Goat Island. Where it is not masked by development, the bedrock is largely exposed, and only partially covered with superficial deposits of peat-rich sandy topsoil.

Prehistoric evidence

There are no known Prehistoric remains in the ISA. In the OSA the earliest known remains are those of a probable Neolithic chambered cairn, Cnoc Na Croich (SM6550). The HER records three prehistoric artefacts discovered by chance within the OSA. A flint scraper was recovered with the grounds of Lews Castle and donated to the Stornoway museum (MWE140012) and a Neolithic stone axe (MWE4315) and mace head (MWE4332) are recorded as being in private hands and the care of the NMS respectively. Further afield, Neolithic axes have been recovered from peat bogs at Newmarket to the north of Stornoway. These are of a type likely to have been used in the widespread clearance of woodland to create fields and pasture. This tree clearance, allied with a change to a cooler and wetter climate around 1500 BCE, eventually resulted in the formation of the peat deposits which characteristic much of Lewis. This peat build-up has buried almost all surviving traces of any Neolithic settlements and field systems that may exist around Stornoway. There is also very little evidence for Bronze Age settlement on Lewis, but funerary monuments in the form of barrows and cairns are evident as mounds beneath the peat, and on hilltops (e.g. Cnoc na Croich) and give some indication of the extent of the prehistoric population of Lewis.

The peat eventually began to encroach on farmland and fields, gradually forcing populations towards the lower-lying and coastal areas of the island where a number of Iron Age settlements have survived. The closest known Iron Age activity to the ISA is south, across Stornoway Bay on Loch Arnish; Loch Arnish Dun (SM5397) is the remains of an apparently artificial island or crannog. The site is probably of Iron Age date. However, in the Outer Hebrides there is a tradition of crannogs being used throughout the medieval period and even into the post-medieval period (Armit 1996, 218).

Medieval to Post Medieval

There are no Medieval assets in the ISA, but the shelter offered by the various coves and bays in the OSA was known to the Vikings, who were an intermittent presence in the Western Isles from at least the eighth century and establishing settlements from the mid-ninth century. The name 'Stornoway' derives from the Norse 'Stjornavagr', meaning 'Steering Bay', and indicates the bay's importance as a safe haven on Scotland's west coast. There are few surviving features from this period in and around the OSA; the medieval St Columba's church at Aughinish (5.5km to the east) is likely to have been built on the site of an early medieval (sixth/seventh century) foundation. Lewis and the Western Isles remained under Viking control and influence until the mid-thirteenth century, when they were ceded to the King of Scots.

There are also no known medieval settlement sites on Lewis, although some duns, brochs and crannogs may have been occupied into this period. Towards the end of Viking control in the twelfth century, a castle was established by the clan

MacLeod on a rocky outcrop south of what is now the junction of Quay Street and South Beach. The site of the castle was incorporated into harbour improvements in the late nineteenth century, and no upstanding remains survive. The 'castle' is depicted on seventeenth century maps of the OSA (Technical Appendix 6.2a) and its ruins on nineteenth-century maps (Technical Appendix 6.2c)

By 1607, Stornoway's importance as a commercial port was recognised as it was created a Burgh of Barony, and in 1610 James VI granted Lewis to the Earls of Seaforth, followed by the granting of Royal Burgh status in 1628. The Seaforths' loyalty to the Stuart crown resulted in the arrival of Cromwell's army on Lewis in 1653. A small garrison built and manned a fort on Goat Island to monitor the harbour approaches, and a second larger fort (of which no trace survives) was built somewhere on the narrow neck of land between what is now South Beach and Cromwell Street.

The earls' investment, and the new burgh status, allowed Stornoway to develop into a prosperous fishing port, and by the early nineteenth century a thriving town had developed along the shore (Technical Appendix 6.2b and 6.2d).

Modern

In 1844 Lewis was bought by the Matheson family, and another round of investments and development began. The harbour was expanded and improved with the addition of a number of new piers and associated buildings. Stornoway became a vital port to the herring industry, and the town continued to grow.

The Admiralty chart of 1846 shows the gradual development of houses along the shoreline east of the ISA, but Goat Island is still depicted as undeveloped save for a 'stone' on its northern tip (Technical Appendix 6.2e). The 1852 and 1895 OS maps depict further development on the coast, and indicate this stone is a survey point, or a navigation marker (Technical Appendix 6.2f and 6.2g).

German aerial photography (Technical Appendix 6.2h) from 1940 shows Goat Island still undeveloped but by 1958, it has been connected to the shore by a causeway, and some small buildings and a jetty have been built (Technical Appendix 6.2i). The causeway was built as part of the harbour extension works undertaken in 1947-51, which also upgraded and extended the wharves along South Beach. Since the causeway was built a variety of boatyard sheds and light industrial buildings have been constructed on Goat Island.

Maritime

As a long-established fishing town, as well as the main transport and freight port for Lewis, Stornoway harbour has been a busy shipping port for hundreds of years. The CneS HER and Canmore database record almost 40 known wrecks within the OSA, most of these are of named vessels which sank in the nineteenth and twentieth centuries. Most of the wrecks are along the northern edge of Stornoway Bay, and immediately west of the ISA, where a number of reefs and rocks ensure a hazardous entrance to the harbour.

Gazetteer of Heritage Assets within the ISA

Ref.	Name/Location	Description/Date	Easting	Northing
MWE4313	Site of fort, Eilean Na Gothail, Lewis	The site of a seventeenth century fort built in 1653 by Cromwellian troops to protect the entrance to Stornoway harbour. In 1919 traces of semi-circular stone-built foundations were visible on the north and south-eastern edges of the island, but by 1964 all upstanding traces had gone. The island has been heavily developed since the 1947 building of a causeway linking it to the shore, and no archaeological remains are visible anywhere on the island.	142600	932100
W1	City of Waterford (ex. River Lagan), Eilean Na Gothail, North Minch	An iron steamship (formerly the River Lagan) taking herring to Hamburg, stranded on Skerryvore (on the south-east point of Eilean Na Gobhail), 2nd February 1927.	142600	932100

Ref.	Name/Location	Description/Date	Easting	Northing
W2	Unknown, North Minch	An un-named wreck, first detected in 1929, but not seen in subsequent surveys	142641	932169
W3	Unknown, North Minch	An un-named wreck, not seen in 1975 survey of harbour	142560	932170
W4	Unknown, North Minch	An un-named wreck, not seen in 1975 survey of harbour	142640	932170

REFERENCES

Bibliographic references

Armit, I, 1996, *The Archaeology of Skye and the Western Isles*

Bagshaw, S and Associates, 2005 *Conservation Area Character Appraisal Document for Stornoway Townscape Heritage Initiative*

Burgess, C. and Church, M. 1997, *Coastal Erosion Assessment: Lewis – A Report for Historic Scotland*

Dennison, EP and Coleman, R 1997 *Historic Stornoway: the archaeological implications of development*

Macdonald, D, 1990. *Lewis: A History of the Island*

RPS Consulting Engineers, 2018 *Newton Basin Stornoway Marina Development Hydraulic Modelling Report* (unpublished client report)

Online Sources

http://www.clydeships.co.uk/view.php?ref=5697

http://www.scapetrust.org/html/czas.html

https://ncap.org.uk/

Historic maps

Blaeu, J, 1662 *Harris and Lewis*

Chapman, J and Johnson, W, 1807 *Plan of the island of Lewis reduced from Mr Chapman's survey*

Wood J, 1821, *Plan of the Town and harbour of Stornoway, Island of Lewis, from actual survey*

Thomson, J, 1822 *Western Isles*

Hydrographic Office of the Admiralty, 1846, *Stornoway Harbour*

Ordnance Survey, 1851, *Ross-shire (Island of Lewis), Sheet 27*, 6-inch

Ordnance Survey, 1895, *Ross-shire (Island of Lewis), Sheet 27*, 6-inch

Ordnance Survey, 1958, *Ross and Cromarty Isle of Lewis, Sheet 27*, 6-inch

Technical Appendix 6.2

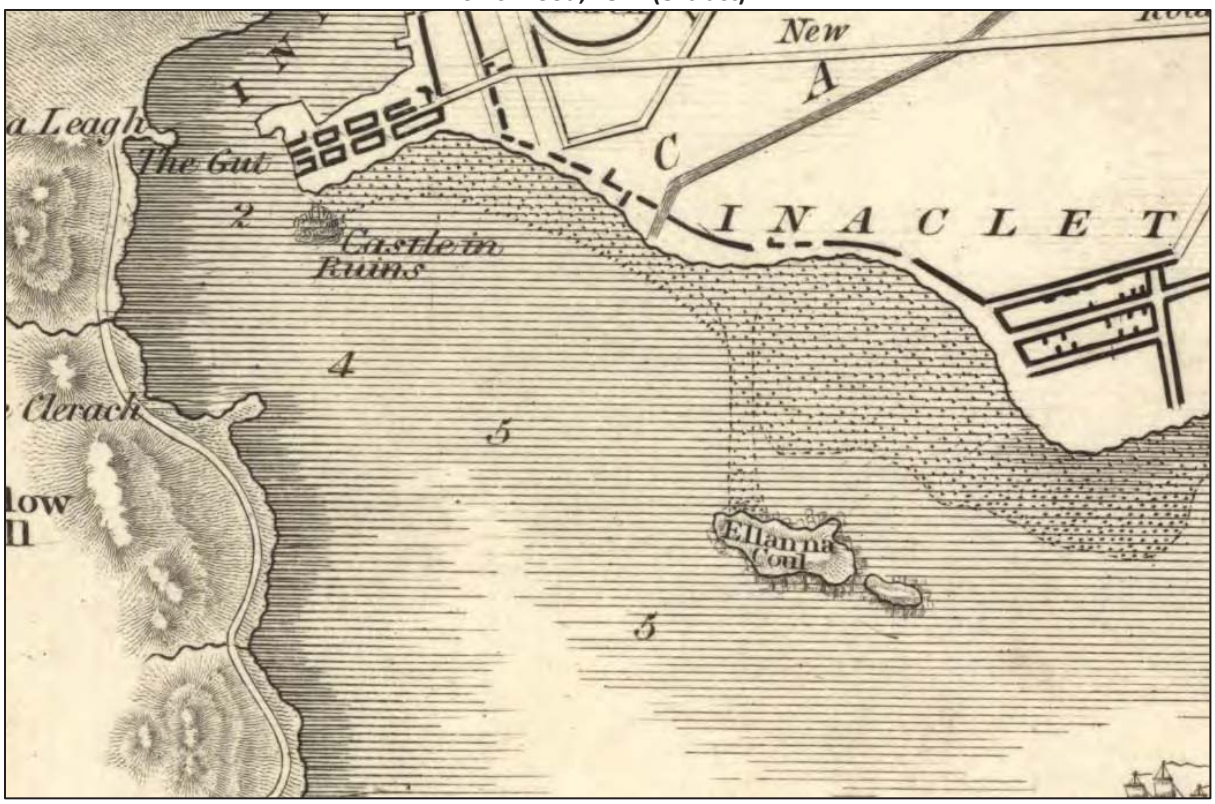
TECHNICAL APPENDIX 6.2

Historical Maps and Images of the Inner Study Area

6.2a Joan Blaeu, 1662 (extract)

6.2b Chapman & Johnson, 1807 (extract)

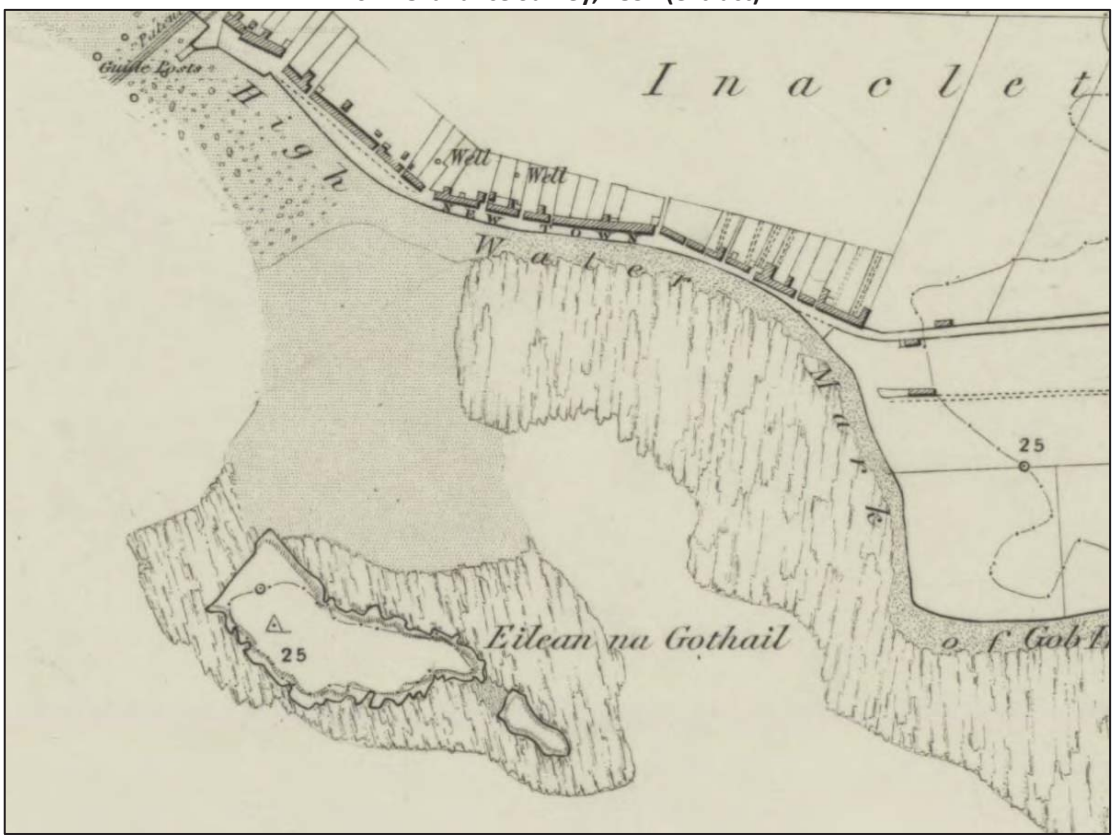
6.2c Wood, 1821 (extract)



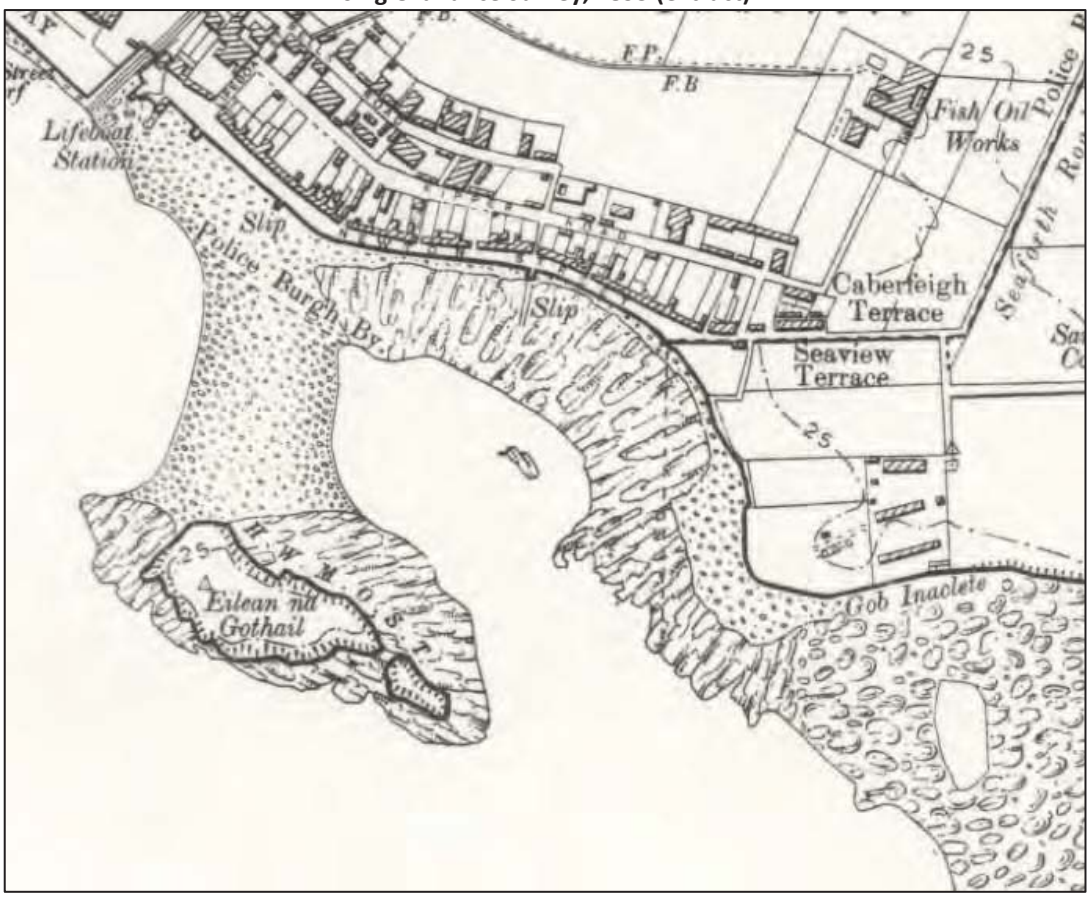
6.2d Thomson, 1822 (extract)

6.2e Admiralty Chart, 1846 (extract)

6.2f Ordnance Survey, 1851 (extract)

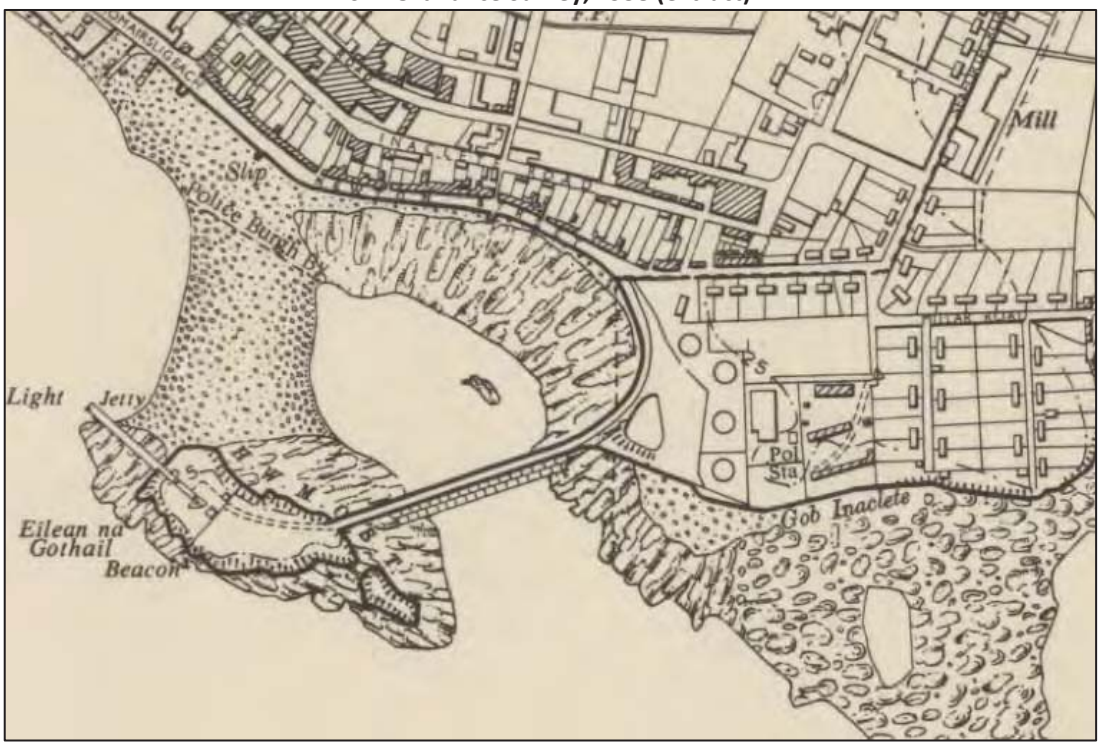


6.2g Ordnance Survey, 1895 (extract)

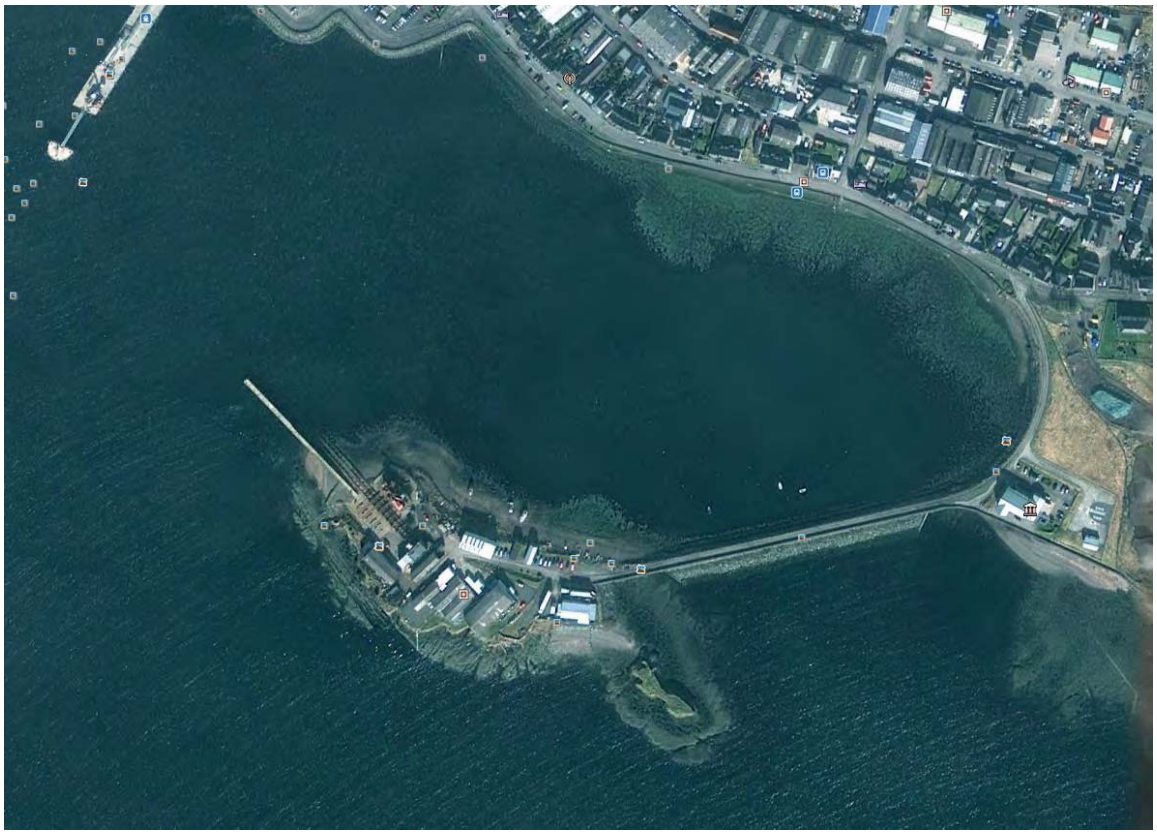


6.2h Luftwaffe Sortie, 3/11/1940, Frame SC449541 (extract)

6.2i Ordnance Survey, 1958 (extract)



Newton Marina
Technical Appendix 7.1: Noise Assessment



July 2018

Newton Marina
Technical Appendix 7.1: Noise Assessment

Client:	Stornoway Port Authority
Document number:	8173
Project number:	670526
Status:	Final
Author:	[Redacte
Reviewer:	[Redacted
Date of issue:	9 July 2018
Filename:	670526 Newton Marina, Technical Appendix 7.1, Noise Assessment

Glasgow

Craighall Business Park
8 Eagle Street
Glasgow
G4 9XA
0141 341 5040
info@envirocentre.co.uk
www.envirocentre.co.uk

Aberdeen

Banchory Business Centre
Burn O'Bennie Road
Banchory
AB31 5ZU
01330 826 596

Inverness

Alder House
Cradlehall Business Park
Inverness
IV2 5GH
01463 794 212

Edinburgh

Suite 114
Gyleview House
3 Redheughs Rigg
Edinburgh
EH12 9DQ
0131 516 9530

Contents

Appendices

Tables

1 INTRODUCTION

1.1 Remit

EnviroCentre Ltd have been appointed by Stornoway Port Authority to undertake a noise assessment at the site of a proposed development at Newton Marina, Stornoway (see Drawing No. 670526-005) for site location.

This report presents the results of the noise assessment for the proposed development. The noise assessment will consider the construction noise impacts at existing sensitive receptors surrounding the Site.

1.2 Site Description and Proposed Development

The proposed development consists of a new marina and supporting facilities at Newton Bay, with additional redevelopment of Goat Island. The works at the marina are proposed to include;

- Breakwater and 72 berth marina;
- Slipway and yacht lift;
- Land based boat storage; and
- Parking area.

The redevelopment of Goat Island is proposed to include;

- Enhanced ship repair/painting facilities, provisions for yacht repairs; and
- Improvement of fish processing facilities.

1.3 Potential Impacts

1.3.1 Construction Noise

Due to the proximity of the site to existing residential properties within Stornoway there is the potential for noise from activities carried out during the construction phase of the development to impact upon existing residents.

1.3.2 Operational Noise

During the operational phase, yacht movements within the marina, mooring activities, and use of the marina facilities are not anticipated to generate significant levels of noise at the location of the closest noise sensitive receptors on Newton Street, located to the north of the Site.

Current noise generating activities in the proposed development site include boat servicing/repair activities and fish processing works on Goat Island. Proposals to build new fish processing facilities, and upgrade boat servicing/repair facilities could lead to a change in the noise environment at the closest sensitive receptors. However, the nature of activities will not change and the proposed enhancements are not considered to be large in scale. It is therefore anticipated there will be no significant increase in noise levels at the most exposed sensitive receptors as a result of the enhancements.

In view of this, operational noise has been scoped out of the noise assessment and shall not be considered further within this report.

1.4 Consultation

A summary of the relevant responses to the Scoping Report submitted by EnviroCentre for the Site, along with further email consultation carried out with Comhairle nan Eilean Siar's (CnES) Environmental Health Department is shown in Table 1-1.

Table 1-1: Summary of Consultation Responses

Organisation	Consultation Response	How and where addressed
CnES EHO	Within the Scoping Opinion dated 03/11/2017, Environmental Health Department has confirmed there are nearby receptors which will be affected during the construction phase. It is agreed that construction noise impacts should be addressed within the EIA. It was agreed that impacts from operational noise can be scoped out of the EIA.	Construction noise is scoped in and operational noise is scoped out of the EIA.
	Within the Scoping Opinion dated 03/11/2017, details of the proposed phasing of other port masterplan projects should be included in the EIA. This will inform the extent to which cumulative assessment with other projects is required to be addressed within any particular EIA report.	The noise assessment considers cumulative impact from the Deep Water Port (DWP) development, and is addressed within Section 6 of this noise assessment.
	CnES Environmental Health Department issued a consultation response on 29th January 2018 based on an initial request by EnviroCentre on 25 January 2018 to establish the methodology for noise assessment. This included baseline monitoring, construction noise assessment methodology / noise criteria. CnES Environmental Health Department confirmed within their email of 25th January 2018 that this approach was acceptable and therefore the methodology, as fully explained in section 7.4 was taken forward.	The methodology and noise criteria proposed by EnviroCentre was accepted by CnES Environmental Health Department and is fully explained within Section 2 of this noise assessment.

As part of the end use at Newton Marina there is a proposed large boatyard repair building/workshop. Planning permission for this part of the development is not being applied for at this stage, however, the noise assessment considers the construction noise impacts from the boatyard building to provide a worst case scenario for the current indicative end use. The assessment contained within this chapter should not be taken as a substitute for assessing the full development design at a later stage.

2 NOISE ASSESSMENT METHODOLOGY

The noise assessment was undertaken to establish the impact of construction activities on noise sensitive receptors surrounding the Site. The assessment involved the following stages;

- Consultation with CnES Environmental Health Department to agree assessment methodology and noise criteria (refer to Section 7.2);
- Measurement of existing baseline noise environment at a sample of 3 areas representative of the most exposed noise sensitive receptors surrounding the DWP and Newton Marina site; the location of the monitoring locations are shown in Drawing No. 670526-024, Appendix A.
- Review of construction activities, locations and noise data;
- Calculation and assessment of construction noise at the most exposed sensitive receptors, following guidance provided in BS5228-1:2009+A1:2-014; Code of Practice for Noise and Vibration on Construction and Open Sites. 3D computer noise modelling using CadnaA software has been used in the calculation of construction noise at sensitive receptors.

2.1 Noise Guidance

2.1.1 BS5228-1:2009+A1:2014; Code of Practice for Noise and Vibration Control on Construction and Open Sites.

Methods for calculating noise produced by construction and open sites are provided in BS5228-1:2009+A1:2014. Annexes C and D of Part 1 provide generic source data for different types of noise source, as well as methods for calculating noise from stationary and mobile plant. Specific advice on noise from sources such as piling is provided.

2.1.2 PAN 1/2011 Planning and Noise

Advice on the role of the planning system in helping to prevent and limit the adverse effects of noise is provided in *Planning Advice Note (PAN) 1/2011 'Planning and Noise'* (The Scottish Government, 2011a). The associated *Technical Advice Note (TAN) 1/2011 'Assessment of Noise*' (The Scottish Government, 2011b) provides guidance on noise impact assessment methods.

The methodology provided in Technical Advice Note (TAN) 1/2011 *'Assessment of Noise'* (The Scottish Government, 2011b) is used to assess the impact of noise on residential properties.

2.2 Noise Assessment Criteria

2.2.1 BS5228-1:2009+A1: 2014 – Methodology (ABC Method)

The assessment of construction noise is carried out in accordance with guidance provided in BS 5228-1:2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise'. The standard describes methods for evaluating the potential significant effects of construction noise, one of which is the 'ABC' method which is based on exceedance of fixed noise limits. The ABC method, as detailed within Annex E.3.2 has been used within this noise assessment.

The ABC method considers that a potential significant effect occurs when the total noise level at a dwelling, including construction activity, exceeds the appropriate category values shown in Table 2-1. The table is used as follows;

- The ambient noise is determined and rounded to the nearest 5dB;
- The rounded ambient noise level is then compared with the total noise level, including construction. A significant effect at a noise sensitive receptor is considered to occur when the total noise, including construction activity exceeds the appropriate category values, shown in Table 2-1.
- The ABC method of BS5228-1:2009+A1:2014 does not provide specific guidance on determining the magnitude and significance of noise impacts above the threshold values shown in Table 2-1. In order to determine the level of significance, guidance provided in the Technical Advice Note (TAN) 1/2011 has been used. The significance criteria adopted within this noise assessment are shown in Table 2-2.

Table 2-1: Threshold of Significant Effect at Dwellings

Period	Threshold Value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 to 07:00)	45	50	55
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise. Note 3: Applied to residential receptors only.			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Table 2-2: Significance Criteria for the Assessment of Construction Noise

Significance	Level Above Threshold Value dB(A)	Definition
Neutral	< 0	No effect, not significant, noise need not be considered as a determining factor in the decision making process.
Slight adverse	≤ 0 to < 3	These effects may be raised but are unlikely to be of importance in the decision making process.
Moderate adverse	≤ 3 to < 5	These effects, if adverse, while important, are not likely to be key decision making issues.
Large adverse	≤ 5.0 to < 10	The effects are likely to be important considerations but where mitigation may be effectively employed such that

Significance	Level Above Threshold Value dB(A)	Definition
		resultant adverse effects are likely to have a moderate or slight significance.
Very large adverse	≥ 10	These effects represent key factors in the decision making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.

2.3 Noise Definitions

The following definitions relating to noise are used in this report:-

$L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level. This is the single number that represents the average sound energy over that time period. It is the sound level of a notionally steady sound that has the same energy as a sound that fluctuates over a specified measurement period.

$L_{A90,T}$: The noise level exceeded for 90% of the measurement period.

$L_{A10,T}$: The noise level exceeded for 10% of the measurement period.

$L_{AF,max}$: The A-weighted maximum sound pressure level over the measurement period. The measurement is taken using the fast time weighting of the sound level meter.

Free-field: As sound propagates from the source it may do so freely, or it may be obstructed in some way by a wall, a fence, building, earth bund, etc. The former is known as free-field propagation.

Ambient Sound Level, L_a: As defined in BS4142:2014; equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.

Façade Effect: When sound is reflected back towards its source, off a surface, such a wall, the reflected and incident sound waves interfere constructively, causing what is known as façade effect, or pressure doubling. This increases the noise, compared to that which exists in free-field, by approximately 2.5 dB(A).

Octave: A range of frequencies whose upper frequency limit is twice that of its lower frequency limit.

Octave Band: Sound pressure level is often measured in octave bands, the centre frequencies of the bands are defined by ISO – 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz to divide the audio spectrum into 10 equal parts. The sound pressure level of sound that has been passed through an octave band pass filter is termed the octave band sound pressure level.

3 BASELINE NOISE MONITORING

A noise survey was carried out in the area surrounding the proposed development site during the day and night-time periods on Tuesday 27th and Wednesday 28th February 2018. The purpose of the survey was to establish day and night-time background noise levels at areas representative of the most exposed properties on Newton Street, South Beach and Builnacraig Street. The noise monitoring locations and methodology were agreed with CnES Environmental Health department through consultation.

3.1 Noise Monitoring Locations

The noise monitoring locations are described in Table 3-1, and shown in Drawing No. 67052-024, Appendix A.

Table 3-1: Noise Monitoring Locations

No.	Grid Reference	Location
01	E 142138 N 932703	On pavement adjacent to entrance of Stornoway Harbour car park.
02	E 142717 N 932460	On grassy area across the road from houses on Newton Street.
03	E 143300 N 932135	At southern end of Builnacraig Street, on pavement.

3.2 Noise Monitoring Details

A fully calibrated Type 1 sound level meter was used to undertake all the noise monitoring events as detailed in Table 3-2. The sound level meter was calibrated both before and after measurements were taken and no significant drift was noted.

Table 3-2: Investigative Equipment Utilised and Technical Details

Monitoring Periods:	05:17hrs – 07:00hrs on 27/02/2018; 12:04hrs – 17:42hrs on 27/02/2018; 23:12hrs – 01:04hrs on 27/02/2018 to 28/02/2018; and 10:19hrs – 14:40hrs on 28/02/2018.
Time Intervals:	Daytime = 1 x 1hr intervals at each of the three noise monitoring locations, repeated over two separate days. Night time = 1 x 30 minute intervals at each of the three noise monitoring locations, repeated over two separate days.
Instrument:	Norsonic 140 sound analyser
Calibration:	At the start and finish of each monitoring event calibration was completed using a Norsonic NOR-1251 Sound Calibrator
Measurement Settings:	Environmental logging mode: A-weighted sound pressure level with time weighting F
Measurement Positions:	Measurements were taken between 1.2m and 1.5m above the ground.

The weather conditions during the monitoring events were recorded and are summarised in Table 3-3.

Table 3-3: Monitoring Periods and Weather Conditions

Monitoring period/ event	Date	Weather Conditions
Weekday Early Morning	27/02/ 2018	Between 0-1°C, dry, light cloud, wind speeds < 3.5 m/s.

Monitoring period/ event	Date	Weather Conditions
Weekday Day	27/02/2018	Between 4 and 7°C, partly cloudy, wind speeds between 3.5 and 8 m/s, gusting at 9 m/s.
Weekday Night	27/02/2018 & 28/02/2018	Between 1 and 2°C, mostly dry, intermittent snow shower, moderate cloud. Wind speeds between 4 and 6 m/s.
Weekday Day	28/02/2018	Between -0.5 and 2.5°C, mostly dry, 5 mins of light hail, moderate cloud. Wind speeds between 3 and 10 m/s.

3.3 Observations

Notes of noise sources characterising the background noise environment at each of the monitoring locations for the monitoring periods were recorded and are summarised below in order of dominance (greatest first).

Position No. 1

Daytime noise sources for each of the monitoring periods included;

27/02/2018;

- Cars entering and exiting the car park at Stornoway Harbour;
- Power washer within Stornoway Harbour (intermittent for 15 to 20 mins);
- General harbour noise such as vehicle movements/reversing beeps; and
- Road traffic within the surrounding area.

28/02/2018;

- Gulls cawing;
- Mid frequency whine from the port;
- Cars entering and exiting the car park at Stornoway Harbour;
- Road traffic within the surrounding area; and
- Cans rattling along the ground within carpark (intermittent).

Early morning / night-time noise sources included.

27/02/2018; Early Morning

- Tug boats passing within Stornoway Harbour;
- Road traffic within the surrounding area;
- Gulls cawing; and
- Port loading/unloading activity within Stornoway Harbour.

27/02/2018; Night-time

- Cars entering and exiting the car park at Stornoway Harbour;
- Wave noise on shore;
- Trawlers/ boats passing along within Stornoway Harbour; and
- People talking in car park.

Position No. 2

Daytime noise sources included;

27/02/2018;

- Road traffic on Newton Street;

- Frequent indistinct industrial activity on platform located within the bay between the measurement position and Goat Island;
- Low frequency drone from direction of Builnacraig Street; and
- Intermittent sawing/cutting/grinding noise on Goat Island.

28/02/2018;

- Road traffic on Newton Street;
- Frequent indistinct industrial works on goat island; and
- Infrequent indistinct industrial activity on platform located within the bay between the measurement position and Goat Island;

Early morning / night time-noise sources included.

27/02/2018; Early Morning

- Generator / intermittent indistinct industrial activity on Goat Island;
- Infrequent road traffic on Newton Street;
- Tug boats in Stornoway Harbour; and
- Road traffic within ferry area of Stornoway Harbour.

27 & 28/02/2018; Night-time

- Generator / intermittent indistinct industrial activity on Goat Island;
- Waves on shore; and
- Infrequent road traffic on Newton Street.

Position No. 3

Daytime noise sources included;

27/02/2018;

- Low frequency drone from power plant to the west;
- Waves on shore; and
- Birds chirping.

28/02/2018;

- Waves on shore;
- Low frequency drone from power plant to the west;
- Gulls cawing; and
- Infrequent distant air traffic.

Early morning / night-time noise sources included;

27/02/2018; Early Morning

- Distant road traffic; and
- Gulls and crows cawing.

27/02/2018; Night-time

- Low/mid frequency drone from the east;
- Gulls and crows cawing; and
- Waves on shore.

3.4 Results

A summary of the noise monitoring results can be found in Table 3-4Table 3-4 and Table 3-5.

Table 3-4: Noise Monitoring Results

Date	Period	Noise Monitoring Location	Start time/ Duration (hrs:mins)	L_{Aeq} (dB_A)	L_{AFmax} (dB_A)	L_{A90} (dB_A)
27/02/2018	Early Morning	01	05:17 / 00:30	48.1	64.6	36.3
		02	05:55 / 00:30	52.0	73.2	41.6
		03	06:30 / 00:30	39.2	65.3	32.5
27/02/2018	Daytime	01	12:04 / 01:00	57.7	72.1	51.3
		02	15:33 / 01:00	60.3	84.0	48.0
		03	16:42 / 01:00	50.3	67.5	47.2
27/02/2018	Night-time	01	23:12 / 00:30	50.0	69.1	35.6
		02	23:54 / 00:30	43.2	63.9	37.5
28/02/2018		03	00:34 / 00:30	36.2	61.6	30.9
28/02/2018	Daytime	01	10:19 / 01:00	55.4	78.8	49.5
		02	12:30 / 01:00	60	84.4	49.3
		03	13:40 / 01:00	49.9	73.9	44.8

Table 3-5: Octave Band Noise Monitoring Results

Period	Start Time (hrs:mins)	Noise Monitoring Location	Octave Band Centre Frequency (Hz)									A
			31.5	63	125	250	500	1000	2000	4000	8000	
27/02/2018												
Early Morning	05:17	01	69.9	63.3	61.0	47.3	43.8	41.0	35.2	28.7	15.2	48.1
	05:55	02	62.3	58.1	57.5	48.6	46.6	48.8	44.1	36.5	27.1	52.0
	06:30	03	51.0	45.4	38.2	31.3	33.0	36.1	32.5	25.8	17.3	39.2
Daytime	12:04	01	75.5	74.0	62.6	55.3	52.5	52.5	50.0	47.1	43.0	57.7
	15:33	02	69.0	69.9	65.9	61.6	55.8	55.4	52.0	46.2	40.8	60.3
	16:42	03	77.7	65.9	58.3	43.2	43.0	45.5	41.8	36.9	31.5	50.3
Night-time	23:12	01	65.4	61.2	56.7	49.1	45.7	45.5	41.4	35.0	30.4	50.0
	23:54	02	66.5	59.1	48.4	43.9	38.6	38.8	31.9	26.5	22.9	43.2

Period	Start Time (hrs:mins)	Noise Monitoring Location	Octave Band Centre Frequency (Hz)									A
			31.5	63	125	250	500	1000	2000	4000	8000	
28/02/2018												
Night-time	00:34	03	63.6	54.4	42.9	38.1	32.7	28.8	26.2	19.1	16.8	36.2
Daytime	10:19	01	76.7	70.3	61.3	54.6	51.8	50.7	46.0	40.3	37.7	55.4
	12:30	02	80.2	74.4	65.1	58.3	55.0	55.5	52.0	45.0	41.5	60.0
	13:40	03	76.5	71.2	60.9	49.6	43.7	41.9	38.2	32.2	29.1	49.9

4 NOISE MODEL INPUT PARAMETERS

4.1 Noise Sensitive Receptors

A sample of 6 noise sensitive receptors have been chosen as being representative of those most exposed to noise from construction activities at the proposed Newton Marina. These are described in Table 4-1, and shown in Drawing No. 670526-020, Appendix A.

Table 4-1: Noise Sensitive Receptor Locations

NSR ID	Location	Grid Reference
1	South Beach	142170 / 932730
2	Newton Street	142638 / 932548
3		142805 / 932437
4		142948 / 932393
5	Seaview Terrace	143096 / 932312
6	Builnacriag Street	143275 / 932138

4.2 Construction Schedule and Modelled Scenarios

Details of the proposed construction schedule at the Site have been supplied by Wallace Stone. A summary of the proposed construction schedule is shown in Table 4-2.

Table 4-2: Newton Marina, Proposed Construction Schedule

Ref	Construction Stage	Start Month	Finish Month
1	Reinforced concrete retaining wall and foundations	1	3
2	Rock infill retention bunds	1	3
3	Dredging (Cutter Suction and Backhoe Options)	4	7
4	Reclamation	4	9
5	Breakwater rock core	7	8
6	Rock armouring	8	10
7	Access ramp	8	9
8	Pontoon Piling	9	11
9	New slipway	9	11
10	Dock structure (boat lift support structure)	12	13
11	Drainage and sewage pump	10	11
12	Pontoons	12	13
13	Surfacing	12	13
14	Services to pontoons	14	14
15	Installation of replacement small boatsheds (2 No.)	13	14
16	Construction of new boat workshop	14	24

As can be seen in Table 4-2, in many cases more than one type of construction activity will to occur during the same months. Noise modelling scenarios have been set up to account for the cumulative impact of the concurrent activities. The scenarios have been set up to model the worst-case potential combination of construction activities for each set of months considered. It has been assumed that the construction activities will commence at the start and finish at the end of each considered month. A summary of the months,

associated combined construction stages and relevant assessment periods for each of the modelled scenarios is shown in Table 4-3.

Table 4-3: Modelled Scenarios

Modelled Scenario	Months	Modelled Combination of Construction Stages (Worst Case)	Relevant Assessment Periods
1	1, 2 & 3	Reinforced concrete retaining wall and foundations	Day, Evening, Night
		Rock infill retention bunds	
2A	4, 5, 6 & 7	Dredging (Cutter Suction option)	Day, Evening, Night
		Reclamation	
2B	4, 5, 6 & 7	Dredging (Backhoe option)	Day, Evening
		Reclamation	
3	8	Reclamation	Day
		Breakwater rock core	
		Rock armouring	
		Access Ramp	
4	9	Reclamation	Day, Night
		Rock armouring	
		Access Ramp	
		Piling	
		New Slipway	
5	10 & 11	Rock armouring	Day, Night
		Piling	
		New Slipway	
		Drainage and sewage pumps	
6	12 & 13	Dock structure	Day, Evening
		Pontoons	
		Surfacing	
		Services to Pontoon	
7	14 & 15	Services to Pontoon	Day, Evening
		Installation of Replacement Small Boatsheds	
		Construction of New Boat Workshop	
8	15	Construction of New Boat Workshop	Day

4.2.1 Night-time Construction Noise

Potential construction activities that may be carried out at night are construction of the reinforced concrete retaining wall and foundations (tidally dependant; months 1 to 3), cutter suction dredging (months 4 to 7), and construction of the new slipway (tidally dependant; months 9 to 11).

4.2.2 Piling

Piling shall be carried out during daytime hours only at Newton Marina as part of the construction of the pontoons (Ref 8, Table 4-2), the dock structure that will serve the boat uplift (Ref 10, Table 4-2), and potentially to construct the foundations for the new boat workshop (Ref 16, Table 4-2).

To construct the pontoon support structure, it is intended to use Overburden Drilling Excentric (Odex) piling equipment mounted on an excavator. This method is used to drill through, and flush out unwanted material such as rock, before placing a steel casing into the drilled space. As a worst case scenario for any one day,

Odex piling equipment is estimated to operate for around 50% of the working hours, with additional time between piling to move equipment and position piles. The noise modelling of piling carried out at the proposed development contains this assumption.

To construct the dock support structure, it is intended to use a combination of vibratory and impact piling. The majority of the pile driving will be carried out by vibratory hammer, with an impact hammer being used to drive each pile into its' final position. Impact piling typically generates higher noise levels than vibratory piling, the maximum period that impact piling is predicted to be used in any one daytime period is 25% of the construction site operating hours, with vibratory methods being used for 40%. The noise modelling of piling carried out at the proposed development contains this assumption.

To construct the foundations for the new boat workshop, there is the potential that impact piling could be carried out. It is understood that a total of 41 piles could be driven, taking approximately 10 to 15 minutes for each during daytime working hours, carried out over a period of around 3 days. It is anticipated that as a worst case scenario the impact piling may be carried out for 3.5 hours continuously on any one day. This noise modelling of piling carried out at the proposed development contains this assumption.

4.2.3 Dredging

Dredging shall be carried out to form the marina entrance channel and basin (Ref 3, Table 4-2), much of the material dredged shall be used in the construction of the land reclamation area. It is expected that part of the dredging shall be carried out using a long reach backhoe dredger, moving along a bund to be constructed from imported rock fill, along the basin area. The backhoe dredging shall be carried out during daytime and evening hours only.

In order to form the deeper entrance channel area, and most likely, the bulk of the dredge, it is expected that a small cutter suction dredger will excavate in from the outside, pumping the dredged material directly through a pipeline into the land reclamation area. Cutter suction dredging is likely to be carried out continuously over a 24 hour period.

Backhoe dredging typically generates higher noise levels than cutter suction dredging. In order to consider the worst case scenario, both potential dredging methods have been modelled and assessed (Scenarios 2A & 2B, Table 4-2).

4.3 Noise Model Data

3D computer noise modelling of the various stages of construction activity at Newton Marina has been carried out using CadnaA software. Details on worst case construction activities, durations, operating times, and associated items of noise generating plant for each stage of construction used within the noise models have been supplied by Wallace Stone.

Calculations were carried out using noise data and guidance provided in BS5228:2009+A1:2014, to derive predicted noise levels at noise sensitive receptors. Where data was not available within BS5228 it has been sourced from the Environmental Protection Department of Hong Kong's Technical Memorandum on Noise from Construction Work. Noise data for cutter suction dredging was taken from Royal Haskoning DHV, Memo on Swansea Channel Noise Impact Assessment, dated 25th June 2014.

In detail, noise data has been sourced from the following publications;

- BS5228;1-2009+A1:2014, *Code of Practice for Noise on Construction and Open Sites*;
- Environmental Protection Department of Hong Kong; *Technical Memorandum on Noise from Construction Work other than Percussive Piling,* 1989.

- Royal Haskoning DHV, *Swansea Channel Noise Impact Assessment, Memo,* 25th June 2014.

Full details of the items of modelled construction plant, noise data (including data source), operating times, durations and source heights for each of the considered scenarios is shown in Appendix C.

4.4 Noise Model Assumptions

A number of assumptions have been established during the CadnaA modelling exercise, as detailed below:

- The ground model uses Lidar 1m resolution terrain height data for Stornoway and the majority of the surrounding area, including the proposed Deep Water Port. The remaining areas use Ordnance Survey 5m resolution terrain data;
- The heights of buildings have been estimated from photographs or scaled from the architect's drawings;
- A façade correction of +3dB(A) has been applied to free-field noise levels externally at buildings;
- Ground absorption has been set to 0.5 for mixed soft/hard ground, areas of water have been set to 1 for reflective surface;
- Evening noise levels generated by construction activities have been assumed to be the same as those generated during daytime hours;
- The noise model assumes locations of plant based on descriptions of construction activities provided by Wallace Stone;
- Worst case scenario combinations of construction activities likely to occur in any one day during the considered assessment periods have been assumed;
- Daytime noise levels have been calculated at ground floor level (i.e lounges/kitchens), which have been taken as being 1.5m above ground level;
- Night-time noise levels have been calculated at first floor level (i.e bedrooms), which have been taken as being 4m above ground level;
- Articulated dump truck and HGV deliveries have been assumed to take 2 mins to arrive within the site, and 2 mins to depart;
- Articulated dump truck deliveries have been assumed to take 1 minute to tip;
- During months 1, 2 & 3 of construction (Scenario 1) several of the same items of plant are understood to move between the construction of the reinforced concrete retaining wall and foundations and the rock infill retention bunds (i.e there is not duplicate plant). In such cases, the worst case % on-time for each item of plant moving between the two construction stages has been assumed;
- Spud-leg barges on which piling equipment is intended to be located have been assumed to have a height of 2m. The height of equipment located on the barges (eg piling excavators) has been assumed as relative to the height of the barge (eg a 1m high noise source height located on the 2m high barge, has a total height of 3m);
- The following sources have been modelled as line sources within CadnaA;
    - Heavy goods vehicles (HGVs) and dump trucks;
    - Concrete trucks;
    - Moving construction plant;
    - Tug / work boats.
- All remaining sources (not outlined above) have been modelled within CadnaA as point sources.

4.5 ABC Category Thresholds

The appropriate ABC category thresholds above which there is considered to be a noise impact from construction noise have been calculated following guidance provided in BS5228-1:2009+A1:2014 (refer to Section 2.2.1). Details of the calculations are shown in Appendix B.

5 NOISE MODEL RESULTS AND ASSESSMENT

The noise model results for each modelled scenario of construction activity, along with the BS5228 assessment at each of the considered noise sensitive receptors are summarised in Table 5-1 to Table 5-6. The predicted level within the tables is defined as the total construction and ambient noise level at each receptor location.

Table 5-1: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 1: South Beach

NSR 01: South Beach		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations Rock infill retention bunds	65	57.1	Neutral	60	55.1	Neutral	55	51.4	Neutral
2A	Dredging (Cutter Suction) Reclamation Breakwater rock core	65	57.2	Neutral	60	55.2	Neutral	55	49.8	Neutral
2B	Dredging (Backhoe) Reclamation Breakwater rock core	65	58.0	Neutral	60	56.4	Neutral	N/A	N/A	N/A
3	Reclamation Breakwater rock core Rock armouring Access ramp	65	57.5	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
4	Reclamation Rock armouring Access ramp Piling New slipway	65	58.4	Neutral	N/A	N/A	N/A	55	49.4	Neutral
5	Rock armouring Piling New slipway Drainage and sewage pump	65	57.1	Neutral	N/A	N/A	N/A	55	49.4	Neutral
6	Dock structure Pontoons	65	57.2	Neutral	60	55.2	Neutral	N/A	N/A	N/A

NSR 01: South Beach		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
	Surfacing									
	Services to pontoon									
7	Services to pontoon	65	56.9	Neutral	60	54.7	Neutral	N/A	N/A	N/A
	Installation of Replacement Small Boatsheds									
	Construction of new boat workshop									
8	Construction of new boat workshop	65	56.9	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 5-2: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 2: Newton Street

NSR 02: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations	65	61.5	Neutral	65	59.7	Neutral	55	55.9	Slight
	Rock infill retention bunds									
2A	Dredging (Cutter Suction)	65	63.4	Neutral	65	62.3	Neutral	55	58.8	Moderate
	Reclamation									
	Breakwater rock core									
2B	Dredging (Backhoe)	65	65.3	Slight	65	64.6	Neutral	N/A	N/A	N/A
	Reclamation									
	Breakwater rock core									
3	Reclamation	65	65.1	Slight	N/A	N/A	N/A	N/A	N/A	N/A
	Breakwater rock core									
	Rock armouring									
	Access ramp									
4	Reclamation	65	64.3	Negligible	N/A	N/A	N/A	55	50.4	Neutral
	Rock armouring									
	Access ramp									

NSR 02: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
	Piling62.3									
	New slipway									
5	Rock armouring	65	62.3	Neutral	N/A	N/A	N/A	55	50.4	Neutral
	Piling									
	New slipway									
	Drainage and sewage pump									
6	Dock structure	65	64.0	Neutral	65	63.1	Neutral	N/A	N/A	N/A
	Pontoons									
	Surfacing									
	Services to pontoon									
7	Services to pontoon	65	61.8	Neutral	65	60.1	Neutral	N/A	N/A	N/A
	Installation of Replacement Small Boatsheds									
	Construction of new boat workshop									
8	Construction of new boat workshop	65	61.8	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 5-3: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 3: Newton Street

NSR 03: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations	65	62.6	Neutral	65	61.2	Neutral	55	57.7	Slight
	Rock infill retention bunds									
2A	Dredging (Cutter Suction)	65	65.6	Slight	65	65.0	Neutral	55	59.8	Moderate
	Reclamation									
	Breakwater rock core									
2B	Dredging (Backhoe)	65	66.8	Slight	65	66.3	Slight	N/A	N/A	N/A
	Reclamation									

NSR 03: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
	Breakwater rock core									
3	Reclamation Breakwater rock core Rock armouring Access ramp	65	67.2	Slight	N/A	N/A	N/A	N/A	N/A	N/A
4	Reclamation Rock armouring Access ramp Piling New slipway	65	65.4	Slight	N/A	N/A	N/A	55	51.4	Neutral
5	Rock armouring Piling New slipway Drainage and sewage pump	65	62.8	Neutral	N/A	N/A	N/A	55	51.3	Neutral
6	Dock structure Pontoons Surfacing Services to pontoon	65	65.4	Slight	65	64.8	Neutral	N/A	N/A	N/A
7	Services to pontoon Installation of Replacement Small Boatsheds Construction of new boat workshop	65	62.9	Neutral	65	61.6	Neutral	N/A	N/A	N/A
8	Construction of new boat workshop	65	62.8	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 5-4: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 4: Newton Street

NSR 04: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations Rock infill retention bunds	65	62.2	Neutral	65	60.8	Neutral	55	56.5	Slight
2A	Dredging (Cutter Suction) Reclamation Breakwater rock core	65	64.6	Neutral	65	63.8	Neutral	55	57.4	Slight
2B	Dredging (Backhoe) Reclamation Breakwater rock core	65	65.5	Slight	65	64.9	Neutral	N/A	N/A	N/A
3	Reclamation Breakwater rock core Rock armouring Access ramp	65	65.9	Slight	N/A	N/A	N/A	N/A	N/A	N/A
4	Reclamation Rock armouring Access ramp Piling New slipway	65	62.7	Neutral	N/A	N/A	N/A	55	51.2	Neutral
5	Rock armouring Piling New slipway Drainage and sewage pump	65	62.4	Neutral	N/A	N/A	N/A	55	51.3	Neutral
6	Dock structure Pontoons Surfacing Services to pontoon	65	64.4	Neutral	65	63.5	Neutral	N/A	N/A	N/A
7	Services to pontoon Installation of Replacement Small Boatsheds Construction of new boat workshop	65	62.1	Neutral	65	60.6	Neutral	N/A	N/A	N/A

NSR 04: Newton Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
8	Construction of new boat workshop	65	62.1	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 5-5: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 5: Seaview Terrace

NSR 05: Seaview Terrace		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations Rock infill retention bunds	65	61.0	Neutral	65	58.9	Neutral	55	54.5	Neutral
2A	Dredging (Cutter Suction) Reclamation Breakwater rock core	65	61.5	Neutral	65	59.7	Neutral	55	54.6	Neutral
2B	Dredging (Backhoe) Reclamation Breakwater rock core	65	63.9	Neutral	65	63.0	Neutral	N/A	N/A	N/A
3	Reclamation Breakwater rock core Rock armouring Access ramp	65	63.1	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
4	Reclamation Rock armouring Access ramp Piling New slipway	65	62.1	Neutral	N/A	N/A	N/A	55	50.6	Neutral
5	Rock armouring Piling New slipway	65	61.2	Neutral	N/A	N/A	N/A	55	50.7	Neutral

NSR 05: Seaview Terrace		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
	Drainage and sewage pump									
6	Dock structure Pontoons Surfacing Services to pontoon	65	62.1	Neutral	65	60.5	Neutral	N/A	N/A	N/A
7	Services to pontoon Installation of Replacement Small Boatsheds Construction of new boat workshop	65	61.0	Neutral	65	58.8	Neutral	N/A	N/A	N/A
8	Construction of new boat workshop	65	61.0	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 5-6: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 6: Builnacraig Street

NSR 06: Builnacraig Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	Reinforced concrete retaining wall and foundations Rock infill retention bunds	65	51.8	Neutral	55	50.2	Neutral	45	46.1	Slight
2A	Dredging (Cutter Suction) Reclamation Breakwater rock core	65	50.8	Neutral	55	48.7	Neutral	45	41.1	Neutral
2B	Dredging (Backhoe) Reclamation Breakwater rock core	65	53.2	Neutral	55	52.1	Neutral	N/A	N/A	N/A
3	Reclamation Breakwater rock core Rock armouring Access ramp	65	51.4	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

NSR 06: Builnacraig Street		Daytime			Evening			Night-time		
Scenario	Combined Construction Stages	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
4	Reclamation Rock armouring Access ramp Piling New slipway	65	51.3	Neutral	N/A	N/A	N/A	45	38.8	Neutral
5	Rock armouring Piling New slipway Drainage and sewage pump	65	50.4	Neutral	N/A	N/A	N/A	45	38.8	Neutral
6	Dock structure Pontoons Surfacing Services to pontoon	65	50.8	Neutral	55	48.7	Neutral	N/A	N/A	N/A
7	Services to pontoon Installation of Replacement Small Boatsheds Construction of new boat workshop	65	50.3	Neutral	55	47.7	Neutral	N/A	N/A	N/A
8	Construction of new boat workshop	65	50.3	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

5.1 Discussion of Results

The worst case noise impacts for each of the modelled scenarios on concurrent construction stages and relevant assessment periods are summarised below (refer to Table 4-3).

Scenario 1 (Months 1 to 3); The combined construction stages of construction of the reinforced concrete retaining wall and the rock infill retention bund's, are predicted to result in noise impacts of Slight significance at night at NSRs 02, 03, 04 (Newton Street) & 06 (Builnacraig Street). The significance of all other impacts is predicted to be Neutral.

Scenario 2A (Months 4 to 7); The combined construction stages of cutter suction dredging, reclamation and construction of the breakwater core, are predicted to result in noise impacts of Slight significance at NSR 03 (Newton Street) during the daytime. At night there is a Slight impact at NSR 04 (Newton Street) and Moderate impacts at NSRs 02 and 03 (Newton Street). The significance of all other impacts is predicted to be Neutral.

Scenario 2B (Months 4 to 7); The combined construction stages of backhoe dredging, reclamation and construction of the breakwater core, are predicted to result in noise impacts of Slight significance during the daytime at NSRs 02 to 03 (Newton Street). During the evening there is an impact of Slight significance at NSR 03. The significance of all other impacts is predicted to be Neutral.

Scenario 3 (Month 8); The combined construction stages of reclamation, construction of the breakwater core, rock armouring and construction of the access ramp, are predicted to result in noise impacts of Slight significance at NSRs 02 to 04 (Newton Street) during the daytime. The significance of all other impacts is predicted to be Neutral.

Scenario 4 (Month 9); The combined construction stages of reclamation, rock armouring, construction of the access ramp, pontoon piling and construction of the new slipway are predicted to result in an impact of Slight significance during the daytime at NSR 03 (Newton Street). The significance of all other impacts is predicted to be Neutral.

Scenario 5 (Months 10 & 11); The combined construction stages of rock armouring, pontoon piling, new slipway and drainage/sewage pump (Scenario 5) are predicted to result in impacts of Neutral significance at all receptors during the day and night-time.

Scenario 6 (Months 12 and 13); The combined construction stages of the dock structure, pontoons, surfacing and services to pontoons (Scenario 6) are predicted to result in Slight impacts at NSR 03 (Newton Street) during the daytime. The significance of all other impacts is predicted to be Neutral.

Scenario 7 (Months 14 and 15); The combined construction stages of services to pontoons, installation of replacement small boatsheds, and construction of the new boat workshop (Scenario 7) are predicted to result in impacts of Neutral significance at all receptors during the day and evening.

Scenario 8 (Months 16 to 24); The construction of the new boat workshop results in impacts of Neutral significance during the daytime.

5.1.1 Greatest Daytime and Evening Noise Impacts

The greatest noise generating activities during the daytime and evening are predicted to be from the combined construction stages of backhoe dredging, reclamation and construction of the breakwater core (Scenario 2B; Months 4 to 7). The worst case impacts from these construction activities at Newton Marina and are predicted to be of Slight significance at NSRs 02 to 04 (Newton Street) during the daytime, and of Slight significance at NSR 03 (Newton Street) during the evening.

5.1.2 Greatest Night-time Noise Impacts

The greatest noise generating activities during the night-time are predicted to be from cutter suction dredging (Scenario 2A; Months 4 to 7). The worst case night-time impacts from this construction activity at Newton Marina are therefore predicted to be of Moderate significance at NSRs 02 & 03 (Newton Street), and Slight significance at NSR 04 (Newton Street). The maximum duration that cutter suction dredging may be carried out at night is four months.

.

6 CUMULATIVE IMPACT

There is the potential for cumulative noise from concurrent construction activities at Newton Marina and the proposed Deep Water Port to impact on existing residential receptors. At the time of writing, the proposed construction commencement date for Newton Marina is December 2018, with construction at the Deep Water Port anticipated to commence in November 2019. There is also the potential for cumulative noise from the proposed construction of a fish processing factory on Goat Island, which is scheduled to occur between January and December 2019 to impact on existing residential receptors

The cumulative impact assessment of noise generated by construction activities from Newton Marina and the Deep Water Port takes into account the proposed 11 month gap between construction commencement dates. Within the 13 month period that construction activities are proposed to occur at Newton Marina and the Deep Water Port concurrently it is understood that exact construction timings may change from those proposed at the moment. In order to assess the worst case scenario of cumulative impact during the concurrent period, the greatest predicted noise generating activities at Newton Marina and the Deep Water Port during the period when both sites are operating concurrently have therefore been assumed to occur at the same time.

Full details of the proposed noise generating construction activities at the proposed Deep Water Port are provided in Technical Appendix 7.1, within Volume 3 of the Deep Water Port ES.

The greatest predicted noise generating construction stages that may occur concurrently for each of the considered periods is shown in Table 6-1.

Table 6-1: Greatest Noise Generating Concurrent Construction Stages; Newton Marina and Deep Water Port

Assessment Period	Greatest Noise Generating Concurrent Construction Stages			
	Newton Marina		Deep Water Port	
	Scenario / Duration	Combined Construction Stages	Scenario / Duration	Combined Construction Stages
Daytime	6; 2 Months	Dock structure, pontoons, surfacing, services to pontoons	3B; 2 Months	Excavate rock and infill reclamation, dredging (backhoe) and infill reclamation, linkspan support dolphin.
Evening	6; 2 Months	Dock structure, pontoons, surfacing, services to pontoons	3B; 2 Months	Dredging (backhoe) and infill reclamation, linkspan support dolphin.
Night-time	N/A	N/A	3B; 2 Months	Dredging (backhoe) and infill reclamation.

The greatest noise generating combination of construction stages during the daytime and evening and are from Scenario 6 at Newton Marina, and Scenario 3B at the Deep Water Port (refer to Technical Appendix 7.1, within Volume 3 of the Deep Water Port EIAR for full details). There is no predicted cumulative impact at night, as there are no concurrent night-time works scheduled.

The construction of the proposed fish processing factory at Goat Island, scheduled to occur during daytime hours between January and December 2019 (but which may be subject to change) has the potential to contribute to the overall cumulative noise impact at existing residential receptors. Noise generated by the proposed construction activities at the factory has been modelled at the location of the existing sensitive receptors using CadnaA software. The noise data and assumptions used within the model is shown as Ref 17 in Appendix C. As the exact timings of the construction of the factory is unknown at this stage, noise generated

by construction activities associated with it have been included within the cumulative noise impact assessment, along with worst case noise generating construction stages from Newton Marina and the Deep Water Port.

An assessment of the worst-cast cumulative impacts, if the greatest noise generating construction stages at Newton Marina, the Deep Water Port and the fish processing factory on Goat Island are to occur concurrently are shown in Table 6-2 and Table 6-3.

Table 6-2: Worst Case Cumulative Impact; Daytime

Noise Sensitive Receptor	Predicted Cumulative Facade Level dB(A)	Threshold Level dB(A)	Excess dB(A)	Significance
1	58.9	65	-6.1	Neutral
2	64.6	65	-0.4	Neutral
3	65.9	65	0.9	Slight
4	65.0	65	0.0	Neutral
5	62.9	65	-2.1	Neutral
6	57.0	65	-8.0	Neutral

Table 6-3: Worst Case Cumulative Impact; Evening

Noise Sensitive Receptor	Predicted Cumulative Façade Level dB(A)	Threshold Level dB(A)	Excess dB(A)	Significance
1	57.5	60	-2.5	Neutral
2	63.6	65	-1.4	Neutral
3	65.1	65	0.1	Slight
4	64.0	65	-1.0	Neutral
5	61.5	65	-3.5	Neutral
6	56.3	55	1.3	Slight

The results show that during the daytime period, the significance of the worst case cumulative impact if the greatest noise generating construction activities at Newton Marina, Deep Water Port and the proposed fish processing factory on Goat Island occur concurrently is Slight at NSR 03 (Newton Street). At the remaining noise sensitive receptor locations the impact is Neutral. During the evening, the significance is Slight at NSRs 03 (Newton Street) and 06 (Builnacraig Street).

There are no scheduled night-time concurrent construction activities at Newton Marina, Deep Water Port and the proposed fish processing factory on Goat Island.

7 CONCLUSIONS

A construction noise assessment has been carried out for the proposed Newton Marina development at Stornoway. Worst case combined construction stages based on the proposed construction schedule have been modelled using CadnaA software. Details of construction activities and associated plant on which assessment assumptions are based have been provided by Wallace Stone and Stornoway Port Authority.

7.1.1 Daytime and Evening Construction Noise

The greatest noise generating activities during the daytime and evening are predicted to be from the combined construction stages of backhoe dredging, reclamation and construction of the breakwater core (Scenario 2B; Months 4 to 7). The worst case impacts from these construction activities at Newton Marina are predicted to be of Slight significance at NSRs 02 to 04 (Newton Street) during the daytime, and Slight at NSR 03 (Newton Street) during the evening.

7.1.2 Night-time Construction Noise

Potential construction activities that may be carried out at night are construction of the reinforced concrete retaining wall and foundations (tidally dependant; months 1 to 3), cutter suction dredging (months 4 to 7), and construction of the new slipway (tidally dependant; months 9 to 11).

The greatest noise generating activities during the night-time are predicted to be from cutter suction dredging (months 4 to 7). The worst case night-time impacts from this construction activity at Newton Marina are predicted to be of Moderate significance at NSRs 02 & 03 (Newton Street), and Slight significance at NSR 04 (Newton Street). The maximum duration that cutter suction dredging may be carried out at night is four months.

7.1.3 Cumulative Impact

A cumulative noise impact assessment has been carried to consider scheduled concurrent construction activities at the proposed Newton Marina, Deep Water Port and fish processing factory on Goat Island. Timings of proposed construction schedules have been provided by Wallace Stone and Stornoway Port Authority.

During the daytime period, the significance of the worst case cumulative impact from scheduled concurrent construction activities at Newton Marina, Deep Water Port and the proposed fish processing factory on Goat Island is Slight at NSR 03 (Newton Street). At the remaining noise sensitive receptor locations the impact is Neutral. During the evening, the significance is Slight at NSRs 03 (Newton Street) and 06 (Builnacraig Street).

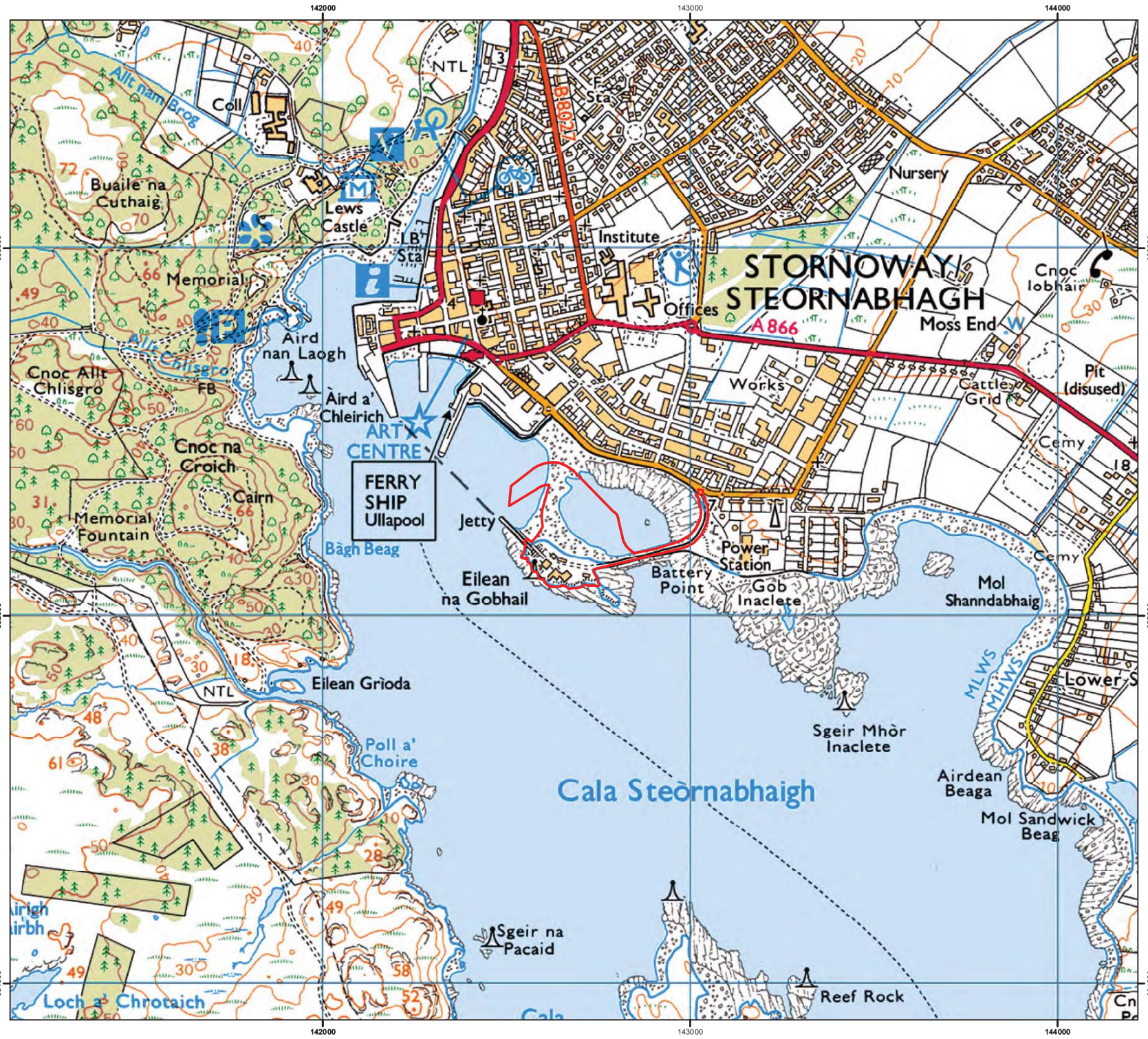
There are no scheduled night-time concurrent construction activities at Newton Marina, Deep Water Port and the proposed fish processing factory.

REFERENCES

- BSi British Standards BS5228-1:2009+A1 – 2014; *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise*.
- Environmental Protection Department of Hong Kong; *Technical Memorandum on Noise from Construction Work other than Percussive Piling,* 1989.
- Royal Haskoning DHV, *Swansea Channel Noise Impact Assessment, Memo,* 25th June 2014. The Scottish Government (2011b). *Technical Advice Note (TAN) 1/2011 - Assessment of Noise*. The Scottish Government.

APPENDICES

A DRAWINGS



Legend

Newton Marina Site Boundary 7.24 hectares

Do not scale this map

Client: Stornoway Port Authority

Project: Newton Marina

Title: Site Location Plan

Status: FINAL

Drawing No.: 670526-005

Revision:

Scale: 1:10,000

A3

Date: 9 April 2018

Drawn: [R

Checked: [R

Approved: [R

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

Legend

- Newton Marina Site Boundary
- Noise Sensitive Receptors

Do not scale this map

Client: Stornoway Port Authority

Project: Newton Marina

Title: Noise Sensitive Receptor Plan

Status: FINAL

Drawing No.: 670526-020

Revision: -

Scale: 1:5,000

A3

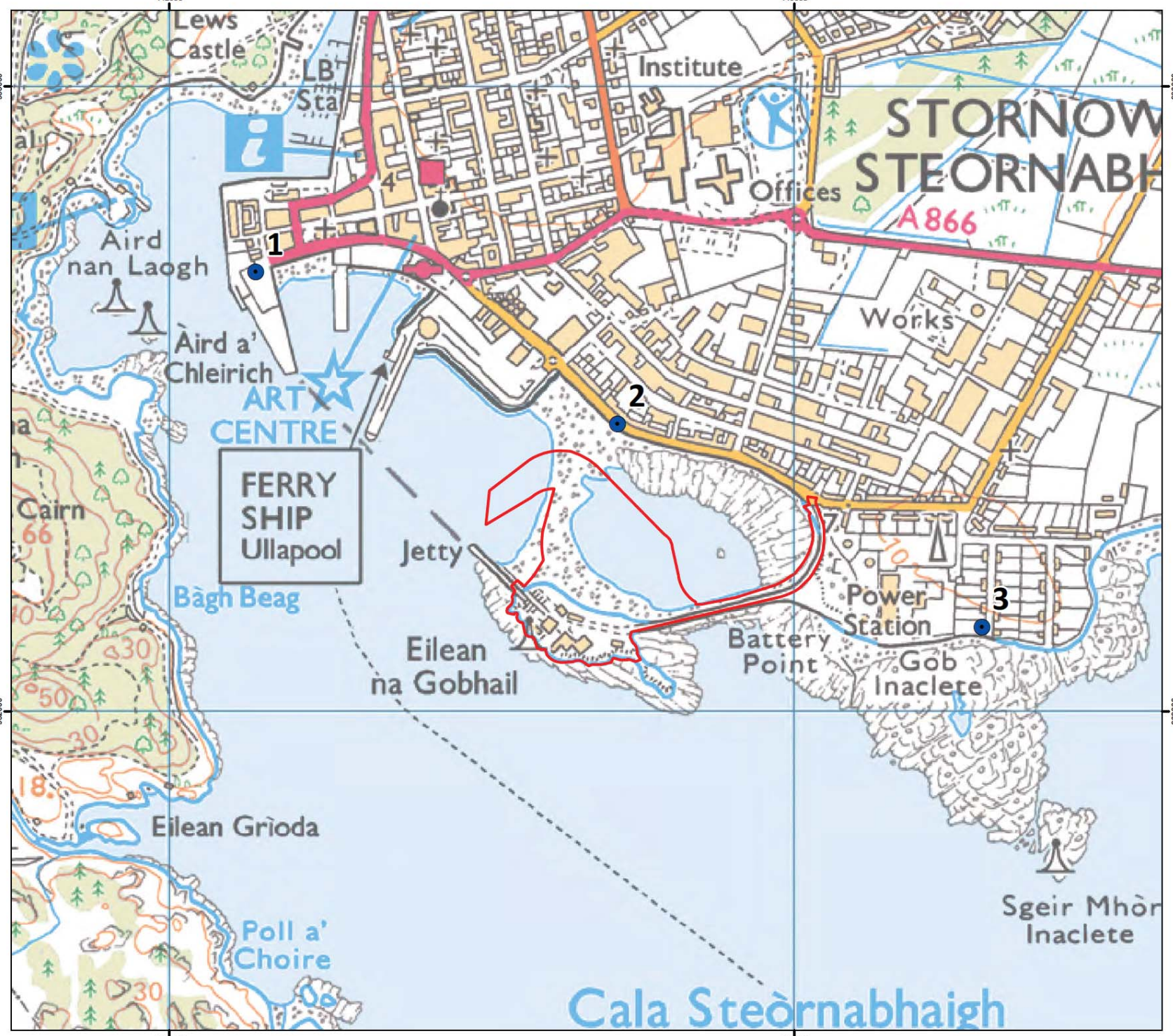
Date: 11/06/2018

Drawn: [Redacted]

Checked:

Approved:

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045



Legend

- Newton Marina Site Boundary
- Noise Monitoring Locations

Do not scale this map

Client: Stornoway Port Authority

Project: Newton Marina

Title: Noise Monitoring Locations

Status: FINAL

Drawing No.: 670526-024

Revision: -

Scale: 1:6,000

A3

Date: 18/06/2018

Drawn: [Redacted]

Checked:

Approved:

ENVIRO Centre
Craighall Business Park, Eagle Street, Glasgow, G4 9XA
Tel: 0141 341 5040
Fax: 0141 341 5045

B ABC CATEGORY THRESHOLDS

The appropriate ABC category thresholds for each of the noise sensitive receptors has been calculated following guidance provided in Annex E of the standard (refer to Section 2.2.1 for assessment criteria).

Calculations for each of the noise sensitive receptors, based on measured day and night-time ambient noise levels in the absence of construction noise is shown in Table 0-1 to
Table 0-3. Evening ambient noise levels have been assumed to be the average of daytime and night-time measured noise levels.

Table 0-1: ABC Category Thresholds, NSR 01

NSR 01; Measurement Position No. 1	Measured Daytime dB(A)	Measured Night-time dB(A)	Evening dB(A)
Ambient Levels	57.7	48.1	N/A
	55.4	50.0	
Average Levels	56.7	49.2	54.4
Average Levels Rounded	55.0	50.0	55.0
BS5228 ABC Category	A	C	B
Threshold Value	65	55	60

Table 0-2: ABC Category Thresholds, NSRs 02 to 05

NSRs 02 to 05; Measurement Position No. 2	Measured Daytime dB(A)	Measured Night-time dB(A)	Evening dB(A)
Ambient Levels	60.3	52	N/A
	60.0	43.2	
Average Levels	60.2	49.5	57.5
Average Levels Rounded	60.0	50.0	60.0
BS5228 ABC Category	A	C	C
Threshold Value	65	55	65

Table 0-3: ABC Category Thresholds, NSR 06

NSRs 06; Measurement Position No. 3	Measured Daytime dB(A)	Measured Night-time dB(A)	Evening dB(A)
Ambient Levels	50.3	39.2	N/A
	49.9	36.2	
Average Levels	50.1	38.0	47.4
Average Levels Rounded	50.0	40.0	50.0
BS5228 ABC Category	A	A	A
Threshold Value	65	45	55

C CONSTRUCTION NOISE MODEL DATA

Ref	Start Month	Finish Month	Construction Stage	Individual Plant / Activities	No. of Units	Lp at 10m dB(A)	Data Source	Source Height (m)	Operating Times	% On-time of Operating Hours	Mins per 16 Hour Daytime	Mins per 8 Hour Night-time
1	1	3	Reinforced concrete retaining wall and foundations	Large crane (300t)	1	78	BS5228 C4 Ref. 38	1.5	Tide dependant. 12:00hrs to 16:00hrs or 00:00hrs to 04:00hrs. (240 mins)	100	240	240
				Articulated dumper truck; tipping	3	80	BS5228 C1 Ref. 11	1		10	24	24
				Articulated dumper truck; site movements	3	85	BS5228 C6 Ref. 17	1		90	216	216
				30t Excavator; grading	1	76	BS5228 D3 Ref 61	0.5		100	240	240
				30t Excavator; pushing rock into place	1	75	BS5228 C2 Ref. 16	0.5		100	240	240
				Articulated dump truck; delivery	8 per day	85	BS5228 C6 Ref. 17	1		13	32	0
				Articulated dump truck delivery; tipping	8 per day	80	BS5228 C1 Ref. 11	1		3	8	0
2	1	3	Rock infill retention bunds	Articulated dumper truck; tipping	3	80	BS5228 C1 Ref. 11	1	0700-1900. (720 mins)	10	72	0
				Articulated dumper truck; site movements	3	85	BS5228 C6 Ref. 17	1		90	648	0
				30t Excavator; grading	1	76	BS5228 D3 Ref 61	0.5		100	720	0
				30t Excavator; pushing rock into place	1	75	BS5228 C2 Ref. 16	0.5		100	720	0
				Articulated dump truck delivery	6 per day	85	BS5228 C6 Ref. 17	1		3	24	0
				Articulated dump truck delivery; tipping fill	6 per day	80	BS5228 C1 Ref. 11	1		1	6	0
3A	4	7	Dredging (cutter suction)	Cutter suction dredger	1	82	Royal Haskoning DHV; Swansea Channel NIA, Memo, dated 25th June 2014.	1	Cutter Suction 24 (960 mins	100	960	480

Ref	Start Month	Finish Month	Construction Stage	Individual Plant / Activities	No. of Units	Lp at 10m dB(A)	Data Source	Source Height (m)	Operating Times	% On-time of Operating Hours	Mins per 16 Hour Daytime	Mins per 8 Hour Night-time
				30t Excavator; pushing rock into place	1	75	BS5228 C2 Ref. 16	0.5	day / 480 mins night)	60	576	288
3B	4	7	Dredging (backhoe)	Backhoe dredger	1	78	BS5228 C7 Ref. 1	1	Backhoe Dredging; 07:00 to 20:00hrs (780 mins)	90	702	0
				Articulated dumper truck; tipping	3	80	BS5228 C1 Ref. 11	1		10	78	0
				Articulated dumper truck; site movements	3	85	BS5228 C6 Ref. 17	1		80	624	0
				Articulated dump truck delivery	23 per day	85	BS5228 C6 Ref. 17	1		12	92	0
				Articulated dump truck delivery; tipping fill	23 per day	80	BS5228 C1 Ref. 11	1		3	23	0
				30t Excavator; pushing rock into place	1	75	BS5228 C2 Ref. 16	0.5		60	468	0
4	4	9	Reclamation	Vibrating rollers (20t)	2	80	BS5228 C.5 Ref 21	0.5		75	540	0
5	7	8	Breakwater rock core	Articulated dumper truck; tipping	3	80	BS5228 C1 Ref. 11	1	0700-1900. (720 mins)	10	72	0
				Dumper truck (driving)	3	85	BS5228 C6 Ref. 17	1		75	540	0
				30t Excavator; shaping core	2	75	BS5228 C2 Ref. 16	0.5		85	612	0
				Articulated dump truck delivery	6 per day	85	BS5228 C6 Ref. 17	1		3	24	0
				Articulated dump truck delivery; tipping fill	6 per day	80	BS5228 C1 Ref. 11	1		1	6	0
6	8	10	Rock armouring	Excavator (50t)	1	85	BS5228 C1. Ref 10	0.5	0700-1900. (720 mins)	90	648	0
				Articulated dump truck delivery	6 per day	85	BS5228 C6 Ref. 17	1		3	24	0
				Articulated dump truck delivery; tipping fill	6 per day	80	BS5228 C1 Ref. 11	1		1	6	0
				Articulated dumper truck; site movements	2	85	BS5228 C6 Ref. 17	1		20	144	0
				Articulated dumper truck; tipping	2	80	BS5228 C1 Ref. 11	1		5	36	0
7	8	9	Access ramp	Excavator, loading	1	85	BS5228 C1 Ref. 10	0.5		40	264	0

Ref	Start Month	Finish Month	Construction Stage	Individual Plant / Activities	No. of Units	Lp at 10m dB(A)	Data Source	Source Height (m)	Operating Times	% On-time of Operating Hours	Mins per 16 Hour Daytime	Mins per 8 Hour Night-time
				Articulated dumper truck; site movements	2	85	BS5228 C6 Ref. 17	1	0700-1800 (660 mins)	9	198	0
				Articulated dumper truck; tipping	2	80	BS5228 C1 Ref. 11	1		30	198	0
				Cement truck (delivery)	1 per day	80	BS5228 C.4 Ref. 20	0.5		1	4	0
				Cement truck (pour)	1 per day	67	BS5228 C.4 Ref. 24	0.5		20	132	0
8	9	11	Pontoon Piling	Excavator (piling)	1	68	BS5228 C3 Ref. 23	0.5	0700-1900 (720 mins)	75	540	0
				Small crane	1	70	BS5228 C3. Ref 29	1		40	288	0
				Tug boat (for spud leg barge)	1	82	CNP 048	1		10	72	0
				Odex piling equipment	1	87	CNP 165	1		50	360	0
				Articulated dump truck delivery	1 per day	85	BS5228 C6 Ref. 17	1		1	4	0
				Articulated dump truck delivery; tipping fill	1 per day	80	BS5228 C1 Ref. 11	1		0	1	0
9	9	11	New slipway	Excavator (30t)	1	75	BS5228 C2 Ref. 16	0.5	07:00hrs to 19:00hrs (720 mins); below mid - tide level, or 12:00hrs to 16:00hrs / 00:00hrs to 04:00hrs; above mid tide level (240 mins).	75	540	180
				HGV concrete delivery (pre-cast)	1 per day	80	BS5228 C6 Ref. 21	0.5		2	4	0
				100t crane (lifting)	1	67	BS 5228 C.3 Ref. 28	1		50	360	120
10	12	13	Dock structure (boat lift	Large capacity vibrating hammer	1	88	BS5228 D4 Ref43	1	0700-1800 (660 mins)	40	264	0
				Large capacity impact hammer	1	90	BS5228 D4 Ref 64b	1		25	165	0
				Tug boat (for spud leg barge)	1	82	CNP 221	1		10	66	0