

Aberdeen Harbour Expansion Project
Additional Environmental Information Report

22 April 2016



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Abbreviations

AHB	Aberdeen Harbour Board
AHEP	Aberdeen Harbour Expansion Project
BPEO	Best Practicable Environmental Option
ERL	Effects Range Low
ERM	Effects Range Median
ES	Environmental Statement
HMW	High molecular weight
HRA	Habitats Regulations Appraisal
HRO	Harbour Revision Order
JNCC	Joint Nature Conservation Committee
LMW	Low molecular weight
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PSD	Particle size distribution
SAC	Special Area of Conservation
SQG	Sediment Quality Guidelines
SPA	Special Protection Area
TBT	Tributyl Tin
WFD	Water Framework Directive

1. Introduction

In November 2015, Aberdeen Harbour Board (AHB) submitted applications for a Harbour Revision Order (HRO), Marine Licences and Planning Permission in Principle for the Aberdeen Harbour Expansion Project (AHEP) in Nigg Bay. A copy of the application documents and the Environmental Statement (ES) for the project are available on AHB's website (<http://www.aberdeen-harbour.co.uk/future/nigg-bay-documents/>).

A public consultation on the applications took place between 6 November and 18 December 2015. Over a negotiation period of three months (January – March 2016), AHB has held meetings, telephone discussions and exchanged written correspondence with all the organisations and individuals who responded to the consultation on the applications. In response to specific concerns raised by consultees relating to the HRO and Marine Licence applications, AHB produced four technical Clarification Notes to provide further information on the following topics:

- Underwater Noise
- Blasting Methodology and Mitigation
- Effects on Eider Duck
- Effects on Terns

In addition, two sediment sampling surveys have been carried out since the ES was produced to provide further information on the sediment quality within the area to be dredged for the AHEP. The volume of material to be dredged has also been refined following additional site investigation carried out in December 2015 and further calculations undertaken by the three contractors tendering for the project.

1.1. Requirement to re-advertise

Under The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended), there is a requirement for AHB to advertise the additional information that has been produced in support of the original HRO and Marine Licence applications. The purpose of this report is to present additional survey data and other information that has been produced since the applications were submitted.

Any person wishing to make representations on the further information to the Scottish Ministers should write within forty-two days from the date of this report to:

Harbour Revision Order:

Val Ferguson, Ports and Harbours Branch, Transport Scotland, Area 2G North, Victoria Quay, Edinburgh EH6 6QQ or email: harbourorders@scotland.gsi.gov.uk

Marine Licences:

Licensing Operations Team, Major Projects, The Scottish Government, Marine Scotland, Marine Laboratory, 375 Victoria Road, Aberdeen, AB11 9DB or email: ms.majorprojects@gov.scot

There is no need to repeat or resubmit any objections in respect of the HRO or Marine Licence applications which have already been made and have not been resolved or withdrawn, as these will be treated as remaining to be addressed.

2. Chemical analysis of material to be dredged

2.1 Existing sampling results

As reported in Section 7.5.3.2 within Chapter 7 of the ES and Appendix 12-B: Subtidal Benthic Ecological Characterisation Survey, surface sediment samples were collected from ten stations in Nigg Bay (shown on Figure 1 below).

In addition, the Chemical Analysis Summary submitted with the Marine Licence application for dredging and disposal in November 2015 presented the results of a marine site investigation carried out in 2013, in which 26 surface sediment samples were collected (as shown on Figure 1) and analysed for chemical quality.

All samples were tested for the full suite of contaminants listed in Appendix II of Marine Scotland's '*Guidance for the sampling and analysis of sediment and dredged material to be submitted in support of applications for sea disposal of dredged material*':

- Heavy metals
- Tributyltin (TBT)
- Polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs)

Results were compared against the thresholds set in the Marine Scotland guidance document for sea disposal of dredged material (Revised Action Levels 1 and 2). All samples returned contaminant concentrations below Action Level 1 for all contaminants tested for, as detailed in ES Appendix 12-B.

Levels of all contaminants were found to be below Marine Scotland's Revised Action Level 1, with the exception of one sample in which the concentration of lead was found to be 74 mg/kg, which is above the revised Action Level 1 (50 mg/kg), but well below the Revised Action Level 2 (400 mg/kg).

2.2 Additional sampling

In accordance with Marine Scotland's Pre-Dredge Sampling Guidance (April 2011), core samples are required when the depth of dredging exceeds 1 m below the existing seabed level. AHB have carried out two separate core sampling surveys since the ES was submitted (locations shown on Figure 1):

- 14 core samples in December 2015
- 34 core samples in February – March 2016

Subsamples were collected at regular intervals from the seabed surface to the depth to be dredged. Approximately 300 samples were collected. The results are presented in the following sub-sections.

2.2.1 *Results of December 2015 survey*

The results of the chemical analysis for the December 2015 survey are presented in Appendix 1, and the results of the physical analysis (particle size distribution – PSD) are provided in Appendix 2.

In summary, the results revealed:

- Levels of nickel elevated above Marine Scotland Revised Action Level 2 at 10 locations, in samples both near surface and at depth.
- Levels of lead several times higher than Revised Action Level 2 at one location (M2015-15) in the two deeper samples.
- Levels of arsenic above Revised Action Level 2 at two locations (M2015-11 and M2015-14) near surface.
- Levels of a broad spectrum of heavy metals between Revised Action Level 1 and 2, both near surface and at depth, in 12 locations.
- Levels of PAHs in excess of Revised Action Level 1 at four locations (there is no Action Level 2 for PAHs).

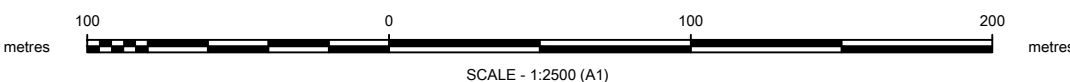
A high proportion (almost 50%) of the 2015 survey dataset revealed levels of nickel that are an order of magnitude above those that would be expected for the natural marine and glacial sediments. It is highly unlikely that these levels would be found within the glacial till layer, due to the glacial nature of this deposit. A range of other heavy metals were also found to be significantly above Action Level 1, again higher than expected background levels for glacial deposits.

No heavy metals above Revised Action Level 2 were found in any of the 34 surface samples collected in 2013 or 2015 (see Section 2.1), or in any of the core samples collected in 2016 (see Section 2.2.2), including at locations that are in close proximity to 2015 sampling locations.

In addition, the 2015 survey data has been called into question by experts within all five of the contractor teams bidding for the project during the first stage of the tendering process.

The survey contractor that undertook the 2015 sampling campaign has agreed that the 2015 sampling campaign results reveal higher levels of heavy metal contamination than the 2016 results. The contractor agrees that these results are anomalous, and they accept that these samples could have been contaminated after being brought to the surface (see letter from the contractor in Appendix 3).

Based on the information presented above, the strong weight of evidence suggests that the results from the 2015 survey are not reliable and should be discarded, and therefore they have not been considered further in this report.



2.2.2 Results and interpretation of 2016 survey

The chemical results of the 2016 sediment sampling survey are presented in Appendix 4, and the results of the PSDs are provided in Appendix 2.

Heavy metals

None of the samples contain heavy metals that are above Marine Scotland Revised Action Level 2. 21 of the 34 sample locations contain levels of heavy metals that are between Revised Action Level 1 and 2 in at least one sub-sample, at surface or at depth. The most prevalent elevated heavy metals are copper and nickel, which occur in at least one sub-sample in 20 and 14 of the sample locations (respectively). In the majority of cases, the levels recorded are well below Revised Action Level 2.

Six cross-sections have been produced to show the levels of heavy metals in the longitudinal and latitudinal planes, as provided in Appendix 5. The cross-sections cover the majority of the samples (28 of the 34 locations) and clearly illustrate that elevations of heavy metals that are above Revised Action Level 1 are, in the majority of cases, limited to one or two individual metals within one or two sub-samples of a core. The exceptions are the five samples RC-2016-2, VC-2016-03, VC-2016-12, RC-2016-14 and RC-2016-16, at which levels of at least two heavy metals are elevated above Revised Action Level 1 in several of the sub-samples within the core.

AHB has been carrying out maintenance dredging within the existing Aberdeen Harbour and disposing of material to the offshore disposal site CR110 (as shown on Figure 3.7 within Chapter 3 of the ES) for many years and, as described in Chapter 3 of the ES, is the proposed disposal site for the capital dredging arising for the AHEP. Marine Scotland has undertaken regular analysis of the material from the dredge hopper as far back as 1988, and the results of the analysis are provided in Appendix 6. The levels of heavy metals range between below the detection limit to above Revised Action Level 2. For example, a set of samples collected in 1998 and 1999 show elevated levels of copper, zinc, nickel and cadmium above Action Levels 1 and 2, and there are notable samples that are far in excess of Action Level 2. It should be noted that the licensing regime for dredging and disposal activities has changed substantially since 1988 and that all dredging and disposal was carried out in accordance with the appropriate regulations of the time.

A report by the Marine Laboratory (Hayes *et al.*, 2005) examined the concentration of heavy metals from the Aberdeen offshore disposal site CR110, along with a number of other disposal sites off the east coast of Scotland. The majority of samples were collected from surveys undertaken in 2002 and 2003; however, historical data collected and analysed in a similar manner was also included. Table 1 presents the average and maximum concentrations of heavy metals.

The results of additional sampling undertaken by Marine Scotland at disposal site CR110 between 1995 and 2011 are presented in Appendix 7, and the average concentrations of heavy metals are presented in Table 2. The results from this dataset and the study by Hayes *et al.* (2005) show that levels of heavy metals at the disposal site are consistently below Revised Action Level 1, even during times when material above Action Level 1 (and in some cases above Action Level 2) was disposed at the site. As the average levels are considerably lower in the sediments at the disposal site than at the source of dredging, there is no evidence of an accumulation of heavy metals at the site at levels that could cause biological harm. As such, the disposal of material at the offshore site that is either below Action Level 1, or between Action Level 1 and 2, during the capital dredging of the AHEP is considered to have a negligible effect on both water quality and biological receptors.

Table 1: Concentrations of heavy metals at Aberdeen offshore disposal site (~2003)

Metal	Average (mg/kg dry weight)	Maximum (mg/kg dry weight)
Arsenic	6.1	14.0
Cadmium	0	0.2
Chromium	13.1	32.5
Copper	7.9	34.9
Mercury	0.1	0.3
Nickel	7.8	21.2
Lead	13.6	28.5
Zinc	35.9	75.8

(Reproduced from Hayes et al. (2005))

Table 2: Average concentration of heavy metals at Aberdeen offshore disposal site (1995 – 2011)

Metal	Average concentration (mg/kg dry weight)
Arsenic	5.65
Cadmium	0.07
Chromium	12.78
Copper	6.17
Mercury	0.07
Nickel	7.19
Lead	10.93
Zinc	35.95

Tri-butyl tin (TBT) and polychlorinated biphenyls (PCBs)

Levels of TBT and PCBs are below Revised Action Level 1 in all samples at all locations.

Polycyclic aromatic hydrocarbons (PAHs)

There are elevations above Revised Action Level 1 for individual PAHs in 25 of the 34 sample locations at varying depths (with some samples only showing elevated levels in one sub-sample). None of the samples exceed the Revised Action Level 1 for total PAHs. There is no Action Level 2 for PAHs.

Sediment quality guidelines (SQGs) developed by Long *et al.* (1998) utilise the 'Effects Range Low'/'Effects Range Median' (ERL/ERM) methodology which is founded on a large

database of sediment toxicity and benthic community information. They were derived based upon empirical analyses of data compiled from numerous field and laboratory studies, including chemistry data and a variety of different types of biological data for numerous taxa derived from either bioassays of field- collected samples, laboratory toxicity tests of clean sediments spiked with specific toxicants, benthic community analyses, or equilibrium-partitioning models. The ERL/ERM methodology derives SQGs representing, respectively, the 10th and 50th percentiles of the effects dataset and can be derived for individual PAH compounds. The ERL/ERM guidelines. This method is adopted by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) in their monitoring of dredged material disposal sites in England (e.g. Bolam *et al.*, 2014).

Adverse biological effects are rarely observed when concentrations are below the ERL; the ERM represents concentrations toward the middle of the effects ranges and above which effects are more frequently observed (Long *et al.*, 1998).

Separate ERL/ERM SQGs have been derived for 'Low molecular weight PAHs' and 'High molecular weight PAHs' (Gorham-Test, 1998).

LMW PAHs include 2- and 3-ring PAH compounds:

- naphthalene
- monomethyl naphthalenes
- acenaphthene
- acenaphthylene
- fluorene
- phenanthrene
- anthracene

HMW PAHs include the 4- and 5-ring PAH compounds:

- fluoranthene
- pyrene
- benz[a]anthracene
- chrysene
- benzo[a]pyrene
- dibenz[a,h]anthracene

Although a wider suite of PAH is determined routinely for both licensing and monitoring purposes, these can be considered as toxicity markers for the PAH as a whole. The ERL and ERM concentrations applied are provided in Table 3. The limits for LMW PAH are lower than those for HMW PAH as they carry a higher acute toxicity.

Table 3: ERL and ERM concentrations for LMW and HMW PAHs in sediments.

PAH compounds	ERL (µg/kg dry weight)	ERM (µg/kg dry weight)
LMW PAH	552	3,160
HMW PAH	1,700	9,600

As shown in Table 4, from a total of approximately 300 samples collected in the 2016 survey, the ERL was only exceeded in one individual sub-sample at five separate locations. At all other locations, the risk of biological effects resulting from the dredging and disposal activity is low. The PAH levels in the samples adjacent to those in which the ERL was exceeded (in both the horizontal and vertical planes) are all below the ERL, which indicates that the elevated levels are highly localised.

As shown in Table 4, the ERM was only exceeded in one sample (VC-2016-19) at a depth of 6.5 m - 7.0 m below Chart Datum for three of the individual PAHs: Fluorene, Benzo(a)Pyrene and Chrysene. The PAH levels of the adjacent sample in the same core (4.5 m - 6.5 m below Chart Datum) and in all the surrounding locations are below the ERL.

The occurrence of individual PAHs that are elevated above the ERL and ERM is limited to approximately 0.02% and 0.003% of the samples respectively. As the extent is negligible, and the material will be well mixed during the dredging process, the risk of biological effects occurring from such a limited volume of elevated PAHs, whether the material is disposed at sea or re-used in the reclamation, is considered to be negligible.

2.3 Comparison with the findings of the ES

Chapter 7 of the ES (Water and Sediment Quality) assessed the environmental impact of the release of sediment-bound substances into the water column, and the deposition of suspended sediments on the seabed (Sections 7.6.3.3 and 7.6.3.4 for the construction phase; and Sections 7.6.4.2 and 7.6.4.3 for the operational phase). The assessment concluded that given the low levels of contaminants in the sediment, no significant release of pollutants into the water column is anticipated to occur as a result of dredging and disposal operations, and hence the residual effect was predicted to be negligible. The information presented above in relation to the 2016 sediment sampling survey supports this conclusion, and therefore there is no change to the assessments presented in the ES.

The Water Framework Directive (WFD) Assessment for the AHEP (ES Appendix 7-C) predicted that there would be no deterioration of the ecological and chemical status of any of the water bodies identified at a water body level, and no effects on the ability to meet targeted WFD objectives for any of the water bodies identified. The information presented above in relation to the 2016 sediment sampling survey supports this conclusion, and therefore there is no change to the assessments presented in the WFD Assessment.

2.4 Dredging methodology

Based on the results presented in Section 2.2.2, the methodology for construction of the AHEP remains unchanged: i.e. in accordance with the Best Practicable Environmental Option (BPEO) Assessment submitted with the Marine Licence application, the BPEO will be a combination of land reclamation within the construction of the harbour for materials that can be practicably recovered during the dredging process (particularly rock, gravel and larger pockets of coarse material); and offshore sea disposal for dredged material that is not suitable for re-use (e.g. glacial till, other fine silts) and that meets Marine Scotland's requirements for disposal at sea. The BPEO has been updated to reflect the latest sampling results and a copy is provided in Appendix 8.

Table 4: 2016 sediment sampling survey results containing PAHs exceeding the ERL or ERM

Sample location			RC-2016-31	VC-2016-08	VC-2016-19	VC-2016-24	VC-2016-33
Sample depth (below Chart Datum)			5.00- 5.50M	5.90m	6.5m - 7.0m	9.0m - 9.5m	11.0m - 11.5m
			(mg/kg dry weight)				
	ERL	ERM					
Acenaphthene	552	3,160	16	89	2,500	41	200
Acenaphthylene	552	3,160	34	12	480	38	68
Anthracene	552	3,160	17	250	1,900	85	270
Fluorene	552	3,160	1,200	54	9,900	620	1,300
Naphthalene	552	3,160	280	5.7	2,300	140	310
Phenanthrene	552	3,160	51	720	430	30	68
Benzo(a)Anthracene	1,700	9,600	12	720	1,700	89	270
Benzo(a)Pyrene	1,700	9,600	84	600	10,000	600	1600
Chrysene	1,700	9,600	1100	590	14,000	700	1,700
Dibenzo(ah)Anthracene	1,700	9,600	300	51	5,100	330	740
Fluoranthene	1,700	9,600	200	1,800	5,000	320	750
Pyrene	1,700	9,600	330	1400	2,800	180	380

3. Volume of material to be dredged

Section 3.6.1 within Chapter 3 of the ES states that the total volume of material to be dredged is 2,300,000 m³, of which 109,000 m³ is rock. Additional site investigation carried out in December 2015 and further calculations undertaken by the three contractors tendering for the project has been used to refine these volumes, and the total volume of material to be dredged has increased to 2,850,000 m³, of which 250,000 m³ is estimated to be rock. The exact volumes will be dependent on the appointed contractor's methodology; these revised figures are based on the greatest volume estimate of the three contractors. As stated in the ES, all rock will be used within the harbour works and will not be disposed offshore.

3.1. Dredging of rock

The Clarification Notes on Underwater Noise, and Blasting Methodology and Mitigation (provided in Appendices 9 and 10), have considered the implications of the drilling, blasting and dredging of this additional volume of rock. The Clarification Notes state that the mitigation measures proposed in Chapter 15 of the ES (i.e. to utilise Marine Mammal Observers and Passive Acoustic Monitoring with a mitigation zone of 1 km, and to adhere to the JNCC blasting guidance) will prevent injury to marine mammals by ensuring that blasting does not take place when marine mammals are in the vicinity. The Clarification Note on Blasting Methodology and Mitigation proposes additional mitigation to require bubble curtains to be used during blasting activities, to reduce the propagation of underwater noise. The predicted reduction in propagation distances when a bubble curtain is deployed will greatly reduce the distances over which injury to marine mammals could occur.

Due to the intermittent nature of the activity (one or two blasts per day over 3-7 months, with breaks in blasting activity for dredging), and with mitigation measures in place to reduce the distance over which the sound from a blast will propagate, the effects of disturbance are considered to be limited. The information presented in the Clarification Notes supports the conclusion in the Habitats Regulations Appraisal (HRA) (Volume 4 of the ES) that underwater noise generated by blasting activities will have no adverse effect on site integrity for the Moray Firth Special Area of Conservation (SAC).

3.2. Dredging of materials other than rock

Whilst the re-use of excavated material will be prioritised wherever viable, the appointed contractor may choose to use infill and rock materials from other sources.

Chapters 6 and 7 and Appendix 7-D of the ES present the results of the plume dispersion modelling that was carried out to model the fate of dredged material both at the source within Nigg Bay, and at the licensed offshore disposal site CR110. The plume dispersion modelling was based on a worst case scenario of all excavated material (except rock) being disposed offshore; however, as presented in Section 2.4, the contractor will seek to maximise the use of suitable material within the reclamation. The overall volume of material to be disposed offshore will not exceed the worst-case volume that was assessed in the plume dispersion modelling, so the conclusions in the ES relating to the effects of plume dispersion during dredging and disposal remain valid.

The BPEO has been updated to reflect the latest volumes and a copy is provided in Appendix 8.

4. Clarification Notes

In response to specific concerns raised by consultees relating to the HRO and Marine Licence applications, AHB has produced four technical Clarification Notes to provide further information on the following topics:

- Underwater Noise
- Blasting Methodology and Mitigation
- Effects on Eider Duck
- Effects on Terns

A summary of the findings of the four Clarification Notes is provided in the following sub-sections. All four Notes conclude by supporting the findings in the ES and the HRA (Volume 4 of the ES). Additional mitigation measures are proposed which reduce the level of environmental impact predicted in a number of areas.

4.1. Effects of underwater noise from marine impact piling

To demonstrate that there will be no adverse effects on the population of bottlenose dolphin from the Moray Firth SAC during marine impact piling activity, AHB has produced a Clarification Note on Underwater Noise (provided in Appendix 9). The Note proposes additional mitigation to require the breakwaters to be partially constructed prior to the commencement of impact piling in the marine environment, to reduce the effects on marine mammals. Marine impact piling will only be carried out in areas in which it is screened from the open water by the presence of a partially or fully constructed breakwater, so that there is no 'direct line of sight' between the impact piling location and the open water.

The Clarification Note demonstrates that this mitigation measure will significantly reduce the propagation of underwater noise from marine impact piling activities. It supports the conclusions in the ES and HRA (Volume 4 of the ES) that there will be no significant adverse effects on marine mammals during the construction of the AHEP.

4.2. Blasting methodology and mitigation

To demonstrate that there will be no adverse effects on the population of bottlenose dolphin from the Moray Firth SAC during blasting activities, AHB has produced a Clarification Note on Blasting Methodology and Mitigation (provide in Appendix 10).

The note illustrates the effectiveness of a bubble curtain in attenuating sound levels on the downstream side of an explosive blast. Based on a review of the available literature, peak sound levels may be reduced by 48 dB or else by 60-90% depending on the measurement metrics used. The effectiveness of a bubble curtain is modelled where the levels of attenuation are based on the data given by the literature search. With a bubble curtain in place, the distance at which the 170 dB threshold is reached falls from 830 m to as low as 58 m.

The mitigation measures proposed in Chapter 15 of the ES, e.g. to utilise Marine Mammal Observers and Passive Acoustic Monitoring with a mitigation zone of 1 km, and to adhere to the JNCC blasting guidance, will prevent injury to marine mammals by ensuring that blasting does not take place when marine mammals are in the vicinity. The predicted reduction in propagation distances when a bubble curtain is deployed will greatly reduce the distances over which injury to and displacement of marine mammals could occur.

In response to an additional request for information from Marine Scotland Science, AHB produced a short report entitled 'Response to Marine Scotland Science: Clarification of underwater noise issues', which is also provided in Appendix 10. This response provides further information on technical aspects of the noise modelling assessments, and the use of bubble curtains.

The information presented above is considered to support the conclusion in the HRA (Volume 4 of the ES) that underwater noise generated by blasting activities will have no adverse effect on site integrity for the Moray Firth SAC.

4.3. Effects on eider

To demonstrate that there will not be an adverse effect on the integrity of Special Protection Areas (SPAs) for eider duck *Somateria mollissima* on the east coast of Scotland, in particular the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, AHB has produced a Clarification Note on Effects on Eider Duck (provided in Appendix 11).

The Clarification Note calculates the extent of suitable foraging habitat for eider in Nigg Bay using data from the intertidal and subtidal benthic surveys (Appendices 12-A and 12-B of the ES, respectively); assesses the suitability of the new structures (e.g. breakwaters) and other areas within the new operational harbour that would provide suitable foraging habitat; and proposes mitigation measures to enhance the quality of these habitats and considers the timescale for these measures becoming effective.

The Clarification Note concludes that although some areas of eider foraging habitat will be lost as a result of the AHEP, the artificial structures and remaining undeveloped areas within Nigg Bay will provide sufficient substitute habitat (particularly once the proposed mitigation measures are implemented), so there will be no net loss of eider foraging habitat, and therefore no adverse effects on eider using Nigg Bay. No adverse effect on site integrity is predicted for the Ythan Estuary, Sands of Forvie and Meikle Loch SPA, which supports the conclusion in the HRA (Volume 4 of the ES).

4.4. Effects on terns

To demonstrate that there would not be an adverse effect on the integrity of relevant SPAs in the region relating to the potential for effects on terns, AHB produced a Clarification Note on the Effects on Terns (provided in Appendix 12). The Note draws on available survey data on tern numbers within Nigg Bay and the vicinity, and uses information presented in the ES and in the literature on tern foraging ranges and substrate preferences, to assess the potential for effects.

The Clarification Note concludes that Nigg Bay is not an area of particular importance to terns. Calculation of the potential foraging area for Sandwich terns (the only SPA featured tern species whose foraging range is likely to overlap with Nigg Bay) indicates that the area within the footprint of the AHEP is a small percentage of the foraging area, so there is not considered to be any significant loss of foraging habitat. This supports the conclusions within the HRA (Volume 4 of the ES) that there will be no adverse effect on SPA integrity in relation to terns.

5. Habitats Regulations Appraisal (HRA)

Marine Scotland Science and Whale and Dolphin Conservation requested additional information to support the HRA (Volume 4 of the ES), relating to the cumulative effects of underwater noise propagation on the east coast bottlenose dolphin population, including the

Moray Firth and Forth and Tay wind farm developments. Bottlenose dolphin is an Annex II species and a primary reason for the designation of the Moray Firth SAC.

The conservation objectives for the site are listed in Table 6.6 in the HRA and are reproduced below:

1) 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 favourable conservation status for each of the qualifying features.

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.*

2) To avoid deterioration of the habitats of 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 interests.

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.*

Objective 1) primarily relates to the avoidance of deterioration of qualifying habitats. As stated in Section 6.3.2.1 within the HRA, the qualifying Annex I habitat 'Sandbanks which are slightly covered by sea water all the time' are not considered, as no Likely Significant Effect on this feature was identified.

Objective 2) primarily relates to the disturbance of qualifying species or their habitats for which the site is designated (i.e. bottlenose dolphin). Section 6.3.2.1 within the HRA considers the effects of the construction and operation of the AHEP on bottlenose dolphin and concludes that there will be no adverse effects on site integrity. In addition, the cumulative effects on bottlenose dolphin of underwater noise generated during the construction of the AHEP and the Moray Firth and Forth and Tay wind farm developments have been considered in further detail, and an amended version of Table 6.1 within the HRA has been produced to specifically address this issue (provided in Appendix 13). The table sets out the various mitigation measures that are proposed in the ES and in the two Clarification Notes on Underwater Noise and Blasting Methodology and Mitigation (see Sections 4.1 and 4.2 respectively). The table concludes that provided these mitigation measures are employed, the cumulative effects relating to displacement of bottlenose dolphin due to underwater noise propagation during the construction of the AHEP are considered to be no worse than as assessed in the AHEP ES or HRA.

6. Conclusion

The sediment sampling undertaken in February – March 2016 reveals that the levels of heavy metals and polycyclic aromatic hydrocarbons (PAHs) in a number of the samples are elevated above the levels that were observed in the ES. An assessment of the implications on the dredging and disposal methodology has concluded that the methodology presented in the ES and the BPEO remains unchanged and there is no increased risk of contamination of the marine or terrestrial environments.

Four Clarification Notes have been produced to address specific issues raised by consultees. All four Notes conclude by supporting the findings in the ES and/or HRA (Volume 4 of the ES) that there will be no adverse effects on the species considered. Additional mitigation measures have been proposed in these Notes, which in all cases result in a reduction in the predicted level of environmental impact than is presented in the ES.

An additional assessment of the cumulative effects on bottlenose dolphin of underwater noise generated during the construction of the AHEP and the Moray Firth and Forth and Tay wind farm developments has concluded that the effects are considered to be no worse than as assessed in the AHEP ES and/or HRA.

In summary, the additional information presented in this report does not materially alter the conclusions of the original ES or HRA.

7. References

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