11 FISHERIES AND FISHING ACTIVITY

11.1 Introduction

11.1.1 This section of the ES describes the existing environment in relation to fisheries and fishing activity and assesses the potential impacts of the construction and operational phases of the proposed scheme. The decommissioning phase would not give rise to any impacts on the marine environment and, therefore, is excluded from further consideration within this section. Mitigation measures are detailed where significant impacts have been identified and residual impacts assessed.

11.2 Guidance and consultation

Policy and guidance

Marine Policy Statement

11.2.1 The MPS states that fishing activity is sensitive to changes in other sea uses, with marine developments having the potential to prevent, displace or encourage fishing activities. There are potential social, economic and environmental implications of displacement of fishing activity caused by other sea uses, particularly if from well-established fishing grounds.

11.2.2 The MPS states that the coastal environment is important as a corridor for migrating Atlantic salmon and European eel, as well as providing the marine feeding ground for sea trout. These important species that support coastal and inland commercial fishing and recreational angling could be vulnerable to a wide range of coastal activities. Marine plan authorities should consider the potential social and economic impacts of other developments on fishing activity, as well as potential environmental impacts.

Redcar and Cleveland Borough Council Local Plan

11.2.3 RCBC adopted its Core Strategy in July 2007 and this provides the development framework for the Borough over the plan period to 2021. At the same time, the Council adopted its Development Policies Document which provides detailed development control policies that are intended to deliver the overarching policy objective of the Core Strategy. Development Plan Document policies of relevance when considering the proposed scheme in relation to the natural fisheries resource include:

- CS24: Biodiversity and geological conservation): the Borough's biodiversity and geological resource will be protected and enhanced. Priority will be given to:
  - Conserving and enhancing biodiversity and geodiversity sites and features in line with PPS9;
  - Improving the integrity and biodiversity value of wildlife corridors particularly along the coast, around the Teesmouth estuary and linking with the North York Moors;
  - Meeting the objectives and targets in the UK and Tees Valley Biodiversity Action Plan (recently disbanded and replaced by the Tees Valley Nature Partnership); and,
  - Strengthening populations of protected species.

Stockton-on-Tees Borough Council Local Plan

11.2.4 As illustrated on **Drawing PB1586-SK90**, the policies within the SBC Local Plan are also of relevance to this section of the ES.

11.2.5 SBC adopted its Core Strategy in March 2010 and this provides the development framework for the Borough over the plan period to 2026. SBC is in the process of producing its Core Strategy Review and Regeneration and Environment LDD, which will contain further planning policies which will shape development until 2029. A draft of the document is due to be published for consultation in February 2015, with the intention to adopt the final version in December 2015. Development Plan Document policies of relevance to this section of the ES comprise:

- CS10: Environmental protection and enhancement.
  - Development throughout the Borough and particularly in the Billingham, Saltholme and Seal Sands area will be integrated with the protection and enhancement of biodiversity, geodiversity and landscape.

Guidance

11.2.6 The principal guidance documents used to inform the assessment of potential impacts to the natural fisheries resource and fishing activity are as follows:

- Guidance note for Environmental Impact Assessment in respect of Food and Environmental Protection Act (FEPA) and Coast Protection Act (CPA) requirements (Cefas, 2004).
- OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR Commission, 2008).
- The Salmon and Freshwater Fisheries Act 1975 which is aimed at the protection of freshwater fish, with a particularly strong focus on salmon and trout.

Consultation

11.2.7 A summary of the comments received from PINS in the formal Scoping Opinion with regard to fisheries and fishing activity is presented in **Table 11-1**. The comments received during consultation under Section 42 of the Planning Act 2008 with regard to fisheries and fishing activity have also been summarised in **Table 11-1**

11.2.8 A separate consultation exercise was undertaken with the Environment Agency during December 2013 in order to identify and source baseline information with regard to fish migrations along the Tees estuary. This approach was in accordance with that proposed within the Environmental Scoping Report (Royal HaskoningDHV, 2013) (i.e. desk based assessment).

11.2.9 During this consultation, the Environment Agency recommended that the EIA for the proposed scheme should be informed by fish count data recovered from the Tees Barrage. This data was subsequently provided to Royal HaskoningDHV during December 2013 by the Environment Agency, and has been used to inform this section of the ES.

11.2.10 Consultation with the North Eastern Inshore Fisheries and Conservation Authority (NEIFCA) was also undertaken during March 2013 to discuss the sea fisheries interests within the area (as recommended within the Environmental Scoping Opinion (PINS, 2013)). The results of the discussion have been used to inform this section of the ES.

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Table 11-1 Summary of scoping comments received from PINS and comments received during consultation under Section 42 of the Planning Act 2008 with regard to fisheries and fishing activity

Consultation Comment	Response / Section of the ES in which the comment is addressed
Scoping comments (January 2014)	
Secretary of State	
The applicant should ensure that any existing data to be used in the assessment is relevant and up to date. Primary data collected in relation to other topics (e.g. hydrodynamic and sedimentary regime and marine and coastal ornithology) should be fed into the assessment.	**Section 11.3**
The applicant is advised to consult with fishing organisations within the local area to determine the origin of any fishing vessels and how and where they operate, in order to inform the assessment.	**Section 11.2**
MMO	
The potential impacts on marine sediment and water quality must be assessed with relation to sensitive receptors such as shellfisheries, spawning and nursery areas and migratory routes.	**Section 11.5**
Cod, spurdog, anglerfish, whiting, sprat, lemon sole and nephrops use this general area and should be assessed alongside currently identified species.	Noted.
The ES must also include an assessment of the effects, if any, on those species and habitats on the OSPAR list of threatened and declining species and habitats.	**Sections 11.5 and 11.6**
The effects on natural fisheries resource from changes to marine sediment and water quality must also be assessed.	**Section 11.5**
Environment Agency	
The development is in close proximity to national and internationally designated sites for nature conservation. On this basis, any proposed piling may disturb migratory fish.	**Section 11.5**
Further information on timing, methodology and type/number of piles should be included in the ES. Winter piling is preferred in order to safeguard migratory fish. If piling is required outside of the winter period, the Environment Agency may recommend tidal restrictions during key mitigation periods, or measurable mitigation measures put in place.	Refer to **Section 3 and Section 11.5**

Consultation Comment	Response / Section of the ES in which the comment is addressed
The dredging method is to be discussed and agreed with the Environment Agency in advance of work to protect migratory fish. Information on timings, method, destination of spoil, quality of spoil, monitoring of dissolved oxygen / turbidity are to be provided to the Environment Agency.	Refer to **Section 3 and Section 11.5**
Details of the piling operations on land should also be considered as this can also affect migratory fish.	**Section 11.5**
The EA stated that NEIFCA should be contacted to provide advice on sea fisheries interests, as should the National Federation of Fishermen's Associations. The most recent rod catch data should be used.	**Section 11.2**
The preferred dredge window is from 1 December to 31 March, as the main salmonid migration period is from mid-April to the end of November. The dredge may cause increased turbidity and a decrease in dissolved oxygen levels, providing a barrier to migration or in extreme cases fish mortality.	Refer to **Section 3 and Section 11.5**
Section 42 consultation responses	
Environment Agency	
Both options show significant loss of available intertidal habitat. Intertidal habitats are a key marine habitat and have high abundance of species. They are highly productive which support large areas of predatory birds and fish. They provide feeding and resting areas for populations of migrant and wintering waterfowl and are also important nursery areas for fish. On the Tees, areas of mudflat are fragmented and this area is seen as a potentially important resource.	**Sections 11.5 and 11.6**
The Salmon and Freshwater Fisheries Act 1975 is aimed at the protection of freshwater fish, with a strong focus on salmon and trout. There are many activities that could constitute an offence under this Act including direct mortality, barriers to migration and degradation of habitat.	**Sections 11.5 and 11.6**
Analysis of potential noise impacts to seals is provided in the PER, but this is not extended to migratory fish. Piling has potential to affect migratory fish runs. Between 1 March and 30 November, no piling work should take place for 3 hours following low water to allow migration of adult salmon and sea trout. During May, no piling should take place to allow migration of juvenile salmon and sea trout. On this basis, assessment of potential noise impact of migratory fish should be undertaken with appropriate mitigation provided.	**Section 11.5** specifically addresses the impacts of underwater noise to a range of fish species

Consultation Comment	Response / Section of the ES in which the comment is addressed
MMO	
The increase in suspended sediment should be assessed in terms of the potential barrier to fish migration and behavioural effects, and this should be included in the ES.	**Section 11.5**
Natural England	
The ES should thoroughly assess the impact of the proposals on habitats and/or species listed as Habitats and Species of Principal Importance. Section 40 of the NERC Act 2006 places a general duty on all public authorities to conserve and enhance biodiversity. Natural England advises that survey, impact assessment and mitigation proposals for Habitats and Species of Principal Importance should be included in the ES. Consideration should also be given to those species and habitats included in the relevant LBAP.	It was not considered appropriate to survey for all 943 species and 56 habitats listed as Habitat and Species of Principal Importance. However, an assessment into effects on species and habitats which are known to be present within the estuary from previous assessments and site specific surveys has been undertaken to enable the potential impact on Habitats and Species of Principal Importance to be assessed; see **Sections 11.5 and 11.6**
A full assessment of impacts due to dredging will be needed in the ES.	**Sections 11.5 and 11.6**
The king piles for the solid quay option will be approximately 2m in diameter, whereas the subsea acoustic modelling assumed a diameter of 914mm. Clarity was requested regarding why the worst case pile diameter was not used.	Following issue of the PER, the acoustic modelling was completed to include using a worst case 2m diameter pile size for the solid quay option. The updated results from the modelling have been used within the impact assessment.

11.3 Methodology

Study area

11.3.1 The study area for this section of the ES comprises the Tees estuary, extending from the mouth of the estuary at the North and South Gare breakwaters, upstream to the Transporter Bridge.

Existing environment

11.3.2 The fisheries resource of the Tees estuary is well understood from several years of data gathered by the Environment Agency. In addition to the existing data, additional site-specific data regarding fish usage in the area was gathered as part of the benthic ecological survey, as discussed below.

Site-specific data

11.3.3 A site-specific benthic survey was undertaken in July 2014 which involved a total of 10 benthic trawls within the study area to sample epifauna. The trawls were evenly distributed across the sampling area and a five minute trawl (20mm mesh with a 5mm cod end) was undertaken at each of the 10 locations.

11.3.4 The results of the benthic trawls have been used to inform understanding of the existing environment with regard to fish usage of the Tees estuary.

Underwater noise modelling

11.3.5 Within the Environmental Scoping Opinion (PINS, 2014), Natural England recommended subsea acoustic modelling was undertaken to assist with the prediction of impacts to marine ecology due to piling. An underwater noise survey has therefore been completed, and a modelling exercise was commissioned for the proposed scheme (from Subacoustech). The results of the model have been used to assist with the prediction of potential impacts of the proposed scheme on resident and migratory fish species.

11.3.6 The methodology used for the underwater noise survey and modelling is presented in **Section 8.3**. The criteria used to assess the environmental effects of underwater noise from piling and dredging are also provided within **Section 8.3**.

11.3.7 Several species of fish have been identified as being of importance in the areas in and around the Tees estuary (discussed within **Section 11.4**). The species of fish considered within the underwater noise study were:

- Dab (*Limanda limanda*). Based on current peer reviewed audiogram data (Chapman and Sand, 1974), dab is the most sensitive flatfish to underwater sound. Hence, dab was used as a surrogate species for other flatfish (e.g. flounder and plaice) and where high quality audiogram data was not available. The dab audiogram was also used as a surrogate for European eel, due to a similar frequency response between these species (Jerko et at., 1989).
- Herring (*Clupea harengus*). Based on peer reviewed audiogram data (Enger and Anderson, 1967), herring is the most sensitive marine fish to underwater sound. Herring was used a surrogate for sprat as they are also a clupeiform fish.

- Salmon (*Salmo salar*). Salmon possess a substantial swim bladder, however as it is not in close proximity to the inner ear, salmon are therefore less sensitive to underwater noise and vibration. In the underwater noise study, audiogram data from Hawkins and Johnstone (1978) have been used.
- Sandeels or sand lances (*Ammodytes tobianus*) lack a swim bladder and generally have poor sensitivity to sound relative to other species considered in the assessment (Suga et al., 2005).
- Sea trout (*Salmo trutta*) are considered to have a low sensitivity to sound (Nedwell et al., 2006).

11.3.8 With regard to the Unweighted Metrics assessment criteria (discussed in Section 8.3), additional criteria have been considered for assessing the impact of noise on fish (based on work of the Fisheries Hydroacoustic Working Group (FHWG) in the USA). FHWS assigns criteria based on unweighted noise levels. This includes a peak SPL of 206 dB re 1 μPa (SPLpeak) and accumulated SEL over a period of time of 187 dB re 1 μPa2s. These generic criteria make no distinction between individual species.

OSPAR list of Threatened and/or Declining Species and Habitats

11.3.9 A review of the fish species and habitats present on the OSPAR list of Threatened and/or Declining Species and Habitats, and any adverse impacts upon species/habitats which could arise as a result of the proposed scheme, has been undertaken (see Section 11.4).

Habitats and species of principal importance in England

11.3.10 Section 41 of the Natural Environment and Rural Communities Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list has been drawn up in consultation with Natural England, and contains some 56 habitats and 943 species. A review of the habitats and species listed has been undertaken, and any impacts upon fish species and supporting habitat for fish species which could arise as a result of the proposed scheme has been undertaken.

Methodology for assessment of potential impacts

11.3.11 The generic assessment methodology used to determine the potential environmental impacts associated with the proposed scheme s set out within **Section 4**. A description of the criteria used to define receptor sensitivity is provided in **Table 11-2**.

Table 11-2 Receptor sensitivity and associated criteria with regard to fisheries and fishing activity

Sensitivity	Criteria
Very high	• The feature is protected under international status. • Environmentally important species, such as those of significant conservation concern, are likely to be killed and/or have their habitat destroyed by the proposed scheme. • Recovery is unlikely to occur within the operational life time. • Receptor extremely intolerant to change.
High	• The feature is protected under international / national status. • Environmentally important species, such as those of conservation concern, are likely to be injured and/or have their habitat changed by the proposed scheme. • Recovery is likely to occur within or shortly after the construction phase.

Sensitivity	Criteria
	• Receptor intolerant to change.
Medium	• The feature is protected under national statute or listed under the Biodiversity Framework • Diversity and function of a community may be reduced or degraded by the proposed scheme through partial destruction of habitat or disturbance to the population. • Recovery is likely to occur within the construction phase of the proposed scheme. • Receptor intolerant to change.
Low	• The feature is subject to a Local Plan. • Environmentally important species, such as those of conservation concern, however are unlikely to be killed / injured by the proposed scheme. • Recovery is likely to occur within the construction phase of the project. • Receptor tolerant to change.
Very low	• The feature is common throughout the UK. • The impact is not detectable and does not impact on the survival or viability of the species. • Recovery would be immediate. • Receptor is highly adaptable and tolerant to change.

11.3.12 The magnitude of the effect on fisheries and fishing activity is presented in **Table 11-3**.

Table 11-3 Magnitude of effect with regard to fisheries and fishing activity

Magnitude	Criteria
Very high	• Total loss of resource with severe damage to key species/habitat. • Permanent, irreplaceable change to existing species/habitat which is certain to occur.
High	• Loss of resource, but not affecting the integrity of the resource. • Permanent, irreplaceable change to existing species/habitat which is likely to occur.
Medium	• A noticeable change (minor) in one (maybe more) key characteristics of the baseline environment. • Long term though reversible change, which is likely to occur.
Low	• Very minor loss of or alteration to one (maybe more) key characteristic of the baseline. • Distribution of spawning, nursery and feeding grounds would not be affected. • Short to medium term though reversible change, which could occur.
Very low	• Possible very minor change to the baseline which are not expected to be detectable above natural variation. • Short term, intermittent and reversible change, which is unlikely to occur.

11.3.13 The matrix presented in **Table 4-3** of this ES was used to determine the significance rating for the potential impacts presented in **Section 11.5 and 11.6.**

11.3.14 The predicted effects of the proposed scheme on the hydrodynamic and sedimentary regime and potential impacts on marine sediment quality, water quality and marine ecology are relevant to this section of the ES and, therefore, reference has been made to the findings of the EIA for these topic areas as appropriate.

11.4 Existing environment

Literature review of existing information on resident and migratory species

11.4.1 Tees Bay and the Tees estuary provide important habitats for a number of fish species which feed on benthic invertebrates found in subtidal and intertidal sediments. Intertidal habitats are a key marine habitat and have a high abundance of species; they are also typically highly productive and support large numbers of fish species. Further detail regarding the fish species known to be present within the Tees estuary is provided below.

11.4.2 The lower Tees estuary supports many fish, some of which are estuary dependant (e.g. *flounder Platichthys flesus*) and some temporary residents (e.g. plaice *Pleuronectes platessa*), which use the estuary as a nursery ground (Tansley 2003), with herring (*Clupea harengus*), sprat (*Sprattus sprattus*), cod (*Gadus morhua*), spurdog (*Squalus acanthias*), anglerfish *(Lophius piscatorius*), whiting (*Merlangius merlangus*), lemon sole (*Microstomus kitt*) and nephrops (*Nephrops norvegicus*) also recorded in the general area.

11.4.3 Herring and plaice are identified as BAP species and priority species by the grouped plan for commercial marine fish (UK BAP, 2009). Sandeels are also abundant in the local area and although there is no commercial fishery, they are an important food source for bird populations.

11.4.4 Migratory fish species are also present within the Tees estuary, including salmon (*Salmo salar*), sea trout (*S. trutta*), and European eel (*Anguilla anguilla*). Improvements in water quality in recent years have enabled the numbers of salmonids to steadily increase, and the Tees is now recognised as a main salmon river in England and Wales, for which the Tees Salmon Action Plan (SAP) is enforced by the Environment Agency. There are upstream movements of salmon from May onwards through summer to peak movement in September/October, with the downstream smolt run peaking in May.

11.4.5 The river lamprey (*Lampetra fluviatilis*) is found only in western Europe and is widespread in the UK. Whilst not a true ‘fish’ (as it is jawless), lamprey are a migratory species which grow to maturity in estuaries and then move into fresh water to spawn in clean rivers and streams. River lampreys enter the Tees estuary to spawn and have been observed at the Tees Barrage at Stockton. Sea lampreys have also been recorded within the Tees estuary.

Environment Agency monitoring

11.4.6 Since 2011, the Environment Agency has been monitoring migratory fish numbers within the Tees estuary through the use of an electronic fish counter. The electronic fish counter replaced a fish trap which was previously located at the Tees Barrage, and is a non-invasive method of monitoring fish passage at the Tees Barrage. The results of the fish counter have been validated by the Environment Agency using underwater video footage and infra-red lighting. The counter is a resistivity type counter, which relies on small changes in electrical resistance being detected when a fish passes over a set of electrodes positioned in the water channel. The counter is able to differentiate between fish moving upstream and downstream, as well as rejecting false signals caused by waves or debris.

11.4.7 It should be noted that the existing fish pass only represents one potential route for fish passage at the barrage, and the Environment Agency is aware that fish would pass across the barrage gates at certain states of the tide. Therefore, the data from the electronic fish counter provides an index of the run rather than a total count of migratory fish within the Tees estuary.

Peak salmon and sea trout migrations

11.4.8 Environment Agency data from the electronic fish counter at the Tees Barrage shows that the salmon and sea trout migration period generally commences in May, with migrations peaking during July or August. Salmon and sea trout migrations continue through to October and November, however the numbers of fish migrating during these months are significantly lower than the peak months. This relationship is shown in **Figure 11-1**.

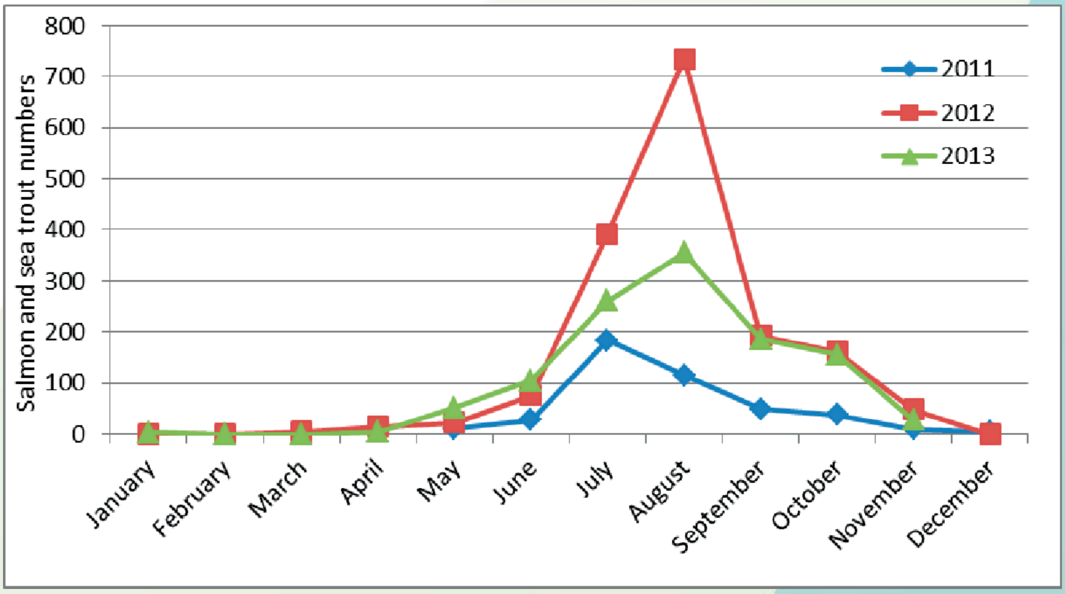
11.4.9 **Figure 11-1** shows that the peak salmon and sea trout run was during July in 2011 (183 salmon and sea trout recorded), August in 2012 (735 salmon and sea trout recorded) and August in 2013 (355 salmon and sea trout recorded). The data shows that there was a significantly greater number of salmon and sea trout migrating and recorded within the fish counter during 2012, in comparison with the data recovered during 2011 and 2013. The reason for this increase during 2012 is currently unknown.

Sea fisheries

11.4.10 Sea fisheries out to 6nm from the UK territorial baseline between the River Tyne and approximately the eastern bank of the Humber estuary fall under the jurisdiction of the NEIFCA. The Environment Agency has responsibility for the management of migratory fisheries for salmon, trout and eels within this area.

11.4.11 Consultation with NEIFCA has confirmed that most commercial fishing activity takes place outside of the estuary, although there is a small amount of fishing targeted at lobster (*Homarus gammarus*) and velvet swimming crab (*Necora puber*) in the lower estuary during summer. The digging of lugworms, ragworms and peeler crabs takes place in the intertidal mud and sandflats of the outer estuary and adjacent coast. Ragworm digging takes place throughout the year but peaks in May and September.

Figure 11-1 Salmon and sea trout catch data from the Tees Barrage electronic fish counter



11.4.12 **Table 11-4** identifies the fish species present on the OSPAR list.

Table 11-4 Summary of fish species present on OSPAR List of Threatened and/or Declining Species

Scientific name	Common name	OSPAR Regions where the species occurs	OSPAR Regions where species is under threat and/or decline
*Acipenser sturio**	Sturgeon	II, IV	All where it occurs
*Alosa alosa**	Allis shad	II, III, IV	All where it occurs
Anguilla anguilla	European eel	I, II, III, IV	All where it occurs
Centroscymnus coelolepis	Portuguese dogfish	All	All where it occurs
Centrophorus granulosus	Gulper shark	IV, V	All where it occurs
Centrophorus squamosus	Leafscale gulper shark	All	All where it occurs
Cetorhinus maximus	Basking shark	All	All where it occurs
Coregonus lavaretus oxyrinchus (Linnæus, 1758)	Houting	II	All where it occurs
**Dipturus batis* (synonym: *Raja batis*)	Common Skate	All	All where it occurs
**Raja montagui* (synonym: *Dipturus montagui*)	Spotted Ray	II, III, IV, V	All where it occurs
**Gadus morhua*– populations in the OSPAR regions II and III	Cod	All	II, III
Hippocampus guttulatus (synonym: *Hippocampus ramulosus*)	Long-snouted seahorse	II, III, IV, V	All where it occurs
Hippocampus hippocampus	Short-snouted seahorse	II, III, IV, V	All where it occurs
Hoplostethus atlanticus	Orange roughy	I, V	All where it occurs
Lamna nasus	Porbeagle	All	All where it occurs
Petromyzon marinus	Sea lamprey	I, II, III, IV	All where it occurs
Raja clavata	Thornback skate / ray	I, II, III, IV, V	II
Rostroraja alba	White skate	II, III, IV	All where it occurs
Salmo salar	Salmon	I, II, III, IV	All where it occurs
Squalus acanthias	[Northeast Atlantic] spurdog	All	All where it occurs
Squatina squatina	Angel shark	II, III, IV	All where it occurs
Thunnus thynnus	Bluefin tuna	V	All where it occurs

11.4.13 Of the species listed in **Table 11-4**, eel, cod, salmon and spurdog are known to be present within the Tees estuary.

Fish species present on the list of Species of Principal Importance

11.4.14 Table 11-5 identifies the fish species which are included on the list of Species of Principal Importance.

Table 11-5 Summary of fish species present on list of Species of Principal Importance

Scientific name	Common name	Species grouping	Taxon group
Acipenser sturio	Common sturgeon	Vertebrates	Fish - bony
Alosa alosa	Allis shad	Vertebrates	Fish - bony
Alosa fallax	Twaite Shad	Vertebrates	Fish - bony
Ammodytes marinus	Lesser Sandeel	Vertebrates	Fish - bony
Anguilla anguilla	European Eel	Vertebrates	Fish - bony
Aphanopus carbo	Black Scabbardfish	Vertebrates	Fish - bony
Clupea harengus	Herring	Vertebrates	Fish - bony
Cobitis taenia	Spined Loach	Vertebrates	Fish - bony
Coregonus albula	Vendace	Vertebrates	Fish - bony
Coregonus lavaretus	Whitefish (Powan, Gwyniad or Schelly)	Vertebrates	Fish - bony
Coryphaenoides rupestris	Roundnose Grenadier	Vertebrates	Fish - bony
Gadus morhua	Cod	Vertebrates	Fish - bony
Hippocampus guttulatus	Long-snouted Seahorse	Vertebrates	Fish - bony
Hippocampus hippocampus	Short-snouted Seahorse	Vertebrates	Fish - bony
Hippoglossus hippoglossus	Atlantic Halibut	Vertebrates	Fish - bony
Hoplostethus atlanticus	Orange Roughy	Vertebrates	Fish - bony
Lophius piscatorius	Sea Monkfish	Vertebrates	Fish - bony
Lota lota	Burbot	Vertebrates	Fish - bony
Merlangius merlangus	Whiting	Vertebrates	Fish - bony
Merluccius merluccius	European Hake	Vertebrates	Fish - bony
Micromesistius poutassou	Blue Whiting	Vertebrates	Fish - bony
Molva dypterygia	Blue Ling	Vertebrates	Fish - bony
Molva molva	Ling	Vertebrates	Fish - bony
Osmerus eperlanus	Smelt (Sparling)	Vertebrates	Fish - bony
Pleuronectes platessa	Plaice	Vertebrates	Fish - bony
Reinhardtius hippoglossoides	Greenland Halibut	Vertebrates	Fish - bony
Salmo salar	Atlantic Salmon	Vertebrates	Fish - bony
Salmo trutta	Brown/Sea Trout	Vertebrates	Fish - bony
Salvelinus alpinus	Arctic Charr	Vertebrates	Fish - bony
Scomber scombrus	Mackerel	Vertebrates	Fish - bony

Scientific name	Common name	Species grouping	Taxon group
Solea sole	Common Sole	Vertebrates	Fish - bony
Thunnus thynnus	Blue-fin Tuna	Vertebrates	Fish - bony
Trachurus trachurus	Horse Mackerel	Vertebrates	Fish - bony
Lampetra fluviatilis	River Lamprey	Vertebrates	Fish – jawless
Petromyzon marinus	Sea Lamprey	Vertebrates	Fish – jawless
Centrophorus granulosus	Gulper Shark	Vertebrates	Shark/skate/ray
Centrophorus squamosus	Leafscraper Shark	Vertebrates	Shark/skate/ray
Centroscymnus coelolepsis	Portuguese Dogfish	Vertebrates	Shark/skate/ray
Cetorhinus maximus	Basking Shark	Vertebrates	Shark/skate/ray
Dalatias licha	Kitefin Shark	Vertebrates	Shark/skate/ray
Dipturus batis	Common Skate	Vertebrates	Shark/skate/ray
Galeorhinus galeus	Tope Shark	Vertebrates	Shark/skate/ray
Isurus oxyrinchus	Shortfin Mako	Vertebrates	Shark/skate/ray
Lamna nasus	Porbeagle Shark	Vertebrates	Shark/skate/ray
Prionace glauca	Blue Shark	Vertebrates	Shark/skate/ray
Raja undulata	Undulate Ray	Vertebrates	Shark/skate/ray
Rostroraja alba	White or Bottlenosed Skate	Vertebrates	Shark/skate/ray
Squalus acanthias	Spiny Dogfish	Vertebrates	Shark/skate/ray

11.4.15 A number of species on the Species of Principal Importance list are known to be present within the Tees estuary, namely European eel, herring, cod, whiting, plaice, Atlantic salmon, sea trout, river lamprey and sea lamprey.

Results of the epibenthic beam trawl survey undertaken in 2014

11.4.16 The epibenthic beam trawl surveys undertaken during 2014 within and adjacent to the footprint of the proposed capital dredge and construction area has provided semi-quantitative records for the larger and more mobile epibenthic species and juvenile fish. The number of each individual fish species recovered within the trawl surveys is presented in **Table 11-6**. The location of beam trawls is shown in **Figure 11-2**.

Table 11-6 Fish and shrimp numbers recovered within epibenthic beam trawl surveys during 2014

Species	Epibenthic beam trawl number									
	AC02	AC05A	AC08	AC11	BP02	BP04	BP12	BP14	BP21	BP23 A
Five bearded rockling *Ciliata mustela*	0	0	0	1	0	0	1	0	0	0
Atlantic cod *Gadus morhua*	1	0	24	15	1	29	0	1	0	12
Whiting *Merlangius merlangus*	0	0	0	0	0	2	1	0	0	0
Atlantic Pollock *Pollachius pollachius*	0	0	0	12	0	0	0	0	0	0
Poor cod *Trisopterus minutus*	0	0	0	0	0	2	0	0	0	0
Short spined sea scorpion *Myoxocephalus scorpius*	0	0	0	1	0	0	0	0	0	0
Armed bullhead *Agonus cataphractus*	3	2	6	2	0	0	4	1	0	2
Butterfish *Pholis gunnellus*	0	0	0	1	0	0	0	0	0	0
Common gragonet *Callionymus lyra*	0	0	0	1	0	0	0	0	0	0
Sand goby *Pomatoschistus minutus*	0	2	0	0	1	0	0	0	1	0
Common dab *Limanda limanda*	2	2	0	0	2	2	2	0	0	0
European flounder *Platichthys flesus*	0	1	0	0	0	0	2	0	0	0
European plaice *Pleuronectes platessa*	3	0	0	3	0	5	3	1	3	0
Pink shrimp *Pandalus montagui*	12	2	12	1	0	0	8	21	0	102
Brown shrimp *Crangon crangon*	733	1,097	1,700	161	165	784	1,167	397	156	1,108

Figure 11-2 Location of beam trawl sampling stations

Map Document: (V:\J3032646_YorkPotashMarineWorks\3_Plots\2_Draft\Q2646_BeamTrawl_SXC_20140930.mxd)
30/09/2014 - 13:05:04

11.4.17 Atlantic cod *Gadus morhua* (highlighted in green above) is listed on the OSPAR List of Threatened and/or Declining Species and Habitats. *G. morhua*, whiting *Merlangius merlangus* and plaice *Pleuronectes platessa* are also listed as Species of Principal Importance (highlighted in blue above).

11.4.18 It is difficult to draw conclusions from data collected from the beam trawl surveys undertaken in 2014, given that these areas have been sampled for a limited period of time and therefore represent a snapshot of the fish usage of the area. However, the data in **Table 11-6** indicates that the brown shrimp *Crangon crangon* was the dominant species recovered. The number of individuals recorded of species listed on the OSPAR List of Threatened and/or Declining Species and the list of Species of Principal Importance was low. The majority of species present within the beam trawl surveys are not present on either the OSPAR List of Threatened and/or Declining Species and Habitats, or the list of Species of Principal Importance. **Table 11-7** summarises the fish species of conservation interest that were recorded during the survey.

Table 11-7 Fish species recorded during the survey and the associated conservation interest

Species	Common name	NERC Act 2006	OSPAR	IUCN Red List	Bern Convention
Gadus morhua	Cod	✓	✓	✓	·
Merlangius merlangus	Whiting	✓	·	·	·
Trisopterus minutus	Poor cod	·	·	✓	·
Pomatoschistus minutus	Sand goby	·	·	·	✓
Platichthys flesus	Flounder	·	·	✓	·
Pleuronectes platessa	Plaice	✓	·	✓	·

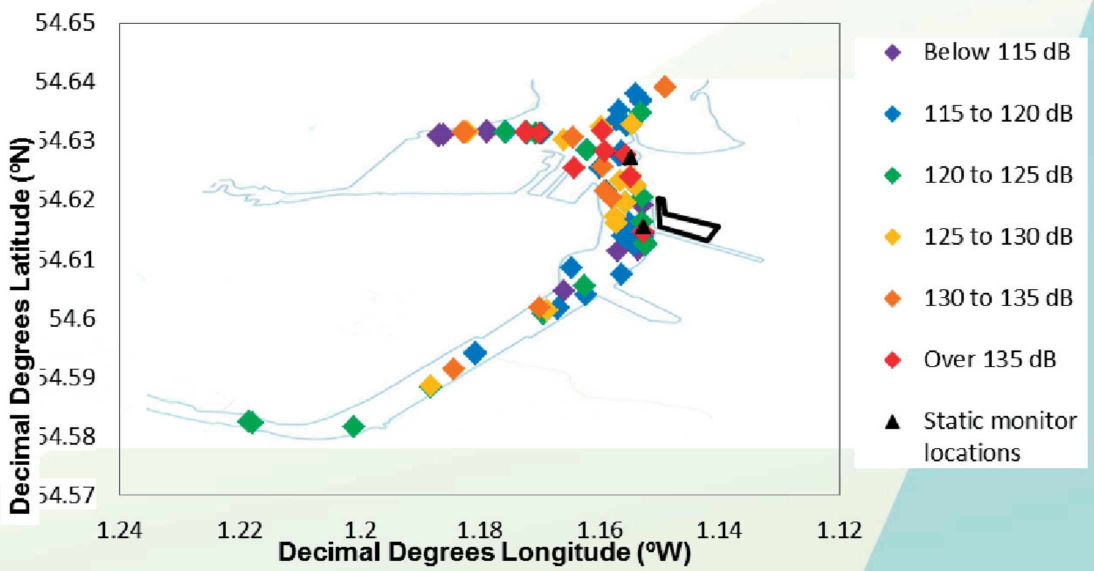
Results of the underwater noise survey

Measurement results

11.4.19 Measurements undertaken during the underwater noise survey have been analysed to determine the sound pressure levels and to identify the main contributing sources of noise that make up the ambient underwater noise environment in the vicinity of the proposed scheme footprint.

11.4.20 **Figure 11-3** presents the mean RMS sound level for all measurements taken throughout both days of the underwater noise survey at various points within the Tees estuary.

Figure 11-3 Location of average RMS sound levels for all measurements recorded during both days of the underwater noise survey



11.4.21 As shown in **Figure 11-3,** the level of underwater noise during the survey was typically in the region of 115 to 120 dB re 1 µPa RMS along the centre of the river. This is considered to be relatively high noise levels for a wide, slow flowing river and is due to the high level of shipping, engines and generators which are audible along the entire length of the main channel. The Seaton Channel was found to be fairly quiet by comparison, with the exception of noise associated with the water intakes for the nuclear power plant.

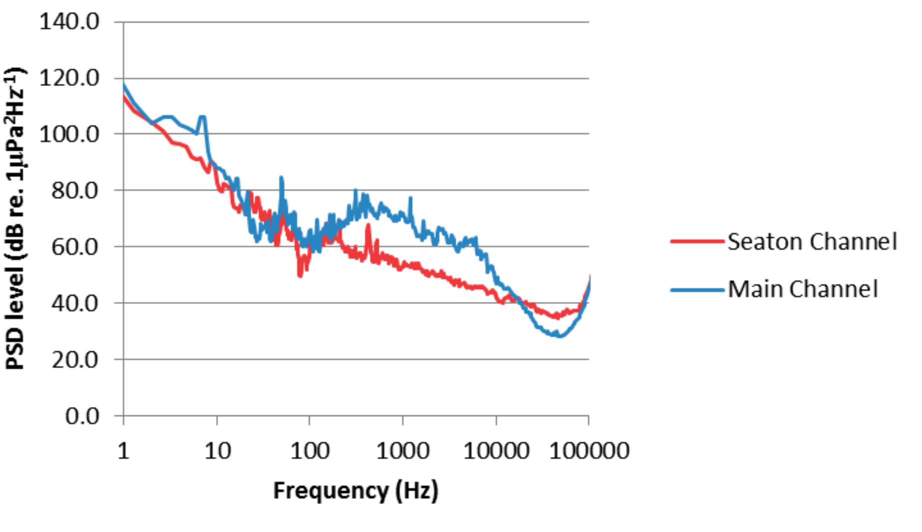
11.4.22 The soundscape of the river is constantly changing due to ships travelling up and down the river, so the average RMS sound levels illustrated in **Figure 11-3** are a 'snapshot' of the noise levels encountered.

Baseline noise levels

11.4.23 **Figure 11-4** shows the frequency spectra of two recordings which were both recorded with no visible vessel traffic or any other significant noise source in the area. Both frequency spectra can therefore be considered as representative of the background noise level at the location where they were recorded.

11.4.24 The Seaton Channel recording presented in **Figure 11-4** shows a typical frequency spectrum for a quiet river with minimal influence of anthropogenic noise. The average sound level for this recording was 101.5 dB re 1 µPa RMS. In contrast, the main channel of the Tees estuary shows increased underwater noise levels from 100 to 20,000 Hz of around 15 dB, with an overall average sound level of 110.6 dB re 1 µPa RMS. The increase is due to the almost contact shipping activity at various points of the river (although no vessels were visible nearby at the time of monitoring). Noise from stationary ships with their generators running also contributes to background noise levels within the main channel.

Figure 11-4 Frequency spectra of background noise in the main channel of the River Tees and the Seaton Channel

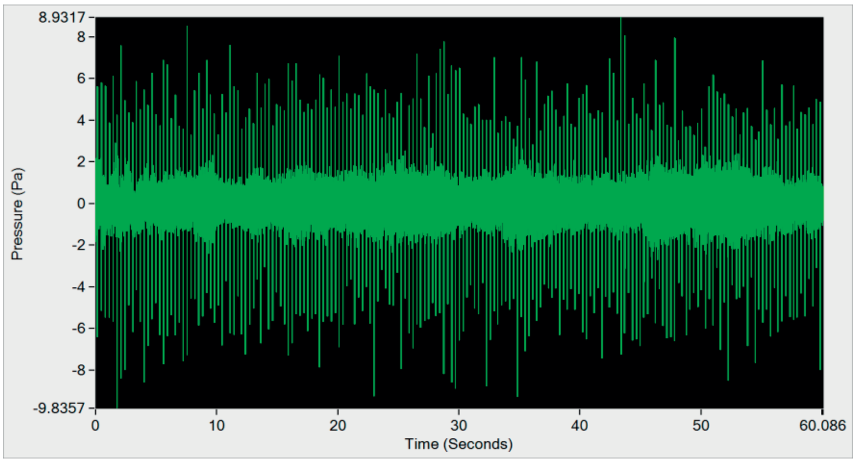


Dredging noise

11.4.25 **Figure 11-5** presents a 60 second time history of a recording of a dredger operating approximately 1km from the noise survey vessel. A distance of 1km between the survey vessel and the dredger was maintained to prevent disturbance to dredging operations.

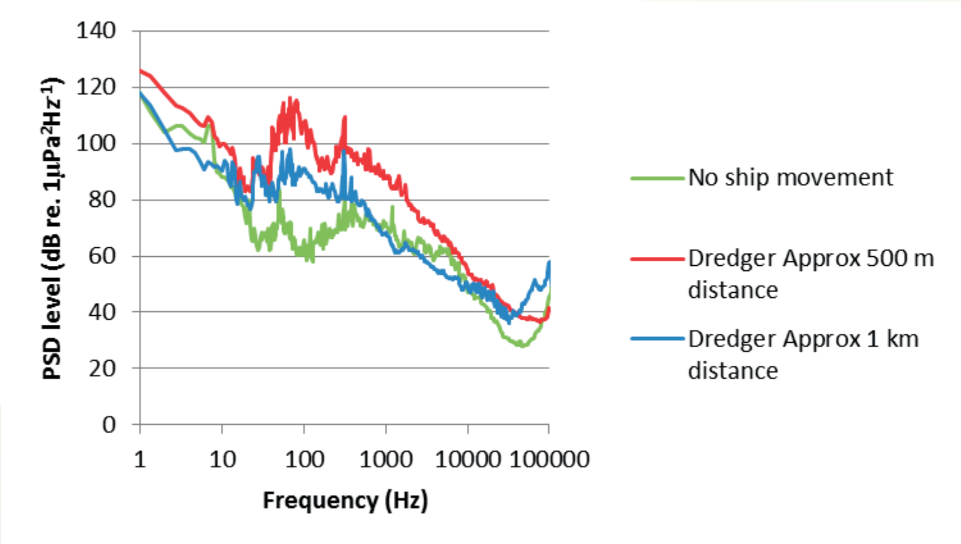
11.4.26 The most obvious sound source in **Figure 11-5** is the dredger's echo sounder which pulses around three times a second reaching sound pressures from approximately -9 to +8 Pa. The sound produced by the dredger machinery is of a fairly constant level, and at this distance fluctuated between -2 and +2Pa. These combined sources produced a sound level of 114.6 dB re 1 µPa at 1km.

Figure 11-5 Time history of a dredger operating approximately 1km from the noise survey boat



11.4.27 **Figure 11-6** presents the frequency spectrum of the time history shown in **Figure 11-5**, as well as one of the measurements taken closer (approximately 500m) to the dredger but with no audible echo sounder, and the background noise level from the main channel shown in **Figure 11-4.** The average sound level of the second dredger sample was 129.8 dB re 1 µPa RMS. This measurement can be considered a background noise level of the river. Although it reaches a high instantaneous sound pressure, the echosounder does not make up a large component of the overall sound level as the pulses are so short and high frequency. Most of the noise can be seen to be made up of the lower frequencies, in the region of 50 to 1000 Hz with many tonal components, typical of most ship and engine noise underwater. The small increase at higher frequencies can be seen toward the upper end of the hydrophone's range.

Figure 11-6 Frequency spectra of two recordings of dredging compared to a recording on the main channel with no visible moving vessels

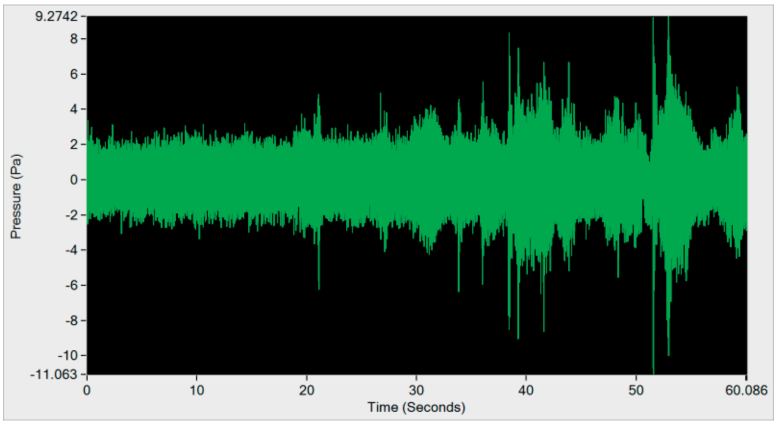


Shipping noise

11.4.28 Shipping noise was present in all measurements excluding some taken towards the end of Seaton Channel, making it the largest contributor to the overall sound level in the river. This is partly due to the many moored ships serving a large number of purposes, including gas ships or container ships.

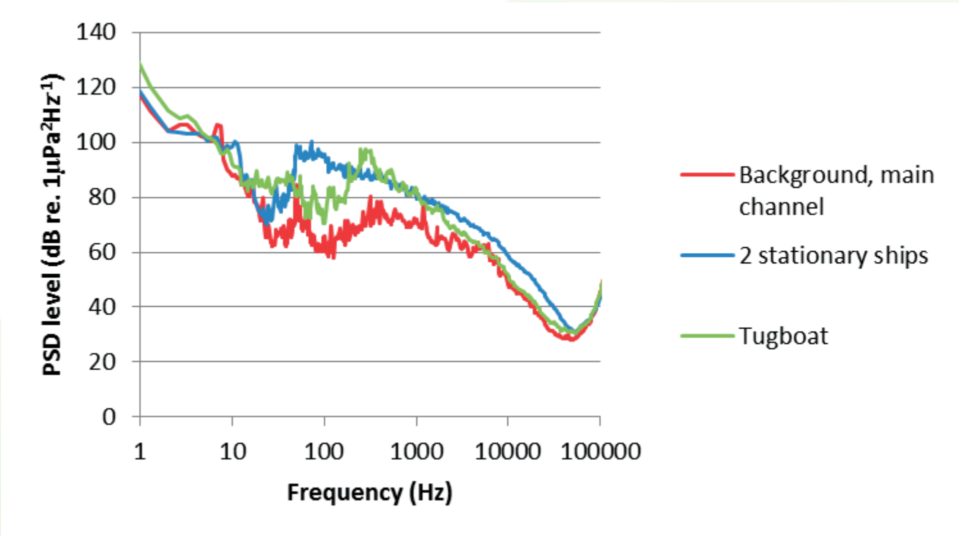
11.4.29 Even when moored, each ship produces a significant amount of noise from unloading and loading, and any generators running on board. No measurements of large vessels in transit were able to be recorded during the survey due to the risk of drifting into their path, so Figure 11-7 shows a recording of two stationary ships, while one or both of them were being loaded.

Figure 11-7 Time history of a recording taken at a distance of around 80m from two ships, the 'Elena VE' and the 'Wilson Hull' while one or both of them were being loaded



11.4.30 **Figure 11-8** compares the frequency spectra of the two stationary ships to one of a tug that was moving at around 1km from the survey vessel and the background noise in the main channel.

Figure 11-8 Frequency spectra of the recording shown in the previous figure compared to one taken of a tug underway and the background noise on the main channel

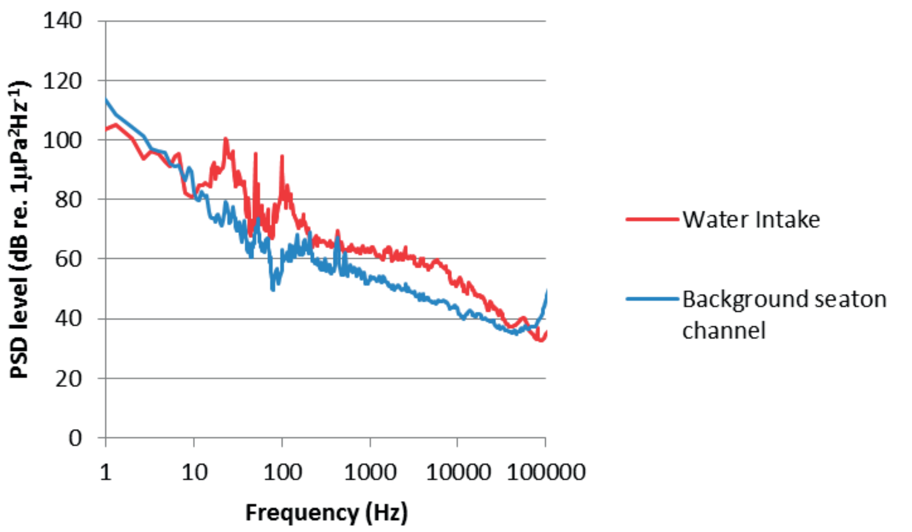


11.4.31 Shipping produces noise over a very wide frequency band from around 50 Hz to 50 kHz in some cases. This varies from ship to ship as it can be seen that the tug produces less noise below 200 Hz than the two stationary ships.

Water intakes

11.4.32 The water intake from the Hartlepool nuclear power station lies near to the entrance of Seaton Channel. It was audible from where the noise measurements were taken, approximately halfway across the river channel at a distance of approximately 100m. **Figure 11-9** shows the frequency spectra from a recording of the noise the intakes produce compared to background noise on the Seaton Channel. The intakes produce noise primarily of low frequency in the region of 10 to 200 Hz, which makes an average noise level of 111.1 dB re. 1 μPa RMS.

Figure 11-9 Frequency spectra of the noise from the water intake at Hartlepool nuclear power station compared to the background level in the Seaton Channel



Measured unweighted sound pressure levels

11.4.33 The measured maximum, minimum and mean unweighted RMS sound pressure levels, divided by area of the Tees estuary are shown in **Table 11-8**. Vessels present in the vicinity of the survey boat were noted and the approximate number and type of vessel is given below.

11.4.34 All levels measured are in keeping with typical riverine ambient noise levels previously measured by Subacoustech in the UK. As might be expected due to the lower level of shipping in Seaton channel, it can be seen that, the mean sound pressure level (SPL) for Area 3 was the lowest on day 1 at 115.3 dB re. 1 μPa RMS, but on Day 2, Area 4 had the lowest level at 112.9 dB re. 1 μPa RMS. This was the result of no shipping activity being undertaken at the time the measurements were taken.

Table 11-8 Maximum, minimum and mean RMS SPLs measured in each area of the Tees estuary during the underwater noise survey

		02-04-2014		03-04-2014	
Unweighted RMS Level		**Level (dB re 1 µPa)**	**Comments**	**Level (dB re 1 µPa)**	**Comments**
Area 1	Max	125.1	Tugboat boat 1 km away. Unidentified echosounder audible.	132.7	
	Min	111.6		105.8	
	Mean	118.5		120.4	
Area 2	Max	139.5	Many moored ships, such as the '*Nordic Sola*', some loading. Some construction noise. 2 tugs 1 km away.	142.3	Dredger 500 m to 1 km away. Many moored ships, such as the '*Trout*', '*Sea Sprat*', '*SKS Sinni*', '*Odin*' and others.
	Min	107.3		108.4	
	Mean	117.5		120.1	
Area 3	Max	132.8	Maintenance work on jackup barges in progress. Noise from Water intakes.	141.1	Noise from water intakes.
	Min	96.6		105.0	
	Mean	115.3		114.4	
Area 4	Max	133.0	Dredger 500 m - 1 km away	117.8	Pilot boat passed.
	Min	113.0		107.9	
	Mean	122.4		112.9	
Overall	Max	133.0		142.3	
	Min	96.6		105.0	
	Mean	118.0		118.9	

Fixed monitor results

11.4.35 The fixed monitor hydrophone was deployed from a large pellet buoy. The data from the fixed monitor hydrophone was filtered to remove very low frequency noise (below 100 Hz) generated as a result of hydrophone movement within the water column. This data (presented in **Figure 11-10 and Figure 11-11**) has been included within this ES to illustrate the variability in the level of underwater sound within the Tees estuary.

11.4.36 Peaks with a long rise and fall time are caused by ships approaching and receding from the monitor, one of which caused the highest recorded sound level of 153.1 dB re. 1µPa. Much shorter peaks were caused by bangs in ship loading or construction.

11.4.37 The background level when there were no ships passing was slightly higher on 3 April 2014 than that recorded on 2 April 2014. This may have been due to the higher windspeed, or the fact that the monitor was placed closer to the location of moored ships whose generator noise may have been picked up by the hydrophone.

Figure 11-10 RMS sound level recorded by the fixed monitor hydrophone on 2 April 2014

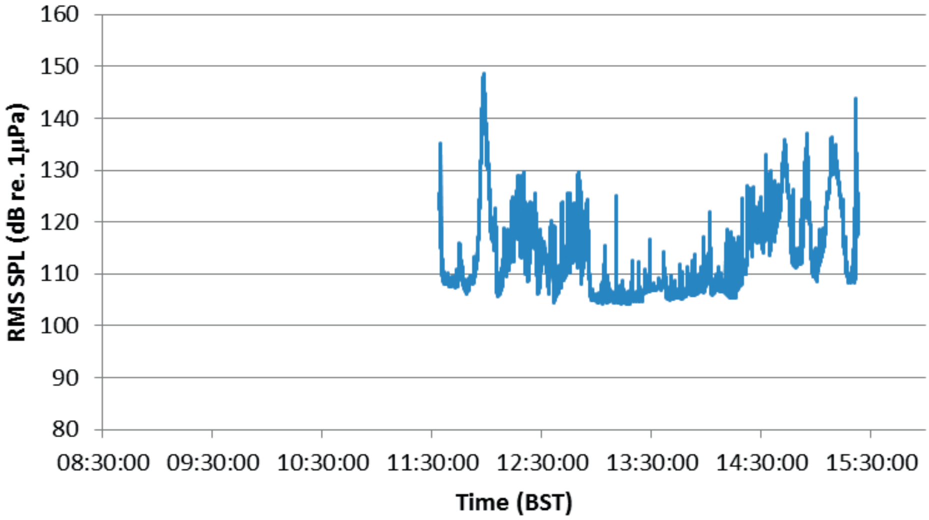
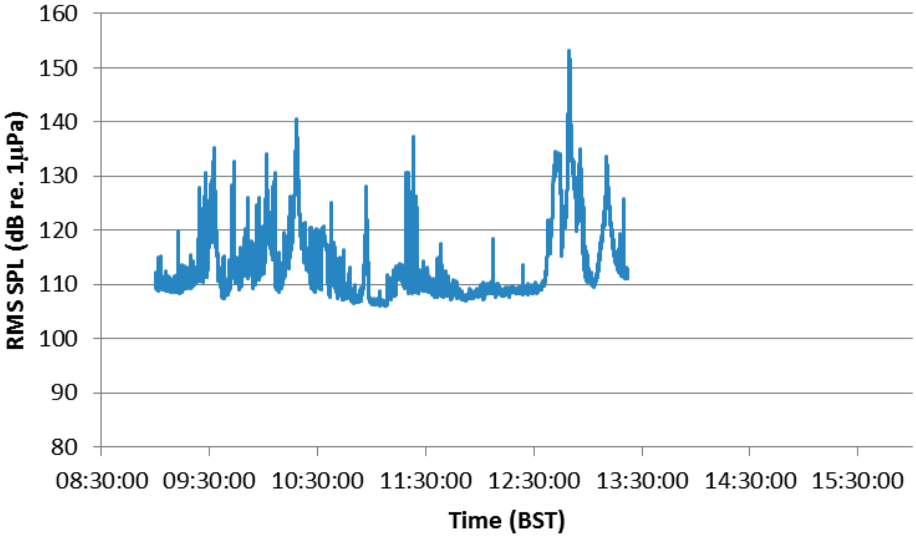


Figure 11-11 RMS sound level recorded by the fixed monitor hydrophone on 3 April 2014



Interpretation of underwater noise survey results

11.4.38 **Table 11-**9 and **Table 11-10** show the maximum, minimum and mean SPL from each area of the Tees estuary during both days of the survey, analysed in terms of the hearing abilities of bass, cod, dab, herring and salmon. The species upon which the analysis has been conducted in the underwater noise study was based upon regional significance and also upon the availability of a good quality peer reviewed audiogram.

Table 11-9 dB$_{ht}$ RMS sound levels for fish for each measurement area on 2 April 2014

Day 1:02-04-2014		RMS dB$_{ht}$(*Species)*				
Area		Bass	Cod	Dab	Herring	Salmon
1	Max	19.9	38.2	21.0	44.6	15.1
	Min	-4.2	24.2	0.7	30.4	1.3
	Mean	9.6	30.3	10.1	38.9	6.6
2	Max	30.7	52.2	38.6	54.4	31.3
	Min	1.6	20.6	-0.1	27.1	-4.5
	Mean	12.9	32.4	13.8	38.5	9.7
3	Max	9.5	35.2	24.9	41.1	13.1
	Min	-16.8	3.1	-13.4	8.2	-17.5
	Mean	1.9	26.2	14.8	31.8	4.6
4	Max	31.5	51.4	36.6	56.2	30.3
	Min	8.5	27.9	11.2	34.4	4.2
	Mean	19.0	39.3	23.2	44.6	16.9
Overall	Max	31.5	52.2	38.6	56.2	31.3
	Min	-16.8	3.1	-13.4	8.2	-17.5
	Mean	11.5	32.0	14.6	38.4	9.3

Table 11-10 dB$_{ht}$ RMS sound levels for fish for each measurement area on 3 April 2014

Day 2:03-04-2014		RMS dB$_{ht}$(*Species)*				
Area		Bass	Cod	Dab	Herring	Salmon
1	Max	26.7	44.8	28.8	52.5	23.6
	Min	-0.4	16.5	-4.1	26.3	-5.5
	Mean	14.8	32.8	14.4	40.7	10.6
2	Max	39.0	62.4	49.6	66.1	40.5
	Min	-1.6	15.2	-4.5	25.1	-9.5
	Mean	15.0	35.4	18.8	40.7	13.3
3	Max	22.4	43.2	33.4	69.6	43.6
	Min	-8.6	11.7	-5.4	34.1	6.8
	Mean	1.3	25.8	13.2	47.8	20.2
4	Max	7.7	28.0	16.5	35.3	5.1
	Min	-1.7	17.1	6.0	27.3	-5.8
	Mean	0.5	22.1	11.6	30.3	-0.4
Overall	Max	39.0	62.4	49.6	66.1	40.5
	Min	-8.6	11.7	-5.4	16.9	-9.5
	Mean	12.1	32.7	16.8	38.7	10.5

11.4.39 For dB_{ht} levels that have been calculated to be below 0dB, this indicates the level of sound was below the target species hearing threshold and they would not be able to perceive it.

11.4.40 It can be seen that the vast majority of dB_{ht} levels for fish (bass, cod, dab, herring and salmon) are less than 50 dB_{ht}. It should be noted that the measurements taken in close proximity to the moored ships and the water intakes rarely exceed 50 dB_{ht}. Exceedances of 50 dB_{ht} are evident within **Table 11-8** and **Table 11-9** with regard to herring and cod, as these species are considered to be hearing specialists.

Summary of underwater noise modelling results

11.4.41 The results of the underwater noise model with specific regard to noise generated as a result of impact piling, dredging and increased vessel activity are presented in **Section 8.4**.

Receptor sensitivity

11.4.42 Based on the information presented above, it is considered that the sensitivity of fish species present within the estuary is variable. A conservative estimate of high sensitivity for fish species within the estuary has been used in the impact assessment presented below.

11.5 Assessment of potential impacts during construction

Effects on the fisheries resource from changes to marine water quality

11.5.1 As discussed in **Section 5**, a proportion of the material that would be disturbed during dredging would be re-suspended into the water column. Hence, the construction phase would result in temporary increases in the TSS concentrations of the water column.

11.5.2 As discussed within **Section 3**, an enclosed grab is proposed for dredging the sediment present above the geological deposits within the footprint of the capital dredge. Therefore this would prevent the dispersion of contaminated sediment within the estuary during dredging. The potential for the release of uncontaminated sediment during dredging of the sands and gravels, clay and marl remains. The text below therefore relates to the potential impact associated with the resuspension of non-contaminated sediment.

11.5.3 An increase in the TSS concentration in the water column would increase turbidity and reduce the depth of water that light can penetrate and, therefore, the amount of light available for primary production by any phytoplankton and marine algae. Such impacts on phytoplankton and marine algae can impact upon food availability for fish species. At high levels and/or for prolonged periods of time, an increase in TSS concentrations can impact upon fish through clogging of gill lamellae, potentially leading to death, whilst lower concentrations can result in sub-lethal stress or avoidance reactions. Larvae and juvenile fish may be more susceptible to adverse physiological effects than mature fish as their sensory systems are less well developed. Consequently, they are less able to detect and avoid adverse conditions.

11.5.4 The re-suspension of sediment as a consequence of the proposed dredging could also potentially affect dissolved oxygen levels in the water column, particularly during summer months.

11.5.5 The proposed dredging activities within the berth pocket for Phase 1 of both forms of quay construction are currently programmed for the summer months. Dredging of the river channel for Phase 1 and dredging for Phase 2 of both forms of quay construction are anticipated to be undertaken during the winter months. The proposed timing of the dredging operation during Phase 1 dredging of the river channel and Phase 2 for both forms of quay construction (open quay and solid quay structure) significantly reduces the potential for disturbance to migrating salmon and sea trout associated with temporary reductions in water quality, given the minimal numbers of migrating salmonids during the winter months within the Tees estuary.

11.5.6 The increase in TSS concentrations has the potential to create a barrier to fish migrations and result in behavioural effects. In general, sediment plumes induced by dredging are considered to pose only a limited risk to water quality (and subsequently fish species) since the affected water usually has the capacity to accommodate an increased oxygen demand, particularly where dredging takes place in open sea or estuaries (CIRIA, 2000). The tidal exchange within the Tees estuary would remain unrestricted during the construction and operation phase, and peaks in TSS are only expected on a short term basis during Phase 1 and Phase 2. During dredging, the silts and clays disturbed would rapidly disperse away from the location of the dredge due to the relatively high current speeds in the unconfined area.

11.5.7 As discussed within **Section 3.1**, it is possible that the capital dredging could be carried out by a combination of a TSHD, CSD and a backhoe dredger, with an enclosed grab used for dredging contaminated sediments. Backhoe dredging and enclosed grab dredgers are considered likely to minimise the resuspension of sediment into the water column (assuming best operational practice is implemented during dredging).

11.5.8 The tidal exchange within the Tees estuary would remain unrestricted during dredging, which is anticipated to rapidly dilute and disperse temporarily increased suspended sediment concentrations.

11.5.9 In general, estuarine fish have a degree of tolerance to conditions of high TSS, as concentrations can vary significantly in response to tidal conditions and other events such as storms (increased wave action), high rainfall and ongoing maintenance dredging within the estuary.

11.5.10 Based on the discussion above, it is considered that the magnitude of effect on the fisheries resource (a receptor of high sensitivity, as a worst case scenario) as a result of reduced water quality (increased TSS concentrations) from dredging is low, and an impact of **minor adverse** significance is predicted.

Mitigation measures and residual impact

11.5.11 As noted above, dredging works are to be undertaken by a combination of TSHD, enclosed grab, CSD and backhoe. The use of an enclosed grab has been built into the design as embedded mitigation, in order to minimise the dispersion of contaminated material during dredging. Mitigation measures associated with a TSHD, CSD and backhoe dredging are presented below.

11.5.12 Limiting re-suspension of sediment during TSHD can be achieved through the following measures:

- Trailing velocity, position of the suction mouth and the discharge of the pump can be optimised with respect to each other.

- Any reduction in the intake of water by the suction head means a more dense pay load, thus reducing or avoiding the need for overflowing. This can be achieved by directing the flow lines of the suction stream to the actual point of excavation, thus making better use of the erosive capacities of the flow of water into the suction head.

11.5.13 Backhoe dredging is the most environmentally acceptable approach as this would result in a significantly lower release rate of sediment to the water column compared with, for example, typical CSD or TSHD. The main measure that can be adopted to minimise losses of sediment to the water column during dredging activities with the backhoe dredger is to use an experienced operator, as control over the dredging equipment is one of the main factors affecting sediment disturbance during backhoe dredging. Other measures that limit plume generation comprise limiting the swing of the backhoe over water, thereby reducing the time when sediment can leak out of the bucket. In addition, the practice of smoothing the excavated area by dragging the backhoe bucket along the bottom should be avoided (CIRIA, 2000).

11.5.14 The re-suspension of sediment caused by CSD can be reduced through optimising the cutter speed, swing velocity and suction discharge, shielding the cutter head or suction head and optimising the design of the cutter head.

11.5.15 With the implementation of the above mitigation measures, the residual impact would be of negligible significance is predicted.

Direct uptake and loss of fish, fish eggs and food resources during dredging and quay construction

11.5.16 During the capital dredging, there is the potential for fish, fish eggs and the food resources on which fish rely to be taken up directly by the dredger. Potential effects are injury, mortality and displacement. The potential for direct uptake is greatest for demersal species (i.e. those which live on the seabed) such as flatfish. The temporary disturbance to a localised area of seabed is likely to result in an avoidance reaction, with the presence of the dredge head likely resulting in fish moving away from the area, thereby avoiding direct uptake.

11.5.17 The results of the benthic infaunal survey (**Section 8.4)** show that the subtidal benthic biotope of the existing navigation channel is widespread and is likely to be influenced by the regular maintenance dredging of the channel. For the same reason, the channel is unlikely to represent an important spawning or feeding ground for fish species.

11.5.18 The area of the berthing pocket supports a different community to the approach channel, with polychaete and oligochaete dominated biotopes present and a high abundance of some species (in particular *Capitella capitata*). Overall, the biotopes recorded are considered representative of the Tees.

11.5.19 As assessed in **Section 8.5,** the effect of the dredging does not represent an irreversible loss of habitat; the benthic community would be expected to recover to one that is similar to that present throughout the existing dredged approach channel.

11.5.20 The direct disturbance to a localised area of the subtidal habitat within the existing channel as a result of the dredging activity is, therefore, considered unlikely to impact upon fish populations within the estuary. Hence an impact of **minor adverse** significance is predicted with regard to the effect of dredging the subtidal habitat.

11.5.21 In addition to the effect on the subtidal, the solid quay construction would result in the loss of intertidal habitat (of up to 3.6ha). The intertidal area is of poor quality (as described in **Section 8.4**), but is likely to represent a feeding area for fish. If the open quay structure is progressed, an area of intertidal would remain, albeit it would constitute a rock revetment.

11.5.22 The fish populations of the estuary are considered to be a high sensitivity receptor and the magnitude of the effect for the solid quay structure (intertidal loss) is predicted to be medium. The impact is, therefore, predicted to be of moderate adverse significance for the solid quay option. The magnitude of the effect for the open quay structure is predicted to be low, as the effect upon the intertidal area would be less, and therefore an impact of minor adverse significance is predicted.

Mitigation measures and residual impact

11.5.23 Mitigation measures are limited and the potential impacts are unavoidable consequences of the proposed scheme. Therefore the residual impact would be **minor adverse** with regard to the subtidal habitat; **moderate adverse** with regard to loss of intertidal feeding habitat should a solid quay structure be progressed; and **minor adverse** should an open quay structure be progressed.

Potential effects of construction noise and vibration on resident and migratory fish

11.5.24 Certain aspects of the construction phase have the potential to impact on fish due to the generation of underwater noise and vibration. This particularly relates to piling activities, but also to noise and vibration generated during dredging. There is also the potential to affect fish migration through the estuary and effects on fish distribution.

11.5.25 When assessing the potential impact of noise on fish populations, it is important to consider the nature of the existing noise in the environment and therefore to assess the potential impacts associated with construction activities, such as piling, in this context. As discussed in **Section 11.**4, the Tees estuary has a relatively high level of underwater noise due to the high level of shipping, engines and generators positioned on vessels which are audible along the entire length of the main channel. Shipping activity was identified as the main source of anthropogenic noise in the Tees estuary. Increased shipping activity during the construction phase therefore has potential to disturb both migratory and resident fish species.

11.5.26 Also of concern is the noise and vibration generated during piling operations for the proposed port terminal. In the worst case scenario, excessive noise may lead to temporary behavioural disturbance of resident and migratory fish species and even mortality. Given that the piles are to be installed within the main channel (rather than within a dock, for example), there is potential for noise disturbance to impact upon salmonid migrations throughout the estuary in addition to causing disturbance to resident species.

11.5.27 An interpretation of the underwater noise modelling results (Subacoustech, 2014) has been undertaken in accordance with the assessment criteria presented in **Section 8.4** to inform this impact assessment. The species of fish which were considered within the underwater noise modelling assessment were dab, herring, salmon, sandeels and sea trout. The results of the interpretation are presented below.

Unweighted metrics

11.5.28 The underwater noise source level from impact piling operations, using a hammer with maximum blow energy of 125 kJ, was estimated to be 223.5 dB re 1 µPa at 1m (SPLpeak) (Subacoustech, 2014). This noise source level exceeds the threshold for physical injury of 220 dB re 1 µPa (SPLpeak) value (Parvin et al, 2007), however, does not exceed the threshold for a lethal effect (240 dB re 1 µPa (SPLpeak)). The information in **Table 11-11** presents a summary of impact ranges to which the various unweighted criteria are estimated to extend with regard to fish.

Table 11-11 Summary of modelled ranges for unweighted peak SPLs for impact piling operations of a 914mm diameter pile and 2000mm diameter pile

Criteria and effect	Species	Maximum range		Minimum range		Mean range	
		914mm	2000mm	914mm	2000mm	914mm	2000mm
206 dB re 1 µPa (physical injury)	Fish	10m	36m	8m	20m*	9m	28m
200 dB re 1 µPa (behavioural effect)	Fish	22m	84m	18m	20m*	20m	61m

* Minimum limit of impact range (shortest distance from the modelled location to the river bank).

11.5.29 As illustrated above, the maximum range to which 206 dB re 1 µPa (SPLpeak) extends for a 914mm and 2000mm diameter pile, indicating physical injury to fish (FHWG, 2008), is predicted to be 10m and 36m respectively. The maximum impact range for the 200 dB re 1 µPa (SPLpeak) for a 914mm and 2000m diameter pile, indicating a behavioural effect, is predicted to be 22m and 84m respectively.

11.5.30 The source levels for the noise from dredging operations (165 dB re 1 µPa and 183 dB re 1 µPa for a backhoe and suction dredger respectively) are below the criteria discussed above. As such, physical injury and behavioural effect as a result of noise generated from dredging operations are not anticipated.

The dB_{ht} (species) criteria: auditory injury

11.5.31 The 130 dB_{ht} (species) perceived level is used to indicate traumatic hearing damage over a very short exposure time. **Table 11-12** shows the ranges to which traumatic hearing damage may occur.

Table 11-12 Summary of modelled ranges for 130 dB_{ht} (species) levels for impact piling

Impact piling		914mm diameter pile (125kJ)		2000mm diameter pile (305kJ)	
		North position	South position	North position	South position
Dab	Maximum	<2m	<2m	<2m	6m
	Minimum	<2m	<2m	<2m	4m
	Mean	<2m	<2m	<2m	5m
Herring	Maximum	16m	18m	18m	56m
	Minimum	14m	14m	14m	20m
	Mean	15m	17m	17m	45m

Impact piling		914mm diameter pile (125kJ)		2000mm diameter pile (305kJ)	
		North position	South position	North position	South position
Salmon	Maximum	<2m	<2m	<2m	4m
	Minimum	<2m	<2m	<2m	2m
	Mean	<2m	<2m	<2m	3m
Sand lance	Maximum	<2m	<2m	<2m	<2m
	Minimum	<2m	<2m	<2m	<2m
	Mean	<2m	<2m	<2m	<2m
Sea trout	Maximum	<2m	<2m	<2m	<2m
	Minimum	<2m	<2m	<2m	<2m
	Mean	<2m	<2m	<2m	<2m

11.5.32 As illustrated in **Table 11-12**, the maximum impact range for the 130 dB_{ht} (species), indicating traumatic hearing damage to fish from impact piling, is 18m and 56m at the South position (with specific regard to herring), for a 914mm and 2000mm diameter pile respectively; the maximum impact ranges from the North position are predicted to be 16m and 46m. For sand lace and sea trout, the maximum impact range is predicted to be less than 2m for both a 914mm and 2000mm diameter pile (this is also the greatest impact range for dab and salmon with regard to a 914mm diameter pile only). The modelled results for a 2000mm diameter pile predict that the greatest range for 130 dB_{ht} extends to a maximum distance of 6m for dab and 4m for salmon at both the North and South position.

The dB_{ht} (species) criteria: behavioural response

11.5.33 The data in **Table 11-13** provide a comparison of the estimated 90 and 75 dB_{h}t (species) impact ranges for behavioural response for the species of interest from impact piling (914mm diameter pile).

Table 11-13 Summary of modelled ranges for 90 and 75 dB_{ht} (species) levels for impact piling operations using a 914mm diameter pile

Impact piling		North position		South position	
		90 dB_{ht} (species)	75 dB_{ht} (species)	90 dB_{ht} (species)	75 dB_{ht} (species)
Dab	Maximum	36m	222m	40m	262m
	Minimum	24m*	24m*	20m*	20m*
	Mean	32m	124m	34m	153m
Herring	Maximum	1.95km	2.75km**	2.37km	4.89km**
	Minimum	24m*	24m*	20m*	20m*
	Mean	482m	511m	551m	632m
Salmon	Maximum	40m	274m	54m	392m
	Minimum	24m*	24m*	20m*	20m*
	Mean	35m	140m	42m	208m

Impact piling		North position		South position	
		90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)	90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)
Sand lance	Maximum	12m	60m	14m	80m
	Minimum	10m	24m*	10m	20m*
	Mean	11m	49m	11m	58m
Sea trout	Maximum	14m	72m	16m	90m
	Minimum	12m	24m*	14m	20m*
	Mean	13m	55m	15m	65m

* Minimum limit of impact range (shortest distance from the modelled location to the river bank).

** Maximum limit of impact range (largest distance from the modelled location to the river bank.

11.5.34 As shown in **Table 11-13**, the estimated impact ranges from impact piling are anticipated to be less than 400m for dab, salmon, sand lace and sea trout. The largest impact range is predicted for herring at 4.89km, where the 75 dB$_{ht}$ (species) impact range extends to the river bank for all modelled transects. **Figure 11-11** to **Figure 11-15** show the impact ranges from impact piling using a 914mm diameter pile in the form of contour maps.

11.5.35 The data in **Table 11-14** provide a comparison of the estimated 90 and 75 dB$_{ht}$ (species) impact ranges for behavioural response for the species of interest from impact piling (2000mm diameter pile).

Table 11-14 Summary of modelled ranges for 90 and 75 dB$_{ht}$ (species) levels for impact piling operations using a 2000mm diameter pile

Impact piling		North position		South position	
		90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)	90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)
Dab	Maximum	460m	2.30km	520m	2.89km
	Minimum	24m*	24m*	20m*	20m*
	Mean	220m	500m	280m	580m
Herring	Maximum	2.75km**	2.75km**	4.89km**	4.89km**
	Minimum	24m*	24m*	20m*	20m*
	Mean	510m	510m	630m	630m
Salmon	Maximum	200m	1.23km	290m	1.80km
	Minimum	24m*	24m*	20m*	20m*
	Mean	110m	410m	160m	500m
Sand lance	Maximum	26m	180m	32m	240m
	Minimum	22m	24m*	20m*	20m*
	Mean	24m	100m	28m	140m
Sea trout	Maximum	46m	290m	56m	360m

Impact piling		North position		South position	
		90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)	90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)
	Minimum	24m*	24m*	20m*	20m*
	Mean	40m	150m	44m	200m

* Minimum limit of impact range (shortest distance from the modelled location to the river bank).

** Maximum limit of impact range (largest distance from the modelled location to the river bank.

11.5.36 **Table 11-14** shows that impact piling using a 2000mm diameter pile results in estimated maximum impact ranges of 2.89km for dab and 1.80km for salmon (from the South position); the maximum impact ranges for sand lace and sea trout are not predicted to exceed 360m. The largest impact ranges are predicted for herring, where impact extends to 4.89km from the South position and 2.75km from the North position. As with the 914mm diameter pile, the impact range for herring using a 2000mm diameter pile was the distance where the 75dB$_{ht}$ impact extended to the river bank for all 180 modelled transects. **Figures 11-12** to **11-21** show the impact ranges from impact piling using a 914mm diameter pile in the form of contour maps.

11.5.37 The data in **Table 11-15** provides a comparison of the estimated 90 and 75 dB$_{ht}$ (species) impact ranges for behavioural response from proposed dredging works.

Table 11-15 Summary of modelled ranges for 90 and 75 dB$_{ht}$ (species) levels for backhoe and suction dredging operations

Species		Backhoe dredging		Suction dredging	
		90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)	90 dB$_{ht}$ (species)	75 dB$_{ht}$ (species)
Dab	Maximum	<5m	<5m	<5m	15m
	Minimum	<5m	<5m	<5m	10m
	Mean	<5m	<5m	<5m	13m
Herring	Maximum	<5m	10m	30m	330m
	Minimum	<5m	10m	30m	165m
	Mean	<5m	10m	30m	250m
Salmon	Maximum	<5m	<5m	<5m	10m
	Minimum	<5m	<5m	<5m	10m
	Mean	<5m	<5m	<5m	10m
Sand lance	Maximum	<5m	<5m	<5m	10m
	Minimum	<5m	<5m	<5m	5m
	Mean	<5m	<5m	<5m	8m
Sea trout	Maximum	<5m	<5m	<5m	<5m
	Minimum	<5m	<5m	<5m	<5m
	Mean	<5m	<5m	<5m	<5m

Figure 11-12 Contour plot showing the predicted 90 and 75 dB_{ht} levels for dab for impact piling operations using a 914mm diameter pile and blow energy of 125kJ

Figure 11-13 Contour plot showing the predicted 130, 90 and 75 dBht levels for herring for impact piling operations using 914mm diameter pile and blow energy of 125kJ

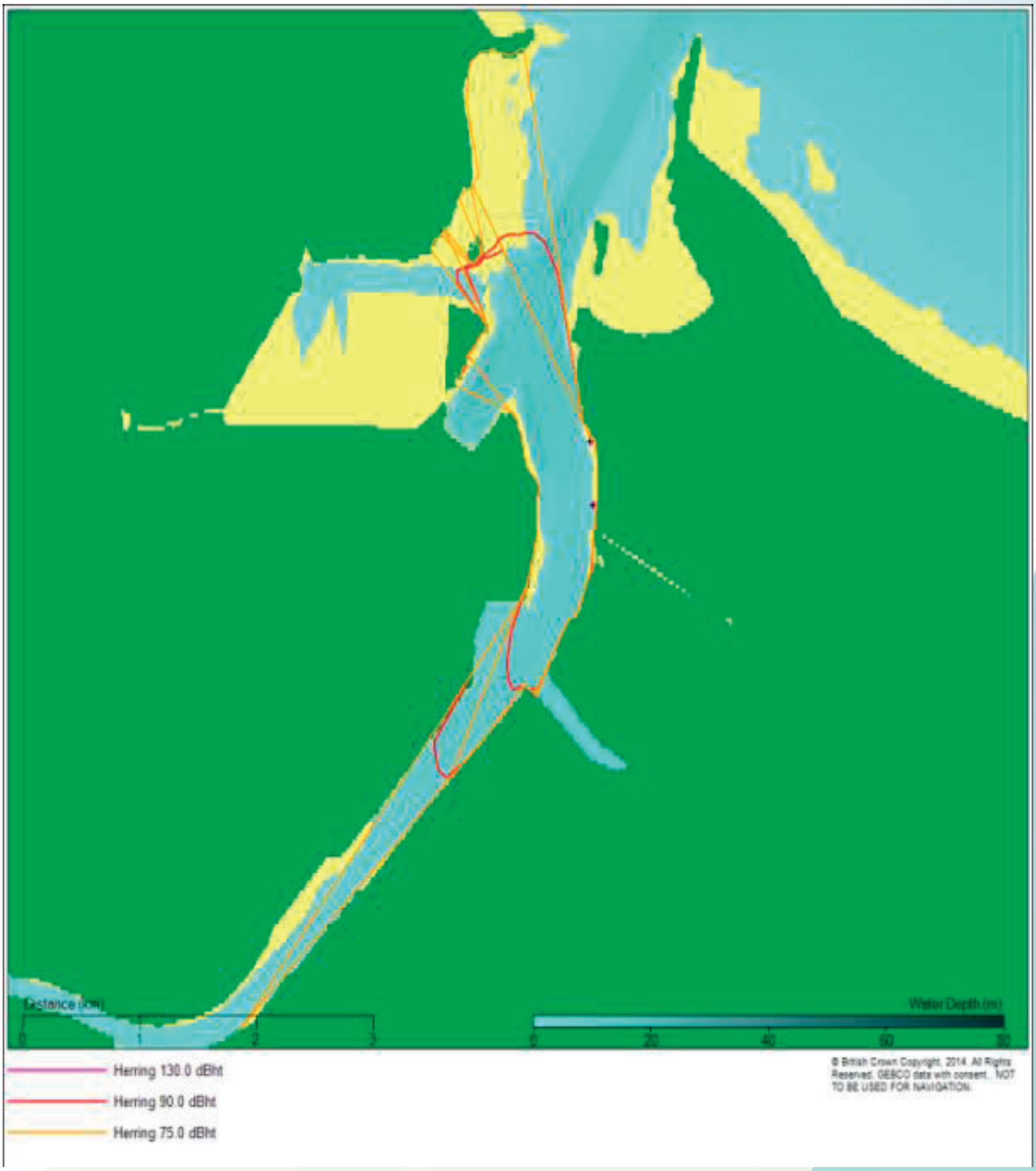


Figure 11-14 Contour plot showing the predicted 90 and 75 dB$_{ht}$ levels for salmon for impact piling operations using 914mm diameter pile and blow energy of 125kJ

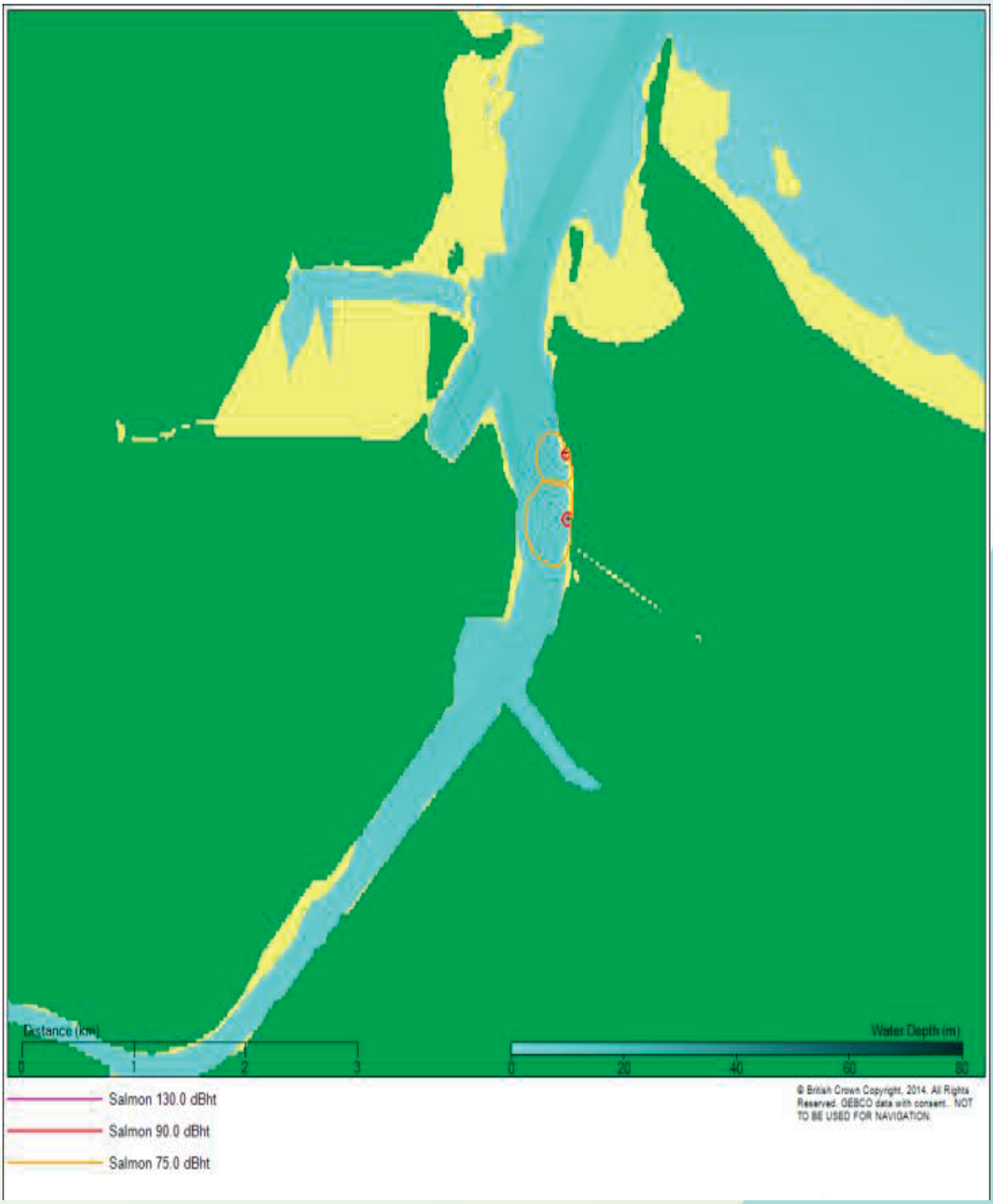


Figure 11-15 Contour plot showing the predicted 90 and 75 dB_{ht} levels for sand lace for impact piling operations using 914mm diameter pile and blow energy of 125kJ

Figure 11-16 Contour plot showing the predicted 90 and 75 dB_{ht} levels for sea trout for impact piling operations using 914mm diameter pile and blow energy of 125kJ

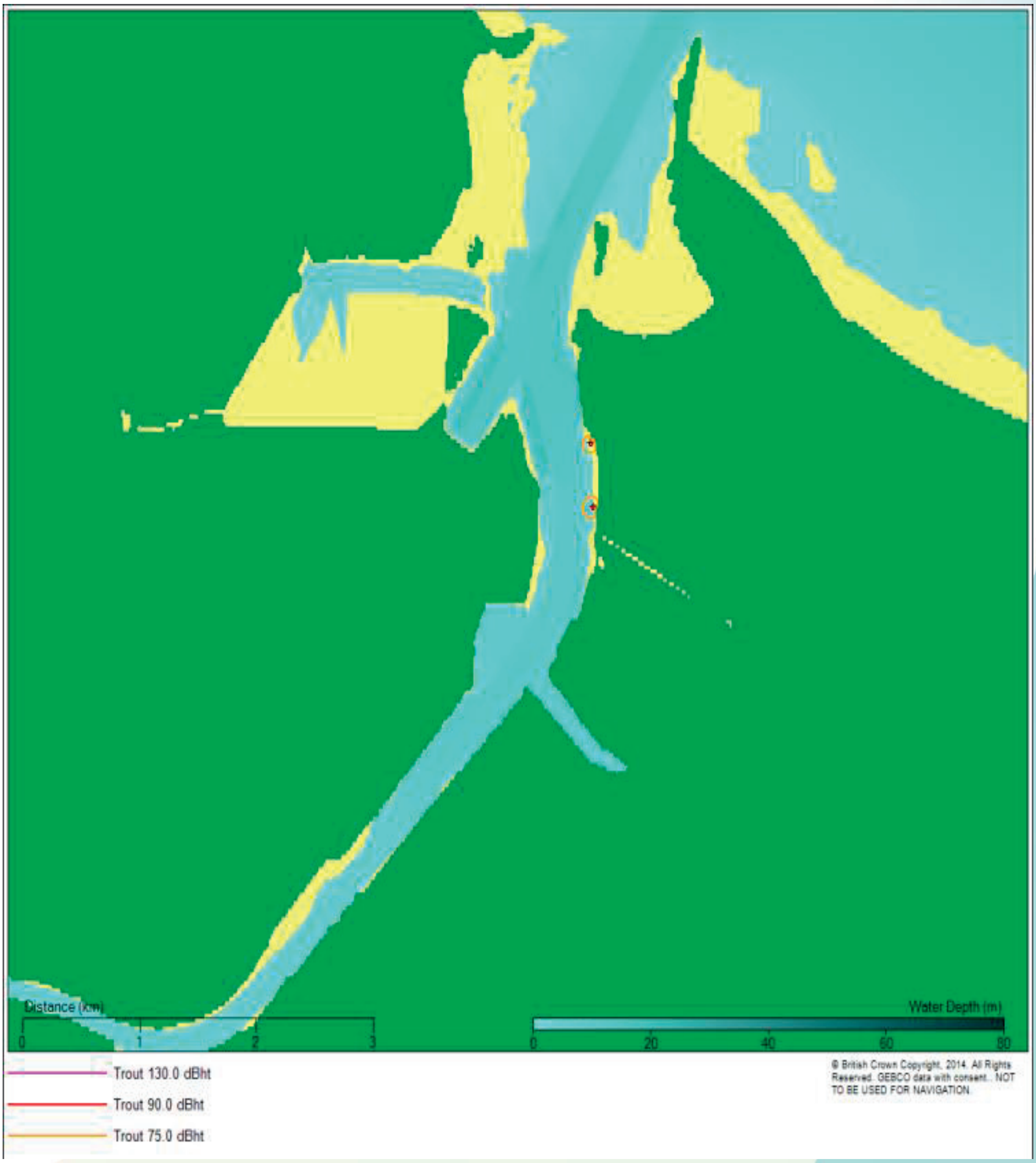


Figure 11-17 Contour plot showing the predicted 90 and 75 dB$_{ht}$ levels for dab for impact piling operations using 2000mm diameter pile and blow energy of 305kJ

Figure 11-18 Contour plot showing the predicted 130, 90 and 75dB$_{ht}$ levels for herring for impact piling operations using 2000mm diameter pile and blow energy of 305kJ

Figure 11-19 Contour plot showing the predicted 90 and 75 dB_{ht} levels for salmon for impact piling operations using a 2000mm diameter pile and blow energy of 305kJ

Figure 11-20 Contour plot showing the predicted 90 and 75 dB$_{ht}$ levels for sand lance for impact piling operations using a 2000mm diameter pile and blow energy of 305kJ

Figure 11-21 Contour plot showing the predicted 90 and 75dB$_{ht}$ levels for trout for impact piling operations using a 2000mm diameter pile and blow energy of 305kJ

Summary of underwater noise modelling results

11.5.38 Modelling of underwater noise from impact piling operations show that, using unweighted SPL_{peak} noise criteria, noise levels are not predicted to be high enough to cause a lethal effect in fish species.

11.5.39 The underwater noise modelling of a 914mm diameter pile predicted that physical traumatic injury to fish species could occur out to 10m from the source of the impact piling noise; a startle reaction to fish is predicted to occur out to 22m from the source of impact piling noise (using unweighted SPL_{peak} noise criteria). The underwater noise modelling results for a 2000mm diameter pile predict that physical injury to fish could occur up to a maximum distance of 36m from the noise source. A maximum range of 84m from the noise source was predicted for a startle reaction in fish. Modelling of underwater noise from backhoe and suction dredging operations has predicted that noise levels would not be sufficient to reach the unweighted criteria for lethal effect, physical injury or behavioural response.

11.5.40 The largest estimated range out to which traumatic hearing damage may occur from impact piling using the 130 dBht (species) criteria is predicted to be 18m and 56m for herring based on impact piling of a 914mm and 2000mm diameter pile respectively. The impact range for all other species considered within the assessment is predicted to be less than 6m. The modelled dB_{ht} (species) sound propagation for backhoe and suction dredging is not predicted to reach the level at which traumatic hearing damage could occur.

11.5.41 The impact range for behavioural response is indicated using the 90 and 75 dBht perceived level criteria, where $90d_{Bht}$ signifies a strong avoidance reaction of a species and 75dBht signifies some avoidance, depending on context. Modelling for behavioural response with respect to the 914mm diameter pile shows that the impact range from impact piling for herring is 2.37km, for 90 dB_{ht}. For 75 dBht, the maximum range reached 4.89km for herring (the distance to the bankside from the noise source). The estimated behavioural impact ranges from impact piling operations are predicted to be significantly lower for dab, salmon, sand lance and sea trout (given their reduced hearing ability in relation to herring).

11.5.42 Modelling of behavioural response with respect to the 2000mm diameter pile shows that the estimated impact ranges to a maximum of 2.89km for dab and 1.80km for salmon; the maximum impact range for sea trout and sand lance was not predicted to exceed 360m from the noise source. The largest impact ranges were predicted for herring at 4.89km, where both the $90dB_{ht}$ and $75dB_{ht}$ impact ranges extend to the river bank for all modelled transects from the South position.

11.5.43 The 90 and 75 dB_{ht} impact ranges for backhoe and suction dredging are predicted to be 10m or less.

Conclusion

11.5.44 The modelling results have predicted that the source noise levels would not result in a lethal effect on fish, however, traumatic injury could arise if fish are located within very close proximity to the source of the impact piling noise. The modelling work has predicted that there is greater potential for behavioural response within fish species in comparison with traumatic injury (from impact piling), due to the larger modelled impact range for a behavioural response (particularly in the case of herring).

11.5.45 However, piling activities would not present a constant noise source and those periods between pile driving (e.g. when repositioning the piling barge) would provide opportunity for unimpeded movement of fish species within the estuary; the impact would also be temporary, lasting for the duration of piling works. It should also be noted that existing noise generated by shipping and industrial activity on the banks of the Tees estuary are already likely to influence the fish distribution within the estuary.

11.5.46 It is predicted that the overriding consequence of the generation of noise during piling operations (as well as the dredging and construction activities) would be for fish to move away from the source. Therefore, in the worst case, the construction works would be expected to result in the localised redistribution of resident fish species and temporary disturbance to migration patterns of fish throughout the Tees estuary.

11.5.47 The sensitivity of the various fish species present within the estuary ranges; hence a conservative estimate of high sensitivity has been used in this impact assessment. Based on the information presented above, the magnitude of the effect on fish species as a result of noise and vibration is predicted to be medium. An impact of **moderate adverse** significance is, therefore, anticipated to arise for fish as a result of underwater noise and vibration.

Mitigation measures and residual impact

11.5.48 In order to prevent adverse impacts to adult migratory fish runs, no piling would be undertaken for three hours following low water between 1 March and 30 November. In addition, during May, no piling would take place in order to allow the migration of juvenile salmon and sea trout. Furthermore, as mitigation of the potential impact on marine mammals, a minimum of an eight hour continuous break in every 24 hour period would be implemented where no impact piling is carried out, which would also act to further mitigate the potential impact on fish.

11.5.49 With the implementation of the mitigation measures outlined above, a residual impact of minor adverse significance is anticipated.

Potential effects of accidental spillages of oils, fuels, chemicals

11.5.50 There is the potential for accidental releases of substances into the marine environment which could result in a pollution incident and consequently impact upon health of fish species. The implications of a pollution incident on water quality and, therefore, other environmental parameters such as marine ecology and fisheries are highly dependent on both the nature of the substance released and the scale of the incident.

11.5.51 As it is difficult to quantify the likely amount (and nature) of any spillages or leakages into the marine environment, it is not possible to predict the significance of the potential impact. In this instance, the assessment is considered in terms of the risk of a spill or other pollution event occurring. The implementation of control measures (e.g. adherence to Environmental Agency PPG5, adherence to the requirements of the MARPOL Convention Regulations, ensuring a spill kit is present on site at all times) and adoption of good practice however, means that the potential for accidental pollution occurring is minimal, therefore the risk is considered to be **low**.

Mitigation measures and residual impact

11.5.52 The risk of a pollution event occurring is low, particularly given the implementation of the control measures and guidance recommended above (as well as within Section 7.5). No further control measures are expected to be necessary in this context. The impact of accidental spills and leaks is assessed in terms of risk, which is considered to be low in this case.

Disturbance to fishing activity

11.5.53 Most commercial fishing activity takes place outside of the Tees estuary, although there is a small amount of fishing targeted at lobster (*Homarus gammarus*) and velvet swimming crab (*Necora puber*) in the lower estuary during summer. The digging of lugworms, ragworms and peeler crabs takes place in the intertidal mud and sandflats of the outer estuary and adjacent coast. As discussed in **Section 16**, there would be no impact to existing navigation practices during Phase 1 of the proposed scheme, and an impact of negligible significance during Phase 2 of the proposed scheme.

11.5.54 Based on the above, it is anticipated that there would be **no direct impact** on fishing activity as a result of the proposed scheme.

Mitigation measures and residual impact

11.5.55 No mitigation measures are proposed. There would be no residual impact.

11.6 Assessment of potential impacts during operation

Potential impact on feeding resources for fish due to maintenance dredging

11.6.1 Estuarine fish feed from a wide range of benthic invertebrates which live within and on the surface of the seabed; as such, impacts on this invertebrate resource can lead to a reduction in the value of an area as a feeding resource.

11.6.2 It is likely that there would be a requirement for maintenance dredging of the newly deepened part of the approach channel and berth pocket during the operational phase, to maintain the required operating depth. This would be necessary for both forms of quay construction.

11.6.3 Maintenance dredging represents a repeated disturbance to the benthic community within the dredged area and limits recovery of the benthic community following the impact that would occur as a result of capital dredging. Although there would be recovery following capital dredging, the community would be likely to be characterised by a community similar to that observed within other maintained reaches of the navigation channel. The recovery in the operational phase is predicted to be of negligible (but beneficial) significance for the benthic community. The implication for fish feeding resource is also beneficial, but of very low magnitude. The potential impact is considered to be of **negligible** significance.

Mitigation measures and residual impact

11.6.4 Maintenance dredging of the approach channel and berth pocket (and the associated regulator disturbance to the benthic community) is an unavoidable consequence of the proposed scheme. The residual impact would be of negligible significance.

Potential impact to fish due to noise disturbance

11.6.5 Underwater noise generation during the operational phase of the proposed scheme has been considered by Subacoustech within the underwater noise assessment. Based on the predicted vessel movements anticipated to be associated with the proposed scheme during operation, in the context of the existing vessel movements in the estuary, it is predicted that the magnitude of effect to fish (considered to be a high sensitivity receptor) due to noise disturbance would be very low; an impact of **negligible** significance is anticipated.

Mitigation measures and residual impact

11.6.6 No mitigation measures are required. The residual impact would be of **negligible** significance.

11.7 Assessment of potential impacts during decommissioning

11.7.1 The proposed port terminal is expected to be a long term infrastructure project; there is no intention to decommission the terminal. Therefore there would be no marine works required during the decommissioning phase, and no impacts on fish or fishing activity.

11.8 Summary

11.8.1 Tees Bay and the Tees estuary provide important habitats for a number of fish species which feed on benthic invertebrates found in subtidal and intertidal sediments. Environment Agency data on fish migrations shows that the month of May generally represents the start of the salmon and sea trout migration period, with migrations peaking during July or August. Salmon and sea trout migrations continue through to October and November, however the numbers of fish migrating during these months are significantly lower than the peak months. There is very limited commercial fishing activity within the Tees estuary itself, with most fishing efforts being undertaken offshore.

11.8.2 The construction phase of the proposed scheme has the potential to impact upon fish species due to noise disturbance from dredging, reduced water quality due to spills and leakages, direct uptake of fish and fish eggs during dredging and loss of feeding areas.

11.8.3 Underwater noise modelling results have predicted that source noise levels would not result in a lethal effect on fish, however, traumatic injury could arise if fish are located within very close proximity to the source of the impact piling noise. The modelling work has predicted that there is greater potential for behavioural response within fish species in comparison with traumatic injury (from impact piling), due to the larger modelled impact range for a behavioural response (particularly in the case of herring). Piling activities would not present a constant noise source and those periods between pile driving (e.g. when repositioning the piling barge) would provide the opportunity for unimpeded movement of fish species within the estuary. The noise disturbance to fish due to piling would be reversible once such operations are completed. It should also be noted that existing noise generated by shipping and industrial activity on the banks of the Tees estuary are likely to influence the fish distribution within the estuary.

11.8.4 It is predicted that the overriding consequence of the generation of noise during piling operations (as well as the dredging and construction activities) would be for fish to move away from the source. Therefore, in the worst case, the construction works would be expected to result in the localised redistribution of resident fish species and temporary disturbance to migration patterns of fish throughout the Tees estuary. Impacts to migratory fish would be minimised as far as possible through the implementation of proposed timing restrictions on piling activity.

11.8.5 There is the potential for accidental releases of substances into the marine environment which could result in a pollution incident and consequently impact upon the health of marine species. The implications of a pollution incident on water quality, and therefore other environmental parameters such as marine ecology and fisheries, are highly dependent on both the nature of the substance released and the scale of the incident. The risk of a pollution incident occurring and its impact on fish can be controlled through the implementation of mitigation measures, as outlined within **Section 7**.

11.8.6 Direct uptake of fish, fish eggs and loss of food resources due to the effect of the proposed scheme on intertidal and subtidal habitats is predicted to represent a potential impact of moderate adverse significance.

11.8.7 No direct impact is predicted on fishing activity due to the lack of activity in the vicinity of the proposed scheme.

11.8.8 Operational phase noise disturbance from vessel movements is not anticipated due to the existing heavy use of the Tees estuary by vessels. Although some recovery of the benthic community would occur during the operational phase, this is predicted to be of negligible significance due to the effect of maintenance dredging.

11.8.9 Given the availability of existing information with regard to fish usage of the estuary (Environment Agency monitoring data) as well as data sourced recovered during site specific surveys (e.g. epibenthic trawl surveys and underwater noise monitoring and modelling), the level of uncertainty within the assessment is considered to be low.

11.8.10 **Table 11-16** provides a summary of impacts with regard to fisheries and fishing activity. The proposed mitigation measures are outlined, and the residual impact presented.

Table 11-16 Summary of potential impacts, impact significance, mitigation measures and residual impacts to fisheries and fishing activity during the construction, operation and decommissioning phases

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Construction					
Effects on fish from changes in marine water quality	High	Low	Minor adverse	Limiting resuspension during TSHD can be achieved by optimising the trailing velocity, position of the suction mouth and the discharge pump with respect to each other and directing the flow lines of the suction stream to the actual point of excavation. The main measure to limit sediment dispersion during backhoe dredging is use of an experienced operator and limiting the swing of the backhoe over water. Reduction in sediment plume generation during CSD can be achieved by optimising the cutter speed, swing velocity and suction discharge.	Negligible
Direct uptake and loss of fish, fish eggs and food resources during dredging and quay construction	High	*Subtidal* Low *Intertidal* Medium (solid quay) Low (open quay)	*Subtidal* Minor adverse *Intertidal* Moderate adverse (solid quay) Minor adverse (open quay)	Mitigation measures are limited and the potential impacts are unavoidable consequences of the proposed scheme	Subtidal *Minor adverse* *Intertidal* Moderate adverse (solid quay) Minor adverse (open quay)
Potential effects of construction noise and vibration on resident and migratory fish	High	Medium	Moderate adverse	No piling would be undertaken for three hours following low water from 1 March to 30 November. No piling would take place during the month of May. A minimum of eight hours continuous break where no impact piling occurs would be implemented in every 24 hour period.	Minor adverse

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Potential effects of accidental spillages of oils, fuels, chemicals	Not applicable	Not applicable	Low risk	None required above those built into the proposed scheme.	Low
Disturbance to fishing activity	Not applicable	Not applicable	No impact	None required.	No impact.
Operation					
Potential impact on feeding resources for fish due to maintenance dredging	High	Very low	Negligible (but beneficial)	Measures to mitigate the impacts to benthic communities due to maintenance dredging are limited as this is unavoidable. The disturbance footprint would be minimised where possible.	Negligible (but beneficial)
Potential impacts due to noise disturbance	High	Very low	Negligible	None required.	Negligible
Decommissioning					
No impact anticipated.					