KEEPING BRITAIN TRADING

IMMINGHAM EASTERN RO-RO TERMINAL

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Chapter 8: Water and Sediment Quality
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Immingham Eastern Ro-Ro Terminal

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Contents

Tables

8 Water and Sediment Quality

8.1 Introduction

8.1.1 This chapter provides an assessment of the potential significant effects of the proposed Immingham Eastern Ro-Ro Terminal (IERRT) on water and sediment quality (dissolved oxygen and contaminants), specifically within the marine environment. The principal marine elements of the proposed development are shown on Figure 1.2 in Volume 2 of this Environmental Statement (ES) (Application Document Reference number 8.3). This chapter has been prepared by ABPmer.

8.1.2 A number of figures support the description of the existing environment (baseline) and are provided in Volume 2 of this ES. Figure 8.1 to this ES shows the location of Water Framework Directive (WFD) water bodies in the vicinity of the proposed development. Figure 8.2 to this ES shows bathing waters and Nitrate Vulnerable Zones (NVZs) within the study area. Figure 8.3 to this ES shows the stations that have been sampled in accordance with the sediment sample plan for the proposed development.

8.1.3 The Physical Processes assessment (Chapter 7 of this ES), in terms of predicted changes in suspended sediment concentrations (SSC), has informed the outcomes of the water and sediment quality assessment for the proposed development as set out in this Chapter 8 of this ES.

8.1.4 Relevant aspects of the water and sediment quality assessment, in terms of changes that may influence environmental receptors, have informed the outcomes of the Nature Conservation and Marine Ecology assessment (Chapter 9 of this ES).

8.1.5 The potential risk of vessel collisions as a result of the proposed development, and the subsequent risk of release of hazardous substances into the water, is considered in the Commercial and Recreational Navigation assessment (Chapter 10 of this ES). The potential impacts to the water quality of surface riverine water bodies in the vicinity of the proposed development are considered in the Ground Conditions including Land Quality assessment (Chapter 12 of this ES).

8.2 Definition of the study area

8.2.1 The study area for this assessment is the area over which potential direct and indirect effects of the IERRT project are predicted to occur during the construction and operational periods. The direct effects on water and sediment quality are those that may arise due to accidental releases during construction or disturbance of sediments into the water column and increases in turbidity. Indirect effects are those that may arise due to sediment that is disturbed and released into the water column during the marine works resulting in changes in water quality through changes in the levels of dissolved oxygen or the release of sediment-bound contaminants.

8.2.2 The study area for the water and sediment quality topic is considered to be the proposed development site and the adjacent Immingham coastline, the existing jetties across the near-field and the central part of the Humber Estuary, generally between Sunk Chanel and Halton Middle. Within the far-field region, the study area includes the wider Humber Estuary from the mouth to up estuary of the Hull Bend. This reflects the same study area for the Physical Processes (Chapter 7) and is shown on Figure 7.1 to this ES.

8.3 Assessment methodology

Data and information sources

8.3.1 Current baseline conditions have been determined by a desk-based review of available information. A project-specific sediment contamination survey has also been undertaken.

8.3.2 The main desk-based sources of information that have been reviewed to inform the current baseline description within the vicinity of the proposed development include:

- ‘Catchment Data Explorer’ website (Environment Agency, 2022a);
- Water body summary table within the Environment Agency (2016) ‘Clearing the Waters for All’ guidance;
- Multi-Agency Geographic Information for the Countryside (MAGIC) website (Natural England, 2020);
- ‘Find a bathing water’ website (Environment Agency, 2022b);
- List of Shellfish Water Protected Areas in England (Defra, 2016);
- ‘Check for Drinking Water Safeguard Zones and NVZs’ website (Environment Agency, 2022c);
- ‘Water Quality Archive’ website (Environment Agency, 2022d); and
- Historic marine surface sediment samples (2001) collected in the area of Immingham Outer Harbour (IOH) for Particle Size Analysis (PSA) and chemical contamination analysis.

8.3.3 A sediment contamination survey was undertaken in October 2021 to characterise the dredge material and to support the application to dispose of the dredge material at an existing licensed disposal site. This was undertaken in accordance with the Marine Management Organisation (MMO) sample plan (SAM/2021/00053) which confirmed the suite of contaminants, number of samples, sample locations, replicates and sampling depth required, taking account of available guidelines for the management of dredge material to be disposed at sea (OSPAR Commission, 2014).

8.3.4 Contaminant concentrations in sediment samples have been compared to Centre for Environment, Fisheries and Aquaculture Science (Cefas) Guideline Action Levels to determine their suitability for disposal at sea. Contaminant concentrations in sediments have also informed the assessment of potential changes to dissolved concentrations in the water column and predicted potential redistribution of contaminants as a result of the proposed development.

Determining significance of effects

8.3.5 To facilitate the impact assessment process and to ensure consistency in the terminology of significance, a standard assessment methodology has been applied. This methodology has been developed from a range of sources, including relevant Environmental Impact Assessment (EIA) Regulations, the EIA Directive (2014/52/EU), statutory and non-statutory guidance, consultations and ABPmer's previous (extensive) EIA project experience. The impact assessment in this Chapter 8 of this ES has also followed the principles of relevant guidance, including the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for ecological impact assessment in the UK and Ireland (which consolidate advice for terrestrial, freshwater, and coastal environments) (CIEEM, 2018) and Institute of Environmental Management and Assessment (IEMA) guidelines (IEMA, 2016).

8.3.6 The environmental issues are divided into distinct 'receiving environments' or 'receptors'. The effect of the proposed development on each of the environmental receptors has been assessed by describing in turn: the baseline environmental conditions of each receiving environment; the 'impact pathways' by which the receptors could be affected; the significance of the impacts occurring; and the measures to mitigate for significant adverse impacts where these are predicted. In accordance with CIEEM (2018), an impact is defined as an action resulting in changes to a receptor (e.g., construction activities resulting in the suspension of material into the water column), and an effect is the outcome to the receptor from an impact (e.g., the effects on water quality as a result of the release of sediment-bound contaminants in the water column).

8.3.7 This impact assessment methodology, which is presented in the following sections, is designed to incorporate the key criteria and considerations without being overly prescriptive.

Stage 1 – Identify receptors and changes

8.3.8 The first stage identifies the potential environmental changes resulting from the proposed activity and the features of interest (receptors) that are likely to be affected (which are together referred to as the impact pathway). The potential impact pathways which are considered relevant to this EIA on water and sediment quality are set out within Section 8.8 of this chapter.

Stage 2 – Understand change and sensitivity

8.3.9 The second stage involves understanding the nature of the environmental changes to provide a benchmark against which the changes and levels of exposure can be compared. The scale of the impacts via the impact pathways depends upon a range of factors, including the following:

- Magnitude (local/strategic):
  - Spatial extent (small/large scale);
  - Duration (temporary/short/intermediate/long-term);
  - Frequency (routine/intermittent/occasional/rare);
  - Reversibility;
- Probability of occurrence;
- The margins by which set values are exceeded (e.g., water quality standards);
- The baseline conditions of the system;
- Existing long-term trends and natural variability;
- The sensitivity of the receptor (resistance/adaptability/recoverability);
- The importance of the receptor (e.g., designated habitats and protected species); and
- Confidence, or certainty, in the impact prediction.

Stage 3 – Impact assessment

8.3.10 To assess the significance of effects, the magnitude of the impact pathway and the probability of it occurring are evaluated to understand the exposure to change, and this is assessed against the sensitivity of a receptor/feature to understand its vulnerability. Finally, this is compared against the importance of a receptor/feature to generate a level of significance for effects resulting from each impact pathway. This is summarised in the following sections.

8.3.11 The key significance levels for either beneficial or adverse impacts are described as follows:

1. Insignificant: Change not having a discernible effect;
2. Minor: Change is discernible but tolerable and not significant;
3. Moderate: Change is significant and if adverse, is likely to require mitigation; and
4. Major: Change is highest in magnitude, and the receptor has a high vulnerability and importance. Change is significant and if adverse, will require mitigation.

8.3.12 To ensure transparency in the impact assessment, it is important to make clear the evidence-based or value-based judgments used at each stage of the assessment, and how they have been attributed to a level of significance. This has been presented in the impact assessment for each impact pathway.

Impact assessment guidance tables

8.3.13 The matrices in Table 8.1 to Table 8.3 of this chapter of the ES have been used to help assess significance (see below).

8.3.14 Table 8.1 of this chapter of the ES has been used as a means of generating an estimate of exposure to change for each impact pathway. Magnitude of change needs to be considered in spatial and temporal terms (including duration, frequency, and seasonality), and against the background environmental conditions in a study area. Once a magnitude has been assessed, this should be combined with the probability of occurrence to arrive at an exposure score which can then be used for the next step of the assessment, which is detailed in Table 8.2 of this chapter of the ES. For example, an impact pathway with a medium magnitude of change and a high probability of occurrence would result in a medium exposure to change.

Table 8.1. Exposure to change, combining magnitude and probability of change

Probability of occurrence	Magnitude of change			
	Large	Medium	Small	Negligible
High	High	Medium	Low	Negligible
Medium	Medium	Medium/Low	Low /Negligible	Negligible
Low	Low	Low /Negligible	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

8.3.15 Table 8.2 of this chapter of the ES has then been used to score the vulnerability of the features/receptors of interest based on the sensitivity of those features and their exposure to a given change. Where the exposure and sensitivity characteristics overlap then vulnerability exists, and an adverse effect may occur. For example, if the impact pathway previously assessed with a medium exposure to change acted on a receptor which had a high sensitivity, this would result in an assessment of high vulnerability. Sensitivity can be described as the intolerance of a receptor to an environmental change and essentially considers the response characteristic of the receptor. Thus, if a single or combination of environmental changes is likely to elicit a response then the receptor under assessment can be considered to be sensitive. Where an exposure to change occurs for which the receptor is not sensitive, then no vulnerability can occur. Similarly, vulnerability is always 'none' no matter how sensitive the feature is if the exposure to change had been assessed as 'negligible'.

Table 8.2. Estimation of vulnerability based on sensitivity and exposure to change

Sensitivity of feature	Exposure to change			
	High	Medium	Low	Negligible
High	High	High	Moderate	None
Moderate	High	Moderate	Low	None
Low	Moderate	Low	Low	None
None	None	None	None	None

8.3.16 The vulnerability has then been combined with the importance of the feature of interest using Table 8.3 of this chapter of the ES to generate an initial level of significance. The importance of a feature is based on its value and rarity (e.g., to either ecosystem or economy), such as the levels of protection, whilst recognising that importance should be determined having regard to geographic context (i.e., international/European, national, regional, and local). For an example of estimating significance, if a high vulnerability was previously given to a feature of low importance, an initial level of significance of minor would be given.

Table 8.3. Estimation of significance based on vulnerability and importance

Importance of feature	Vulnerability of feature to impact			
	High	Moderate	Low	None
High	Major	Moderate	Minor	Insignificant
Moderate	Moderate	Moderate/Minor	Minor/ Insignificant	Insignificant
Low	Minor	Minor/ Insignificant	Insignificant	Insignificant
None	Insignificant	Insignificant	Insignificant	Insignificant

Stage 4 – Impact management (mitigation)

8.3.17 The final stage is to identify any impacts that are found to be significant (i.e., moderate and/or major adverse) and require mitigation measures to reduce residual impacts, as far as possible, to environmentally acceptable levels. Within the assessment procedure the use of mitigation measures will alter the risk of exposure and, hence, will require significance to be re-assessed and thus the residual impact (i.e., with mitigation) identified.

8.3.18 Mitigation measures considered throughout the EIA process can take three forms (IEMA, 2016):

- Primary (inherent) – modifications to the location or design of the development made during the pre-application phase that are an inherent (or embedded) part of the project. These are captured and taken account of in the initial impact assessment;
- Secondary (foreseeable) – actions that will require further activity in order to achieve the anticipated outcome (identified as necessary through the assessment process). Within the impact assessment process, the use of secondary mitigation measures will alter the risk of exposure and, hence, will require significance to be re-assessed and thus the residual impact (i.e., with mitigation) identified; and
- Tertiary (inexorable) – actions that would occur with or without input from an EIA process, including actions that will be undertaken to meet other existing legislative requirements, or actions considered to be standard practices to manage commonly occurring environmental effects. These are captured and taken account of in the initial impact assessment.

8.3.19 In addition, it is appropriate to adopt a mitigation hierarchy which, from the CIEEM (2018) guidance on ecological impact assessment specifically, can be summarised as follows:

- Seek to adopt options that avoid harm in the first instance;
- Identify ways to minimise adverse effects that cannot be completely avoided;
- Undertake compensation where there are significant residual adverse effects despite the mitigation proposed; and
- Provide net benefits (for biodiversity) above requirements for avoidance, mitigation, or compensation.

8.3.20 In certain instances, a decision may need to be taken despite residual uncertainty about the effects. In such cases, adaptive management, linked to a bespoke monitoring programme, is a well-established and recommended way of ensuring that any negative impacts or effects are addressed during the construction of the development and during the subsequent operational phase.

Confidence assessment

8.3.21 Following the significance assessment, a confidence assessment has been undertaken which recognises the degree of interpretation and expert judgement applied. This is presented in the summary table contained within the conclusions section of each impact assessment section. Confidence is assessed on a scale incorporating three values: low, medium, and high.

8.4 Consultation

8.4.1 Consultation as to whether there are likely to be any water and sediment quality effects as a result of the construction and operation of the IERRT project has been undertaken with the Environment Agency and the MMO. The relevant outcomes of the formal scoping process, as well as any relevant feedback received in response to the statutory consultation and the publication of the Preliminary Environmental Information Report (PEIR) and supplementary statutory consultation and the publication of the Supplementary Consultation Report, have also been taken into account to inform the assessment.

8.4.2 The outcome of the consultation that has been undertaken, along with how it has influenced the water and sediment quality assessment, is presented in Table 8.4 of this chapter of the ES.

Table 8.4. Summary of consultation

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Planning Inspectorate (PINS)	Scoping Opinion, October 2021 Table ID 4.2.1	The ES should include an assessment of changes to levels of contaminants in water during construction and operation or the information referred to demonstrating agreement with the relevant consultation bodies and the absence of a Likely Significant Effect (LSE).	An assessment has been undertaken of these potential impacts and is included within the impact pathways on 'Changes to chemical water quality as a result of potential sediment-bound contaminants being released' during construction and operation (Section 8.8 of this chapter).
PINS MMO	Scoping Opinion, October 2021 Table ID 4.2.2 Appendix 2 MMO response	The ES should assess the potential for chemical contamination to accumulate at the dredge disposal sites.	An assessment of this potential impact has been undertaken and is included within the impact pathways on the 'Redistribution of sediment-bound contaminants' during construction and operation (Section 8.8 of this chapter).
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	The ES should include information on the sediment quality and potential for any effects on water quality through suspension of contaminated sediments. The EIA should also consider whether increased suspended sediment concentrations resulting are likely to impact upon the interest features and supporting habitats of the designated sites.	An assessment is included within the impact pathways on 'Changes to chemical water quality as a result of potential sediment-bound contaminants being released' during construction and operation (Section 8.8 of this chapter). The outputs of this assessment have also been used to inform the Nature Conservation and Marine Ecology assessment (Chapter 9 of this ES).

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	The ES should consider whether there will be an increase in the pollution risk as a result of the construction or operation of the development.	This has been assessed within the impact pathways on ‘Changes to chemical water quality as a result of potential sediment-bound contaminants being released’ during construction and operation (Section 8.8 of this chapter).
Natural England	Scoping Opinion, October 2021 Appendix 2 Natural England response	For activities in the marine environment up to 1 nautical mile out at sea, a Water Framework Directive (WFD) assessment is required as part of any application. The ES should draw upon and report on the WFD assessment considering the impact the proposed activity may have on the immediate water body and any linked water bodies.	A WFD Compliance Assessment has been undertaken and is included within Appendix 8.1 in Volume 3 of the ES (Application Document Reference number 8.4).
Environment Agency	Scoping Opinion, October 2021 Appendix 2 Environment Agency response	We are in agreement with the aspects of water and sediment quality, which are scoped in for assessment.	N/A
Environment Agency	Pre-application meeting, 29 November 2021	Discussion was had around the Environment Agency’s response to the Scoping Report, and the proposed approach to the water and sediment quality assessment. The proposed scope and approach to the assessment was considered suitable for the proposed development.	N/A

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Environment Agency (PI34)	Statutory Consultation 19 Jan – 23 Feb 2022	No concerns regarding the preliminary conclusions on the residual effects and look forward to reviewing the full assessment in due course.	The full assessment is provided in this ES chapter and the WFD Compliance Assessment is provided in Appendix 8.1 to this ES.
MMO (PI35)	Statutory Consultation 19 Jan – 23 Feb 2022	All sediment sampling data should be presented in the MMO Results Template alongside the ES.	The completed MMO Results Template has been provided with the DCO application (Application Document reference number 9.5).
North Lincolnshire Council (NLC) (PI38)	Statutory Consultation 19 Jan – 23 Feb 2022	NLC do not have any objections to the approach set out in the PEIR at this stage. However, it should be noted that NLC does not have expertise in the methods used in the study of disciplines such as water and sediment quality within the marine environment.	Noted.
MMO	Pre-application meeting, 24 February 2022	Discussion was had around the MMO's response to the statutory consultation on the PEIR, and preliminary outcomes of the impact assessment on water and sediment quality assessment. The MMO did not have major concerns regarding impacts to water and sediment quality or the assessment that has been presented in the PEIR.	Noted.

Consultee	Reference, Date	Summary of Response	How Comments have been Addressed in this Chapter
Member of public (PI 5)	Supplementary Statutory Consultation 28 Oct – 27 Nov 2022	Concerns regarding toxins in dredge material and the disposal of material at sea impacting fish and crustaceans.	The impact of the disposal of capital and maintenance dredge material at sea is assessed in Section 8.8. This considers a review of the concentrations of contaminants within sediment samples from the area to be dredged. Given the relatively low concentrations of contaminants, the impacts are assessed as insignificant.
MMO (PI 10)	Supplementary Statutory Consultation 28 Oct – 27 Nov 2022	The impact pathways seem appropriate and proportionate; however, the MMO are not able to fully comment at this stage from this high-level review as to whether we agree with this conclusion without view of this supporting information that will be provided in the ES. The MMO recommend this impact pathway is fully considered as to whether it should be included in the Environmental Impact Assessment (EIA).	The assessment of impact pathways relating to water and sediment quality are provided in Section 8.8 of this chapter.
		As per previous advice, all data should be presented in the MMO Results Template alongside the ES.	The completed MMO Results Template has been provided with the DCO application (Application Document reference number 9.5).

8.5 Implications of policy legislation and guidance

8.5.1 This section of the chapter sets out key aspects and implications of applicable legislation, regulation, policy, and guidance that are relevant to the assessment of likely impacts on water and sediment quality. It builds upon the overarching chapter covering the Legislation, Policy and Consenting Framework (Chapter 5 of this ES).

Legislation

Water Framework Regulations

8.5.2 The WFD (2000/60/EEC) establishes a framework for the management and protection of Europe's water resources. It is implemented in England and Wales through the Water Environment (WFD) (England and Wales) Regulations 2017, known as the Water Framework Regulations.

8.5.3 The overall objectives of the WFD as implemented by the Water Framework Regulations is to achieve "good ecological and good chemical status" in all inland and coastal waters by 2021 unless alternative objectives are set or there are grounds for time limited derogation. For example, where pressures preclude the achievement of good status (e.g., navigation, coastal defence) in heavily modified water bodies (HMWBs), the WFD provides that an alternative objective of "good ecological potential" is set.

8.5.4 In terms of water and sediment quality, "Good ecological status/potential" has regard to physico-chemical quality elements, and specific pollutants. The Good ecological status/potential assessment also considers biological and hydromorphological elements. "Good chemical status" has regard to a series of priority substances and priority hazardous substances.

8.5.5 The water and sediment quality assessment takes account of the location of any WFD water bodies within the study area.

8.5.6 A WFD Compliance Assessment has been undertaken to determine whether the proposed development complies with the objectives of the WFD and is presented in Appendix 8.1 in Volume 3 of this ES (Application Document Reference number 8.4). This includes a consideration of the potential risks for key receptors, including water quality. The WFD Compliance Assessment has been informed by the outcomes of the water and sediment quality assessment reported in this chapter.

Bathing Water Regulations

8.5.7 The revised Bathing Water Directive (2006/7/EC) was adopted in 2006, updating the microbiological and physico-chemical standards set by the original Bathing Water Directive (76/160/EEC) and the process used to measure/monitor water quality at identified bathing waters. It is implemented in England and Wales under the Bathing Water Regulations 2013 (as amended). The revised Bathing Water Directive focuses on fewer microbiological indicators, whilst setting higher standards, compared to those of the original Bathing Water Directive. Bathing waters under the revised Bathing Water Directive are classified as excellent, good, sufficient, or poor according to the levels of certain types of bacteria (intestinal enterococci and *Escherichia coli*) in samples obtained during the bathing season (May to September).

8.5.8 The original Bathing Water Directive was repealed at the end of 2014 and the UK Government's target under the revised Bathing Water Directive was to achieve a classification of 'sufficient' for all bathing waters by 2015, as described under the Bathing Water Regulations 2013 (as amended). Monitoring of bathing water quality has been reported against revised Bathing Water Directive indicators since 2015. The new classification system considers all samples obtained during the previous four years and, therefore, data has been collected for revised Bathing Water Directive indicators since 2012.

8.5.9 The water and sediment quality assessment takes into account the location of any designated bathing waters within the study area for the project.

Nitrate Pollution Prevention Regulations

8.5.10 The Nitrates Directive (91/676/EEC) is implemented in England under the Nitrate Pollution Prevention Regulations 2015 (as amended). It aims to reduce water pollution from agricultural sources and to prevent such pollution occurring in the future (nitrogen is one of the nutrients that can affect plant growth). Under the Nitrates Directive, surface waters are identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water body.

8.5.11 The water and sediment quality assessment takes account of the location of any designated NVZs within the study area for the project.

Urban Waste Water Treatment Regulations

8.5.12 The Urban Waste Water Treatment Directive (91/271/EEC) is implemented in England and Wales through the Urban Waste Water Treatment (England and Wales) Regulations 1994 (as amended). It aims to protect the environment from the adverse effects of the collection, treatment, and discharge of urban waste water. It sets treatment levels on the basis of sizes of sewage discharges and the sensitivity of waters receiving the discharges. In general, the Urban Waste Water Treatment Directive requires that collected waste water is treated to at least secondary treatment standards for significant discharges. Secondary treatment is a biological treatment process where bacteria are used to break down the biodegradable matter (already much reduced by primary treatment) in waste water. Sensitive areas under the Urban Waste Water Treatment Directive are water bodies affected by eutrophication due to elevated nitrate concentrations and act as an indication that action is required to prevent further pollution caused by nutrients.

8.5.13 The water and sediment quality assessment takes into account the location of any sensitive areas within the study area for the project.

Shellfish Waters Directive

8.5.14 The Shellfish Waters Directive (2006/113/EC) was repealed in December 2013 and subsumed within the WFD. However, the Shellfish Water Protected Areas (England and Wales) Directions 2016 require that the Environment Agency (in England) endeavour to observe a microbial standard in all 'Shellfish Water Protected Areas'. The microbial standard is 300 or fewer colony forming units of *E. coli* per 100 ml of shellfish flesh and intravalvular liquid. The Directions also require the Environment Agency to assess compliance against this standard to monitor microbial pollution (75% of samples taken within any period of 12 months below the microbial standard and sampling/analysis in accordance with the Directions).

8.5.15 The water and sediment quality assessment takes into account the location of any Shellfish Water Protected Areas within the study area for the project.

The Marine and Coastal Access Act (MCAA)

8.5.16 The MCAA provides the legal mechanism to help ensure clean, healthy, safe, productive, and biologically diverse oceans and seas by putting in place a new system for improved management and protection of the marine and coastal environment.

The Habitats Regulations

8.5.17 The Conservation of Habitats and Species Regulations 2017 (as amended) (the Habitats Regulations) transpose the Habitats Directive (Directive 92/43/EEC) and the Birds Directive (2009/147/EC) into English law.

8.5.18 The Habitats Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European Sites. The Habitats Regulations also require the compilation and maintenance of a register of European sites, to include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) (classified under the Birds Directive). These sites form the Natura 2000 network. In addition, Natural England (2017) advice suggests that these regulations apply to Ramsar sites (designated under the 1971 Ramsar Convention for their internationally important wetlands), candidate SACs (cSAC), potential Special Protection Areas (pSPA), and proposed and existing European offshore marine sites.

8.5.19 Where a development project is located close to, or within, a European/Ramsar Site, the Habitats Regulations apply. This requires the 'Competent Authority' to determine whether the proposed works have the potential for a likely significant effect (LSE) on the interest features and/or supporting habitat of a European/Ramsar site either alone or in-combination with other plans, projects, and activities and, if so, to undertake an Appropriate Assessment of the implications of the proposals in light of the site's conservation objectives.

8.5.20 A Habitats Regulations Assessment (HRA) has been undertaken given the proposed development (specifically the marine infrastructure, proposed dredge, and the proposed disposal sites) is within the Humber Estuary SAC, SPA and Ramsar site (Figure 9.3 to this ES) and there is potential for an LSE. The outcomes of the water and sediment quality assessment have informed the HRA which is included within the DCO application (Application Document Reference number 9.6), in particular with respect to the potential release of sediment-bound contaminants.

National policy

National Policy Statement for Ports (NPSfP)

8.5.21 The NPSfP provides the policy framework for nationally significant infrastructure projects involving new port development (DfT, 2012). In order to meet the requirements of the Government's policies on sustainable development, the NPSfP requires that new port infrastructure should also, amongst other things, assess the impact on the water environment, including transitional and coastal waters.

8.5.22 Section 5.6 of the NPSfP advises that applicants should assess the existing status and impacts of the proposed project on water quality, water resources and physical characteristics of the water environment as part of the ES. The ES should describe:

- The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges: a consideration of surface water discharges is presented in the Coastal Protection, Flood Defence and Drainage chapter (Chapter 11 of this ES);
- Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates: a consideration of groundwater and surface water abstractions is presented in the Ground Conditions including Land Quality chapter (Chapter 12 of this ES);
- Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics: a consideration of these is presented in the Physical Processes chapter (Chapter 7 of this ES);
- Any impacts of the proposed project on water bodies or protected areas under the WFD and source protection zones (SPZs) around potable groundwater abstractions: a consideration of these is provided in this chapter and also assessed in the WFD Compliance Assessment (Appendix 8.1 to this ES); and
- Any cumulative effects: an assessment of any cumulative water and sediment quality effects that could arise from the proposed development

alone, as well as through other plans, projects and ongoing activities within the study area is considered in Chapter 20 of this ES.

8.5.23 The mitigation measures that are proposed to be implemented as standard good practice to manage water quality impacts are presented in Section 8.9 of this chapter. A Construction Environmental Management Plan (CEMP) has been prepared and provided with the DCO application (Application Document reference number 9.2) which sets out the mitigation measures considered necessary to manage environmental effects.

UK Marine Policy Statement (MPS)

8.5.24 The MPS (HM Government, 2011) is the framework for preparing marine plans and taking decisions affecting the marine environment. The MPS also sets out the general environmental, social, and economic considerations that need to be taken into account in marine planning and provides guidance on the pressures and impacts that decision makers need to consider when planning for and consenting development in the UK marine areas.

8.5.25 Section 2.6.4 of the MPS is relevant to the water and sediment quality assessment. In particular, paragraph 2.6.4.3 states, amongst other things, that - "*The marine plan authority should satisfy itself where relevant that any development will not cause a deterioration in status of any water to which the WFD applies... Decision makers should also take into account impacts on the quality of designated bathing waters and shellfish waters from any proposed development.*"

UK Marine Strategy

8.5.26 The aim of the UK Marine Strategy is to protect the UK's marine environment. The Strategy sets out a comprehensive framework for assessing, monitoring, and taking action to achieve the UK's shared vision for clean, healthy, safe, productive, and biologically diverse seas (Defra, 2019a). It aims to achieve good environmental status of marine waters by 2020 (followed by a six-year review) and then to protect the resource base upon which marine-related economic and social activities depend. The Strategy constitutes a vital environmental component of future maritime policy, designed to achieve the full economic potential of oceans and seas in harmony with the marine environment.

8.5.27 The UK Marine Strategy applies to the landward boundary of coastal waters as defined under the WFD (i.e., from mean high-water springs (MHWS)) to the outer limit of the UK Exclusive Economic Zone (EEZ), as well as the area of UK continental shelf beyond the EEZ. Reporting against the Strategy is a cyclical process, and the most recent assessments and Marine Strategy documents were updated in 2019. The anticipated pressures exerted on the marine environment by the proposed development are considered to be of small magnitude in the context of UK Marine Regions such that they are unlikely to be a significant issue. The Strategy is, therefore, not considered further in this ES with regards to the water and sediment quality assessment.

East Inshore and East Offshore Marine Plans

8.5.28 The first Marine Plans include the East Inshore and East Offshore Marine Plans, which are collectively referred to as 'the East Marine Plans'. These were formally adopted on 2 April 2014 (Defra, 2014). The East Inshore Marine Plan area covers 6,000 km² of sea, from MHWS out to the 12 nautical mile (nm) limit from Flamborough Head in the north to Felixstowe in the south. The East Offshore Marine Plan covers 49,000 km² of area from the 12 nm limit to the border with The Netherlands, Belgium, and France.

8.5.29 There is one policy within the East Marine Plans specifically related to water and sediment quality:

- Policy ECO2 - "*The risk of release of hazardous substances as a secondary effect due to any increased collision risk should be taken account of in proposals that require an authorisation*": The potential risk of vessel collisions as a result of the proposed development are considered in the Commercial and Recreational Navigation assessment (Chapter 10 of this ES).

8.5.30 There are also several references to the importance of water quality in supporting a healthy ecosystem and the potential for pollutants to affect the environment as well as people (from marine as well as riverine and terrestrial sources). The impacts of the IERRT project on water and sediment quality are assessed in Section 8.8 of this chapter. Chapter 9 of this ES also assesses the impacts to marine habitats and species due to changes in water and sediment quality.

Local policy

North East Lincolnshire Local Plan 2013 to 2032

8.5.31 The proposed development site is located largely within the administrative area of North East Lincolnshire, although elements of the marine infrastructure fall beyond the local Council's administrative boundary.

8.5.32 As far as the Local Planning Authority is concerned, the North East Lincolnshire Local Plan was adopted in 2018 and covers the period 2013 to 2032.

8.5.33 Within its Spatial Portrait, the Local Plan highlights the importance of the 'Estuary Zone' of the local authority area, which includes the 'nationally important port' of Immingham. When considering the detail of how the economy of the area will be developed, the Plan specifically identifies at the outset that there are good expectations of growth within the ports and logistics sector.

8.5.34 On the policies map which accompanies the Local Plan, the site of the proposed project is shown as being located within an area identified as 'Employment – Operational Port'.

8.5.35 In addition, Policy 34 of the plan makes clear that:

> *"Water management*
> *1. Development proposals that have the potential to impact on surface and ground water should consider the objectives and programme of measures set out in the Humber River Basin Management Plan."*

8.5.36 The Humber River Basin Management Plan provides a framework for protecting and enhancing the benefits provided by the water environment within the Humber River Basin District and informs decisions on land-use planning. The Humber River Basin District covers an area of 26,100 km² and extends from the West Midlands in the south, northwards to North Yorkshire and from Staffordshire in the west to part of Lincolnshire and the Humber Estuary in the east.

Guidance

Clearing the Waters for All

8.5.37 In 2016, the Environment Agency published guidance, referred to as "Clearing the Waters for All", regarding how to assess the impact of activities in WFD transitional and coastal water bodies (Environment Agency, 2016). The guidance sets out the following three discrete stages for WFD compliance assessments to follow:

- Screening: excludes any activities that do not need to go through the scoping or impact assessment stages;
- Scoping: identifies the receptors and quality elements that are potentially at risk from an activity and need further detailed assessment; and
- Assessment: considers the potential impacts of an activity, identifies ways to avoid/minimise impacts, and indicates if it may cause deterioration or jeopardise the water body achieving good status.

8.5.38 The WFD Compliance Assessment for the proposed development in Appendix 8.1 to this ES follows the format specified in this guidance.

PINS Advice Note Eighteen: The Water Framework Directive

8.5.39 Advice Note Eighteen (Planning Inspectorate, 2017) explains the information that the Inspectorate considers an applicant must provide with their Nationally Significant Infrastructure Project (NSIP) application in order to clearly demonstrate that the WFD and the Water Environment (WFD) (England and Wales) Regulations 2017 have been appropriately considered.

8.5.40 The Advice Note also refers to Environment Agency guidance (as described above) in terms of the WFD process and the information required. Furthermore, the guidance describes the relevant bodies to be consulted in the pre-application process, and the presentation of information.

8.5.41 The WFD Compliance Assessment for the proposed development in Appendix 8.1 to this ES contains the information specified in this guidance as appropriate.

8.6 Description of the existing environment

Water quality

Water Framework Regulations

8.6.1 Water quality standards and objectives are implemented through a range of legislation including the Water Framework Regulations, the Bathing Water Regulations, and the UK Marine Strategy. The standards and objectives were established through the WFD which provided for holistic management of all water bodies including rivers, estuaries, groundwater, lakes, and coastal waters to 1 nm offshore. Domestic legislation derived from the WFD integrates and requires protection of designated shellfish waters, through The Water Framework Regulations; bathing waters, through the Bathing Water Regulations; nature conservation sites, through the Habitats Regulations; and eutrophication, through the Nitrate Pollution Prevention Regulations.

8.6.2 The Environment Agency published River Basin Management Plans (RBMPs), which set out measures through which compliance with WFD objectives will be achieved. The Humber River Basin District RBMP identifies the Humber Lower water body (ID: GB530402609201) within and surrounding the IERRT project (including Humber Estuary disposal sites) (Environment Agency, 2022a) (Figure 8.1 to this ES). It is recorded as a heavily modified water body (HMWB) due to coastal protection use, flood protection use, and navigation use. This means ‘ecological potential’ is applied rather than ‘ecological status’. The current (2019) overall status of this waterbody is ‘moderate’, with an ecological potential of ‘moderate’, and a chemical status of ‘fail’. The reason for the ‘fail’ chemical status is based on priority substances cypermethrin and dichlorvos, and priority hazardous substances polybrominated diphenyl ethers (PBDE), perfluorooctane sulphonate (PFOS), benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds, and tributyltin compounds. Surface water bodies overlapping the landside works are detailed in the Ground Conditions, including Land Quality chapter (Chapter 12 of this ES).

Bathing Waters

8.6.3 Cleethorpes designated bathing waters is located approximately 11.5 km south east of the IERRT project, and Humberston Fitties is located approximately 15 km south east (Figure 8.2 to this ES). Cleethorpes was assessed as having ‘good’ bathing water quality in 2021 (Environment Agency, 2022b), declining from an ‘excellent’ classification in 2019. Humberston Fitties was assessed as having ‘good’ bathing water quality in 2021 (Environment Agency, 2022b), remaining steady from a ‘good’ classification in 2019.

Shellfish Water Protected Areas

8.6.4 There are no Shellfish Water Protected Areas in the vicinity of the IERRT project (Defra, 2016). The nearest is the West Wash Shellfish Water Protected Area, located over 65 km south.

Nitrate Vulnerable Zones

8.6.5 The landside extent of the IERRT project is located on land included in the North Beck Drain NVZ, covering Immingham as well as South Killingholme and Healing, as designated under the Nitrates Pollution Prevention Regulations (Environment Agency, 2022c) (Figure 8.2 to this ES).

Sensitive Areas

8.6.6 There are no sensitive areas designated under the Urban Waste Water Treatment Regulations in the vicinity of the IERRT project site (Defra, 2019b). The main watercourses in the vicinity of the proposed development site (within 5 km) are South Killingholme Haven which drains to the north-west corner of the Port of Immingham (but is defined as part of the Humber Estuary water body), North Killingholme main drain, Habrough Marsh drain and the Humber Estuary itself.

Water quality monitoring

8.6.7 The Environment Agency's 'Water Quality Archive' (accessible on their website) provides data on water quality measurements taken at sampling points around England (Environment Agency, 2022d). These can be from coastal or estuarine waters, rivers, lakes, ponds, canals or groundwaters. They are taken for a number of purposes including compliance assessment against discharge permits, investigation of pollution incidents or environmental monitoring.

8.6.8 The nearest saline water sampling point to the proposed development (with adequate temporal coverage and a reasonable amount of determinands measured) is Clean Site - Ti02 Monitoring Point, 1985 (sampling ID: AN-CLNMON1). This is shown on Figure 8.3 to this ES. Contaminant concentrations measured in the water at this location are shown in Table 8.5. These are compared against environmental quality standards (EQS) as described under the WFD (Standards and Classification) Directions (England and Wales) 2015, specifically annual average (AA) concentrations and/or maximum allowable concentrations (MAC)), to provide an indication of the water quality measured at the sampling point. As indicated below in Table 8.5, metal concentrations reported between 2015 and 2022 were typically below respective EQSs. There were some exceedances related to the AA EQS for tributyl tin (TBT) and the Humber Estuary transitional water body was failing chemical status due to excessive concentrations of TBT in 2019. Benzo(a)pyrene and benzo(g,h,i)perylene were failing their respective MAC EQSs between 2015 and 2021. Benzo(b)fluoranthene was also failing its MAC EQSs in 2015 to 2021 (with the exception 2019), and benzo(k)fluoranthene was failing its MAC EQS in 2016 to 2018. The Humber Lower transitional water body was failing chemical status due to benzo(b)fluoranthene and benzo(g-h-i)perylene in 2019.

Table 8.5. Concentration range, mean and number of water samples collected between 2015 and 2022 by the Environment Agency for contaminants measured near the proposed development

Parameter	Unit	EQS	2015	2016	2017	2018	2019	2020	2021	2022
Arsenic	µg/l	25 (AA)	1.9 – 2.39 $\bar{x}$ = 2.10 (n = 3)	2.32 (n = 1)	-	1.94 – 2.59 $\bar{x}$ = 2.276667 (n = 3)	1.95 (n = 1)	-	-	-
Cadmium	µg/l	0.2 (AA)	0.044 – 0.101 $\bar{x}$ = 0.077 (n = 9)	0.041 – 0.066 $\bar{x}$ = 0.04875 (n = 4)	0.062 – 0.063 $\bar{x}$ = 0.063 (n = 2)	0.046 – 0.14 $\bar{x}$ = 0.089 (n = 9)	0.0408 – 0.0706 $\bar{x}$ = 0.055433 (n = 3)	-	0.058 – 0.12 $\bar{x}$ = 0.084 (n = 8)	0.051 – 0.079 $\bar{x}$ = 0.066 (n = 8)
Chromium (VI)	µg/l	0.6 (AA); 32 (MAC)	<0.3 (n = 1)	<0.3 (n = 1)	-	<0.3 (n = 3)	<0.3 (n = 1)	-	-	-
Copper	µg/l	3.76 (AA)	1.7 – 2.62 $\bar{x}$ = 2.01 (n	2.35 – 2.96 $\bar{x}$ = 2.85 (n = 2)	2.35 – 2.96 $\bar{x}$ = 2.66 (n = 2)	1.99 – 2.52 $\bar{x}$ = 2.2 (n = 3)	1.59 (n = 1)	-	1.7 – 3.2 $\bar{x}$ = 2.19 (n = 8)	1.7 – 2.3 $\bar{x}$ = 1.96 (n = 8)
Lead	µg/l	1.3 (AA); 14 (MAC)	<0.04 – 0.074 $\bar{x}$ = 0.056 (n = 9)	0.04 – 0.098 $\bar{x}$ = 0.07 (n = 3)	-	<0.04 – 0.088 $\bar{x}$ = 0.053189 (n = 9)	0.0656 – 0.108 $\bar{x}$ = 0.0798 (n = 3)	-	0.046 – 0.12 $\bar{x}$ = 0.069 (n = 8)	0.04 – 0.084 $\bar{x}$ = 0.065 (n = 8)
Mercury	µg/l	0.07 (MAC)	<0.01 (n = 9)	<0.01 (n = 3)	-	<0.01 (n = 9)	<0.01 (n = 3)	-	-	-
Nickel	µg/l	8.6 (AA); 34 (MAC)	1.25 – 2.29 $\bar{x}$ = 1.69 (n = 9)	1.14 – 2.11 $\bar{x}$ = 1.61 (n = 4)	1.79 – 2.11 $\bar{x}$ = 1.95 (n = 2.11)	1.4 – 2.00 $\bar{x}$ = 1.71 (n = 8)	1.35 – 1.8 $\bar{x}$ = 1.54 (n = 3)	-	1.4 – 7.8 $\bar{x}$ = 2.43 (n = 8)	1.3 – 1.6 $\bar{x}$ = 1.41 (n = 8)
Zinc	µg/l	7.9 (AA)	2.2 – 4.7 $\bar{x}$ = 3.79 (n = 3)	3.47 – 4.86 $\bar{x}$ = 4.165 (n = 2)	4.22 – 4.86 $\bar{x}$ = 4.54 (n = 2)	2.21 – 4.32 $\bar{x}$ = 3.15 (n = 3)	4.05 (n = 1)	-	1.9 – 5.7 $\bar{x}$ = 3.29 (n = 8)	1.9 – 3.4 $\bar{x}$ = 2.93 (n = 8)
Tributyltin (TBT)	µg/l	0.0002 (AA); 0.0015 (MAC)	0.00021 – 0.00096 $\bar{x}$ = 0.00044 (n = 9)	<0.0002 – 0.0008 $\bar{x}$ = 0.00041 (n = 12)	0.00029 – 0.00092 $\bar{x}$ = 0.00052 (n = 3)	<0.0002 – 0.00081 $\bar{x}$ = 0.00030 (n = 10)	0.00025 – 0.00032 $\bar{x}$ = 0.00029 (n = 2)	-	0.0002 – 0.00023 $\bar{x}$ = 0.0002 (n = 8)	0.0002 – 0.00036 $\bar{x}$ = 0.00023 (n = 8)

Parameter	Unit	EQS	2015	2016	2017	2018	2019	2020	2021	2022
Benzo(a)-pyrene	µg/l	0.00017 (AA); 0.0027 (MAC)	>0.002 - <0.01 $\bar{x}$ = 0.0087 (n = 12)	>0.002 – 0.22 $\bar{x}$ = 0.042 (n = 12)	0.00055 – >0.05 $\bar{x}$ = 0.026 (n = 0.026)	<0.0004 – 0.0874 $\bar{x}$ = 0.033 (n = 8)	0.015 – 4.05 $\bar{x}$ = 1.02 (n = 4)	-	0.0004 – 0.033 $\bar{x}$ = 0.013 (n = 8)	0.0005 – 0.026 $\bar{x}$ = 0.007 (n = 8)
Benzo(g,h,i)-perylene	µg/l	0.00082 (MAC)	>0.002 – <0.01 $\bar{x}$ = 0.0087 (n = 12)	>0.002 – 0.24 $\bar{x}$ = 0.042 (n = 12)	0.00063 – >0.05 $\bar{x}$ = 0.025 (n = 3)	0.00057 – 0.091 $\bar{x}$ = 0.026 (n = 8)	0.015 – 0.018 $\bar{x}$ = 0.017 (n = 2)	-	0.0004 – 0.03 $\bar{x}$ = 0.011 (n = 8)	0.0005 – 0.024 $\bar{x}$ = 0.006 (n = 8)
Benzo(b)-fluoranthene	µg/l	0.017 (MAC)	>0.002 – 0.20 $\bar{x}$ = 0.038 (n = 12)	>0.002 – 0.20 $\bar{x}$ = 0.038 (n = 12)	0.00056 - >0.05 $\bar{x}$ = 0.024 (n = 3)	0.00045 – 0.074 $\bar{x}$ = 0.028 (n = 8)	0.013 – 0.014 $\bar{x}$ = 0.013 (n = 2)	-	0.0005 – 0.03 $\bar{x}$ = 0.011 (n = 8)	0.0005 – 0.021 $\bar{x}$ = 0.006 (n = 8)
Benzo(k)-fluoranthene	µg/l	0.0063 (AA); 0.017 (MAC)	>0.002 – <0.01 $\bar{x}$ = 0.0087 (n = 12)	>0.002 – 0.11 $\bar{x}$ = 0.024 (n = 12)	<0.0004 – >0.05 $\bar{x}$ = 0.021 (n = 3)	<0.0004 – 0.038 $\bar{x}$ = 0.015 (n = 8)	0.0070 – 0.0075 $\bar{x}$ = 0.0072 (n = 2)	-	0.0004 – 0.016 $\bar{x}$ = 0.006 (n = 8)	0.0004 – 0.012 $\bar{x}$ = 0.004 (n = 8)
Fluoranthene	µg/l	0.12 (MAC)	>0.002 - <0.01 $\bar{x}$ = 0.0087 (n = 12)	>0.002 – 0.14 $\bar{x}$ = 0.036 (n = 12)	0.00103 - >0.05 $\bar{x}$ = 0.027 (n = 3)	<0.0004 – 0.095 $\bar{x}$ = 0.031 (n = 8)	0.016 – 0.019 $\bar{x}$ = 0.018 (n = 3)	-	0.0015 – 0.026 $\bar{x}$ = 0.012 (n = 8)	0.0012 – 0.023 $\bar{x}$ = 0.009 (n = 8)
Hexachloro-benzene	µg/l	0.05 (MAC)	<0.001 (n = 12)	<0.0001 – 0.001 $\bar{x}$ = 0.00049 (n = 7)	<0.0001 – 0.005 $\bar{x}$ = 0.0020 (n = 3)	-	-	-	-	-
Hexachloro-butadiene	µg/l	0.6 (MAC)	<0.003 (n = 12)	<0.0001 – <0.001 $\bar{x}$ = 0.00049 (n = 7)	<0.0001 – <0.005 $\bar{x}$ = 0.0020 (n = 3)	-	-	-	-	-
BDE 28	µg/l	-	<0.0006 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-
BDE 47	µg/l	-	<0.0006 - 0.0001 $\bar{x}$ = 0.000065 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-

Parameter	Unit	EQS	2015	2016	2017	2018	2019	2020	2021	2022
BDE 99	µg/l	-	<0.0006 – 0.00017 $\bar{x}$ = 0.000076 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-
BDE 100	µg/l	-	<0.0006 – 0.00017 $\bar{x}$ = 0.000076 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-
BDE 153	µg/l	-	<0.0006 – 0.0007 $\bar{x}$ = 0.000061 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-
BDE 154	µg/l	-	<0.0006 (n = 7)	<0.0006 (n = 7)	<0.0006 (n = 3)	-	-	-	-	-

$\bar{x}$ = mean
n = number of water samples
Data from sampling point ‘Clean Site - Ti02 Monitoring Point, 1985, ID: AN-CLNMON1)’ in the Humber Estuary, obtained from the Environment Agency’s ‘Water Quality Archive’ (Environment Agency, 2022d)

Sediment quality

8.6.9 The UK has not adopted formal quantitative EQS for sediments. In the absence of any quantified UK standards, therefore, common practice for characterising baseline sediment quality conditions is to compare against the Cefas Guideline Action Levels for the disposal of dredged material (MMO, 2014).

8.6.10 Cefas Guideline Action Levels are used as part of a 'weight of evidence' approach to assessing material suitability for disposal at sea. Cefas guidance indicates that, in general, contaminant levels below Action Level 1 (AL1) are of no concern. Material with contaminant levels above Action Level 2 (AL2), however, is generally considered unsuitable for disposal at sea whilst dredged material with contaminant levels between AL1 and AL2 requires further consideration before a decision can be made as to disposal. Consequently, the Action Levels should not be viewed as pass/fail thresholds, and it is also recognised that these guidelines are not statutory requirements.

8.6.11 In September 2021, a sample plan (SAM/2021/00053) was provided by the MMO, prepared in consultation with Cefas. In October 2021, sediment samples were collected from ten stations (1 to 10) across the proposed dredge area comprising the proposed development, including subsurface samples[1] (Figure 8.3 to this ES).

8.6.12 The sampling regime and analysis was undertaken in accordance with the sample plan. The sediment samples were analysed by an MMO-approved laboratory for the following physical and chemical parameters:

- Particle size analysis (PSA);
- Trace metals;
- Organotins;
- Polycyclic aromatic hydrocarbons (PAHs);
- Polychlorinated biphenyls (PCBs);
- Total hydrocarbon content (THC);
- Polybrominated diphenyl ethers (PBDEs); and
- Organochlorine pesticides (OCPs).

[1] The sample plan from the MMO advised that sampling should be undertaken a 1 m depth intervals down to the maximum dredge depth for each proposed dredge area. However, the corer used during sampling was unable to retrieve samples from the full dredge depths due to the very stiff nature of the material encountered at depth. One sample was, therefore, retrieved at 1 m depth intervals down to the maximum depth the corer could penetrate. This is considered adequate in this case given these areas have not been dredged beyond this depth historically and the contaminant analysis results indicate contamination generally does not increase with depth. Furthermore, the maximum depths that were possible to sample from the dredge area were into the geological stiff sandy clay material (i.e., virgin material that was laid down prior to the existence of humans) and, therefore, unlikely to be contaminated (as supported by the contaminant analysis results).

8.6.13 The PSA results are presented in Table 8.6. Sediments from most sampling locations were dominated by silt material. Samples from Sample 2 (3.8 m), Sample 3 (1 m), Sample 4 (2 m), Sample 5 (2 m), Sample 6 (4.10 m), and Sample 8 (1 m) predominantly comprised sand. With the exception of Sample 4 (2 m and 2.70 m), Sample 5 (4.70 m), Sample 9 (3 m), and Sample 10 (2.60 m), gravel comprised less than 10% of samples collected.

8.6.14 Sediment samples have also been analysed for total organic carbon (TOC) (Table 8.6). Values typically ranged from about 0.5% to 6%, with a minimum of 0.15% and a maximum of 18.8%. The average organic carbon content across all samples was 2.16%. Generally, samples with higher proportions of sand and gravel had lower TOC as organic matter tends to accumulate in finer grained sediments.

8.6.15 A summary of sediment quality (chemical analysis) of samples from the dredge areas is provided in Table 8.7 to Table 8.16. Concentrations above or below Cefas Guideline Action Levels are highlighted to provide an indication of sediment quality. In general, concentrations were typically higher in surface samples compared to those obtained at depth. Contaminant concentrations were generally low, with most values below the respective AL1 or marginally exceeding AL1. There were no instances where the concentration exceeded the respective AL2 (or a sample concentration was close to exceeding this threshold).

8.6.16 Trace metal concentrations were typically below AL1 in most samples, with some minor exceedances of AL1 for some metals (mainly in Sample 1 and Sample 6). Organotins were consistently below the respective AL1, as were PCBs in most samples (with the exception of some sub-samples in Sample 1, Sample 2, Sample 6, and Sample 7). Numerous individual PAHs were found to be above AL1 (there is currently no AL2 for individual or total PAHs), particularly in Sample 1, Sample 6, Sample 7, and Sample 9. OCP concentrations were often below the limit of detection (LOD) in most samples. Dieldrin and p,p'-Dichlorodiphenyltrichloroethane (DDT) were mostly below or marginally exceeding AL1. PBDE concentrations also appeared to be low in general with most below the LOD. Currently, no ALs apply to PBDEs, however, Cefas and Defra are proposing to introduce AL1s for these contaminants. A small proportion of surface samples are above the proposed AL1 for BDE 99, BDE 100 and BDE 209 noting that these ALs are still subject to review and are not yet implemented. These values are considered typical of surface concentrations of PBDEs in the Humber Estuary.

Table 8.6. Particle size analysis (PSA) results and total organic carbon (TOC) from sediment samples collected in October 2021

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2 mm)	Sand (2 mm – 63 µm)	Silt (<63 µm)
1	0	Odourless Brown Mud.	1.89	0.00	7.28	92.71
	1	Odourless Brown Mud.	2.07	0.00	5.29	94.68
	2	Odourless Brown Mud.	2.24	0.00	16.57	83.42
	3	Odourless Brown Mud.	2.74	0.00	16.60	83.41
	4	Brown Sandy Mud with an Earthy Odour.	2.32	0.00	13.64	86.34
	4.70	Brown Sandy Mud with an Earthy Odour.	2.06	0.00	17.31	82.70
2	0	Odourless Brown Mud.	2.07	0.00	9.19	90.82
	1	Odourless Brown Mud.	2.26	0.00	18.04	81.97
	2	Brown Mud with an Earthy Odour.	1.01	0.00	0.00	100.00
	3	Brown Mud with an Earthy Odour.	1.06	0.00	11.56	88.44
	3.80	Odourless Brown Sandy Mud.	0.59	0.00	57.58	42.40
3	0	Odourless Brown Mud.	0.43	0.00	4.01	96.01
	1	Odourless Brown Muddy Sand.	0.15	0.00	93.25	6.74
	2	Odourless Brown Mud.	0.94	0.00	0.93	99.06
	3.10	Odourless Brown Gravelly Mud.	0.69	9.43	25.46	65.10
4	0	Odourless Brown Mud with Organic Matter.	4.37	0.10	27.80	72.09
	1	Odourless Brown Mud with Organic Matter.	6.71	0.05	30.42	69.50
	2	Odourless Brown Muddy Sandy Gravel.	0.66	39.44	41.63	18.94
	2.70	Odourless Brown Gravelly Mud.	0.80	10.37	24.36	65.25

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2 mm)	Sand (2 mm – 63 µm)	Silt (<63 µm)
5	0	Odourless Brown Mud.	2.15	0.00	8.80	91.19
	1	Odourless Brown Mud.	2.13	0.00	8.09	91.89
	2	Odourless Brown Muddy Sand.	0.38	0.00	77.00	23.01
	3	Odourless Brown Sandy Mud.	1.15	0.00	0.00	100.00
	4	Odourless Brown Gravelly Mud.	0.88	3.93	23.14	72.92
	4.7	Odourless Brown Gravelly Mud.	0.83	19.80	22.27	57.89
6	0	Odourless Brown Mud.	1.65	0.00	18.07	81.94
	1	Odourless Brown Mud.	1.85	0.00	17.34	82.67
	2	Brown Mud with an Earthy Odour.	1.87	0.00	14.76	85.24
	3	Brown Mud with an Earthy Odour.	3.10	0.00	18.53	81.47
	4.10	Odourless Grey-Brown Gravelly Muddy Sand with Shell Fragments and Organic Matter.	0.29	9.60	70.79	19.61
7	0	Odourless Brown Mud.	1.66	0.00	11.77	88.22
	1	Brown Mud with an Earthy Odour.	1.72	0.00	17.62	82.38
	2	Brown Mud with an Earthy Odour.	2.04	0.00	35.84	64.17
	3	Brown Mud with an Earthy Odour.	4.87	0.00	31.16	68.80
	4	Odourless Brown Mud with Organic Matter.	2.55	0.00	36.24	63.77
	4.80	Odourless Brown Mud with Organic Matter.	2.72	0.00	14.89	85.13
8	0	Odourless Brown Gravelly Mud with Organic Matter.	18.80	4.00	10.91	85.09
	1	Odourless Brown Muddy Sand.	0.42	0.00	68.98	31.02
	2	Odourless Brown Sandy Mud.	0.97	0.00	16.51	83.51
	3	Odourless Brown Sandy Mud.	0.92	0.00	5.98	94.02
	3.65	Odourless Brown Sandy Mud.	1.06	0.00	0.56	99.43

Sample	Depth (m)	Visual Appearance	Total organic carbon (TOC) M/M %	Particle Size Distribution (%)		
				Gravel (>2 mm)	Sand (2 mm – 63 µm)	Silt (<63 µm)
9	0	Odourless Brown Mud.	1.99	0.00	3.16	96.82
	1	Odourless Brown Mud.	2.10	0.00	6.16	93.86
	2	Odourless Brown Mud.	2.14	0.00	5.56	94.47
	3	Odourless Brown Gravelly Mud.	0.88	10.21	8.60	81.18
	4	Odourless Brown Mud.	1.15	0.00	0.00	99.99
	4.60	Odourless Brown Mud.	1.20	0.00	0.00	100.00
10	0	Brown Mud with Organic Matter and an Anoxic Odour.	4.36	0.02	29.80	70.19
	1	Odourless Brown Gravelly Sandy Mud with Organic Matter.	6.03	0.55	62.86	36.60
	2	Odourless Brown Sandy Mud.	0.74	0.00	50.69	49.34
	2.60	Odourless Grey-Brown Muddy Sandy Gravel.	0.55	32.49	46.14	21.35

Table 8.7. Sediment contamination data for Sample 1 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 1 (0 m)	Sample 1 (1.0 m)	Sample 1 (2.0 m)	Sample 1 (3.0 m)	Sample 1 (4.0 m)	Sample 1 (4.7 m)
Arsenic	mg/kg	20	100	17.8	26.5	41.3	62.0	43.7	34.6
Cadmium	mg/kg	0.4	5	0.37	0.46	0.81	0.87	1.06	1.20
Chromium	mg/kg	40	400	49.4	60.6	73.8	113	98.4	77.9
Copper	mg/kg	40	400	31.3	36.5	55.0	69.6	78.5	71.0
Lead	mg/kg	50	500	58.6	69.3	90.1	140	130	110
Mercury	mg/kg	0.3	3	0.19	0.23	0.40	0.50	0.54	0.47
Nickel	mg/kg	20	200	33.2	35.2	40.6	54.8	49.4	43.0
Zinc	mg/kg	130	800	163	191	228	324	314	279
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	0.013	0.013	0.012	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	0.016	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.0601	0.0543	0.15	0.173	0.235	0.351
Acenaphthylene	mg/kg	0.1	-	0.039	0.0349	0.0718	0.104	0.12	0.139
Anthracene	mg/kg	0.1	-	0.114	0.111	0.255	0.321	0.399	0.516
Benzo[a]anthracene	mg/kg	0.1	-	0.251	0.230	0.588	0.675	0.813	0.977
Benzo[a]pyrene	mg/kg	0.1	-	0.345	0.308	0.695	0.954	1.090	1.200
Benzo[b]fluoranthene	mg/kg	0.1	-	0.312	0.324	0.698	0.908	0.972	1.110
Benzo[e]pyrene	mg/kg	0.1	-	0.321	0.326	0.638	0.841	0.889	0.991
Benzo[ghi]perylene	mg/kg	0.1	-	0.333	0.334	0.615	0.905	0.934	0.93
Benzo[k]fluoranthene	mg/kg	0.1	-	0.173	0.172	0.335	0.469	0.574	0.537
C1-naphthalenes	mg/kg	0.1	-	0.586	0.568	0.981	1.17	0.876	0.937
C1-phenanthrene	mg/kg	0.1	-	0.435	0.337	0.671	0.709	0.672	0.805
C2-naphthalenes	mg/kg	0.1	-	0.484	0.456	0.776	0.91	0.666	0.739
C3-naphthalenes	mg/kg	0.1	-	0.491	0.408	0.692	0.8	0.593	0.67
Chrysene	mg/kg	0.1	-	0.26	0.227	0.573	0.681	0.692	0.913
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0594	0.0499	0.124	0.137	0.15	0.156

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 1 (0 m)	Sample 1 (1.0 m)	Sample 1 (2.0 m)	Sample 1 (3.0 m)	Sample 1 (4.0 m)	Sample 1 (4.7 m)
Fluoranthene	mg/kg	0.1	-	0.486	0.437	1.17	1.25	1.49	1.95
Fluorene	mg/kg	0.1	-	0.0961	0.083	0.213	0.255	0.305	0.413
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.282	0.296	0.609	0.912	0.948	0.991
Naphthalene	mg/kg	0.1	-	0.22	0.223	0.437	0.565	0.493	0.572
Perylene	mg/kg	0.1	-	0.157	0.167	0.31	0.382	0.444	0.454
Phenanthrene	mg/kg	0.1	-	0.433	0.345	0.778	0.848	0.935	1.11
Pyrene	mg/kg	0.1	-	0.488	0.417	1.07	1.09	1.27	1.63
Total Hydrocarbon Content (THC)	mg/kg	-	-	78.1	98.5	79.1	138.0	202.0	480.0
PCBs – Sum of ICES 7	µg/kg	10	-	5.19	8.82	16.64	35.93	39.10	29.83
PCBs – Sum of 25 Congeners	µg/kg	20	200	11.15	18.76	37.23	76.78	11.15	18.76
AHCH	mg/kg	-	-	<0.0001	<0.0001	0.0002	0.0003	0.0002	0.0002
BHCH	mg/kg	-	-	<0.0001	0.0001	0.0002	0.0003	0.0006	0.0005
GHCH	mg/kg	-	-	0.0003	0.0006	0.0027	0.0010	0.0002	<0.0001
Dieldrin	mg/kg	0.005	-	0.0008	0.0008	0.0026	0.0074	0.0065	0.0066
HCB	mg/kg	-	-	0.0005	0.0009	0.0013	0.0015	0.0005	0.0005
PPTDE	mg/kg	-	-	0.0089	0.0115	0.0170	0.0301	0.0364	0.0392
PPDDE	mg/kg	-	-	0.0013	0.0019	0.0034	0.0082	0.0091	0.0099
PPDDT	mg/kg	0.001	-	0.0070	0.0030	0.0121	0.0077	0.0208	0.0189
PBDE 17	µg/kg	-	-	0.474	1.31	0.148	0.0836	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.348	0.962	0.127	0.144	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.72	4.27	0.277	0.337	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.232	0.534	0.0357	0.0484	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.103	0.277	0.0245	0.0358	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.8	4.39	0.295	0.368	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.199	0.552	0.0299	<0.02	<0.02	<0.02

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 1 (0 m)	Sample 1 (1.0 m)	Sample 1 (2.0 m)	Sample 1 (3.0 m)	Sample 1 (4.0 m)	Sample 1 (4.7 m)
PBDE 138	µg/kg	-	-	0.0408	0.0858	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.245	0.516	0.0313	0.0327	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.115	0.233	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.0824	0.127	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	81.8	84.3	1.4	0.361	<0.1	0.109
Key	Below AL1								
	Above AL1, Below AL2								
	Above AL2								

Table 8.8. Sediment contamination data for Sample 2 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 2 (0 m)	Sample 2 (1.0 m)	Sample 2 (2.0 m)	Sample 2 (3.0 m)	Sample 2 (3.8 m)
Arsenic	mg/kg	20	100	30.5	43.4	10.1	9.7	5.0
Cadmium	mg/kg	0.4	5	0.46	0.99	0.21	0.25	0.19
Chromium	mg/kg	40	400	56.7	75.8	37.0	30.1	14.1
Copper	mg/kg	40	400	36.4	56.1	22.2	21.8	13.3
Lead	mg/kg	50	500	70.9	94.7	19.4	16.5	9.7
Mercury	mg/kg	0.3	3	0.26	0.44	0.04	0.01	<0.01
Nickel	mg/kg	20	200	34.4	39.9	42.1	38.2	20.8
Zinc	mg/kg	130	800	186	250	70.5	65.8	40.8
Dibutyltin (DBT)	mg/kg	0.1	1	0.013	0.012	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.101	0.144	0.0214	0.0178	0.0124
Acenaphthylene	mg/kg	0.1	-	0.0616	0.068	0.00833	0.00557	0.00447

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 2 (0 m)	Sample 2 (1.0 m)	Sample 2 (2.0 m)	Sample 2 (3.0 m)	Sample 2 (3.8 m)
Anthracene	mg/kg	0.1	-	0.194	0.275	0.0208	0.0176	0.0139
Benzo[a]anthracene	mg/kg	0.1	-	0.384	0.551	0.0622	0.0547	0.0472
Benzo[a]pyrene	mg/kg	0.1	-	0.487	0.736	0.087	0.0714	0.0609
Benzo[b]fluoranthene	mg/kg	0.1	-	0.513	0.69	0.101	0.0941	0.0956
Benzo[e]pyrene	mg/kg	0.1	-	0.498	0.641	0.169	0.168	0.168
Benzo[ghi]perylene	mg/kg	0.1	-	0.487	0.687	0.216	0.197	0.16
Benzo[k]fluoranthene	mg/kg	0.1	-	0.193	0.301	0.036	0.0194	0.019
C1-naphthalenes	mg/kg	0.1	-	0.889	1.06	0.574	0.365	0.394
C1-phenanthrene	mg/kg	0.1	-	0.596	0.711	0.386	0.309	0.32
C2-naphthalenes	mg/kg	0.1	-	0.731	0.838	0.401	0.304	0.311
C3-naphthalenes	mg/kg	0.1	-	0.726	0.734	0.362	0.283	0.278
Chrysene	mg/kg	0.1	-	0.384	0.545	0.0911	0.101	0.0897
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0802	0.103	0.0211	0.0186	0.0181
Fluoranthene	mg/kg	0.1	-	0.677	1.11	0.0926	0.0838	0.061
Fluorene	mg/kg	0.1	-	0.138	0.213	0.0693	0.0477	0.0474
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.44	0.691	0.0668	0.0539	0.0395
Naphthalene	mg/kg	0.1	-	0.337	0.441	0.19	0.0769	0.0915
Perylene	mg/kg	0.1	-	0.217	0.291	0.0268	0.0234	0.0143
Phenanthrene	mg/kg	0.1	-	0.562	0.855	0.309	0.235	0.25
Pyrene	mg/kg	0.1	-	0.651	0.99	0.118	0.128	0.104
Total Hydrocarbon Content (THC)	mg/kg	-	-	26.3	87.8	10.8	8.37	42.4
PCBs – Sum of ICES 7	ug/kg	10	-	8.84	20.58	0.59	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	19.48	47.80	2.03	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	0.0003	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	0.0002	0.0008	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 2 (0 m)	Sample 2 (1.0 m)	Sample 2 (2.0 m)	Sample 2 (3.0 m)	Sample 2 (3.8 m)
GHCH	mg/kg	-	-	0.0003	0.0017	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0019	0.0035	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0010	0.0018	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	0.0127	0.0283	0.0007	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0022	0.0053	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0018	0.0214	0.0004	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	0.543	0.212	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.448	0.104	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.97	0.241	0.0371	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.208	0.033	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.12	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.83	0.26	0.0289	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.134	0.024	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	0.0494	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.241	0.0272	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.0803	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.0654	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	45.5	0.556	0.687	0.137	0.148
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 8.9. Sediment contamination data for Sample 3 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0 m)	Sample 3 (1.0 m)	Sample 3 (2.0 m)	Sample 3 (3.1 m)
Arsenic	mg/kg	20	100	5.6	2.4	5.2	6.4
Cadmium	mg/kg	0.4	5	0.13	0.08	0.20	0.24
Chromium	mg/kg	40	400	16.4	8.4	20.4	22.1
Copper	mg/kg	40	400	14.9	10.1	19.2	13.8
Lead	mg/kg	50	500	16.3	6.1	15.0	10.4
Mercury	mg/kg	0.3	3	0.03	<0.01	0.01	0.04
Nickel	mg/kg	20	200	17.4	14.6	28.4	26.9
Zinc	mg/kg	130	800	52.0	31.1	57.5	48.8
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.0239	0.00107	0.0108	0.00809
Acenaphthylene	mg/kg	0.1	-	0.0156	<0.001	0.00427	0.00291
Anthracene	mg/kg	0.1	-	0.0448	0.00174	0.0128	0.0113
Benzo[a]anthracene	mg/kg	0.1	-	0.125	0.0042	0.0619	0.0312
Benzo[a]pyrene	mg/kg	0.1	-	0.158	0.00295	0.0534	0.0368
Benzo[b]fluoranthene	mg/kg	0.1	-	0.194	0.0058	0.158	0.0501
Benzo[e]pyrene	mg/kg	0.1	-	0.206	0.00989	0.243	0.0747
Benzo[ghi]perylene	mg/kg	0.1	-	0.196	0.00943	0.182	0.0985
Benzo[k]fluoranthene	mg/kg	0.1	-	0.0812	0.00206	0.0241	0.0145
C1-naphthalenes	mg/kg	0.1	-	0.325	0.0122	0.487	0.18
C1-phenanthrene	mg/kg	0.1	-	0.242	0.0126	0.354	0.185
C2-naphthalenes	mg/kg	0.1	-	0.253	0.0106	0.326	0.158
C3-naphthalenes	mg/kg	0.1	-	0.238	0.00934	0.237	0.173
Chrysene	mg/kg	0.1	-	0.152	0.00604	0.187	0.0477
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0322	0.00179	0.0317	0.00964
Fluoranthene	mg/kg	0.1	-	0.207	0.00525	0.0865	0.0514

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0 m)	Sample 3 (1.0 m)	Sample 3 (2.0 m)	Sample 3 (3.1 m)
Fluorene	mg/kg	0.1	-	0.0435	0.00138	0.0425	0.0217
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.164	0.00191	0.057	0.0267
Naphthalene	mg/kg	0.1	-	0.135	0.00524	0.119	0.0477
Perylene	mg/kg	0.1	-	0.127	0.0702	0.00684	0.0192
Phenanthrene	mg/kg	0.1	-	0.219	0.00986	0.324	0.139
Pyrene	mg/kg	0.1	-	0.221	0.00812	0.11	0.0637
Total Hydrocarbon Content (THC)	mg/kg	-	-	36.8	6.7	96.7	26.7
PCBs – Sum of ICES 7	ug/kg	10	-	<0.56	<0.56	0.57	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	2.58	<2.00	<2.00	2.01
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	0.0014	0.0002	<0.0001	0.0007
PPDDE	mg/kg	-	-	0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0002	<0.0001	<0.0001	0.0002
PBDE 17	µg/kg	-	-	0.0645	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.0488	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	0.204	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.0311	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	0.199	<0.02	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.0297	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.035	<0.02	<0.02	<0.02

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 3 (0 m)	Sample 3 (1.0 m)	Sample 3 (2.0 m)	Sample 3 (3.1 m)
PBDE 154	µg/kg	-	-	0.0206	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	12.9	0.143	0.195	0.102
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

Table 8.10. Sediment contamination data for Sample 4 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 4 (0 m)	Sample 4 (1.0 m)	Sample 4 (2.0 m)	Sample 4 (2.7 m)
Arsenic	mg/kg	20	100	13.8	16.8	6.6	6.5
Cadmium	mg/kg	0.4	5	0.33	0.37	0.23	0.21
Chromium	mg/kg	40	400	37.5	35.2	14.2	19.0
Copper	mg/kg	40	400	18.9	18.6	21.5	13.7
Lead	mg/kg	50	500	19.7	18.1	9.0	9.3
Mercury	mg/kg	0.3	3	0.03	0.03	0.02	0.02
Nickel	mg/kg	20	200	41.3	41.7	24.7	22.0
Zinc	mg/kg	130	800	93.2	99.7	60.0	44.2
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.00760	0.00522	0.0106	0.0105
Acenaphthylene	mg/kg	0.1	-	0.00199	0.00103	0.00358	0.00262
Anthracene	mg/kg	0.1	-	0.00732	0.00433	0.0123	0.0125
Benzo[a]anthracene	mg/kg	0.1	-	0.01460	0.00869	0.032	0.0323

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 4 (0 m)	Sample 4 (1.0 m)	Sample 4 (2.0 m)	Sample 4 (2.7 m)
Benzo[a]pyrene	mg/kg	0.1	-	0.02110	0.01160	0.038	0.0379
Benzo[b]fluoranthene	mg/kg	0.1	-	0.03950	0.02550	0.0499	0.0455
Benzo[e]pyrene	mg/kg	0.1	-	0.0596	0.0375	0.0905	0.0750
Benzo[ghi]perylene	mg/kg	0.1	-	0.0705	0.0469	0.0869	0.0925
Benzo[k]fluoranthene	mg/kg	0.1	-	0.00897	0.00484	0.0168	0.0138
C1-naphthalenes	mg/kg	0.1	-	0.14300	0.07840	0.214	0.146
C1-phenanthrene	mg/kg	0.1	-	0.12600	0.07570	0.229	0.192
C2-naphthalenes	mg/kg	0.1	-	0.11700	0.07280	0.202	0.14
C3-naphthalenes	mg/kg	0.1	-	0.10900	0.06030	0.21	0.155
Chrysene	mg/kg	0.1	-	0.02720	0.02220	0.0535	0.0485
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.00736	0.00527	0.00909	0.0102
Fluoranthene	mg/kg	0.1	-	0.02660	0.01600	0.0464	0.0511
Fluorene	mg/kg	0.1	-	0.01860	0.01260	0.0281	0.0216
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.01990	0.01220	0.0192	0.0241
Naphthalene	mg/kg	0.1	-	0.03800	0.02030	0.0494	0.0313
Perylene	mg/kg	0.1	-	0.16000	2.40000	0.0174	0.0181
Phenanthrene	mg/kg	0.1	-	0.09300	0.06140	0.173	0.137
Pyrene	mg/kg	0.1	-	0.03480	0.02220	0.0693	0.0673
Total Hydrocarbon Content (THC)	mg/kg	-	-	4.98	9.35	156	5.31
PCBs – Sum of ICES 7	ug/kg	10	-	<0.56	<0.56	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	<2.00	<2.00	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 4 (0 m)	Sample 4 (1.0 m)	Sample 4 (2.0 m)	Sample 4 (2.7 m)
PPTDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	<0.0001	<0.0001	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 100	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	<0.1	0.139	<0.1	<0.1
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

Table 8.11. Sediment contamination data for Sample 5 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 5 (0 m)	Sample 5 (1.0 m)	Sample 5 (2.0 m)	Sample 5 (3 m)	Sample 5 (4 m)	Sample 5 (4.7 m)
Arsenic	mg/kg	20	100	17.7	19.1	4.0	12	7.8	13.6
Cadmium	mg/kg	0.4	5	0.38	0.42	0.17	0.24	0.18	0.22

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 5 (0 m)	Sample 5 (1.0 m)	Sample 5 (2.0 m)	Sample 5 (3 m)	Sample 5 (4 m)	Sample 5 (4.7 m)
Chromium	mg/kg	40	400	49.7	58.5	9.0	28.6	19.2	19.7
Copper	mg/kg	40	400	32.7	33.0	9.7	22.6	14.9	17.0
Lead	mg/kg	50	500	62.8	67.6	6.9	18.0	13.3	10.5
Mercury	mg/kg	0.3	3	0.13	0.14	0.01	0.02	0.03	0.03
Nickel	mg/kg	20	200	35.2	38.2	11.6	36.3	24.0	25.8
Zinc	mg/kg	130	800	167	178	35.2	66.8	45.8	49.5
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.04640	0.05990	0.00316	0.03170	0.01410	0.01030
Acenaphthylene	mg/kg	0.1	-	0.02890	0.03630	0.00113	0.01060	0.00375	0.00321
Anthracene	mg/kg	0.1	-	0.22400	0.09480	0.00418	0.02460	0.01250	0.00938
Benzo[a]anthracene	mg/kg	0.1	-	0.23000	0.24200	0.01110	0.08670	0.02940	0.02450
Benzo[a]pyrene	mg/kg	0.1	-	0.30600	0.33700	0.01270	0.12800	0.03500	0.03090
Benzo[b]fluoranthene	mg/kg	0.1	-	0.31600	0.36200	0.01850	0.17100	0.04270	0.03800
Benzo[e]pyrene	mg/kg	0.1	-	0.322	0.355	0.0302	0.3350	0.0779	0.0633
Benzo[ghi]perylene	mg/kg	0.1	-	0.3270	0.3730	0.0304	0.3230	0.0924	0.0848
Benzo[k]fluoranthene	mg/kg	0.1	-	0.1640	0.1780	0.0054	0.0423	0.0173	0.0109
C1-naphthalenes	mg/kg	0.1	-	0.5650	0.6410	0.0671	1.14	0.201	0.183
C1-phenanthrene	mg/kg	0.1	-	0.3790	0.4270	0.0763	0.725	0.243	0.172
C2-naphthalenes	mg/kg	0.1	-	0.4550	0.5450	0.064	0.782	0.227	0.185
C3-naphthalenes	mg/kg	0.1	-	0.3910	0.5150	0.0649	0.567	0.252	0.195
Chrysene	mg/kg	0.1	-	0.3070	0.2410	0.0195	0.181	0.0416	0.0381
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0494	0.0507	0.00294	0.0409	0.0102	0.0065
Fluoranthene	mg/kg	0.1	-	0.3740	0.4280	0.0162	0.134	0.0488	0.0383
Fluorene	mg/kg	0.1	-	0.0746	0.0914	0.00802	0.175	0.0297	0.0222
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.2800	0.3240	0.00809	0.0826	0.0223	0.0193
Naphthalene	mg/kg	0.1	-	0.2210	0.2460	0.0149	0.236	0.0284	0.0378

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 5 (0 m)	Sample 5 (1.0 m)	Sample 5 (2.0 m)	Sample 5 (3 m)	Sample 5 (4 m)	Sample 5 (4.7 m)
Perylene	mg/kg	0.1	-	0.1340	0.1660	0.00422	0.0241	0.015	0.0151
Phenanthrene	mg/kg	0.1	-	0.3580	0.3790	0.0515	0.66	0.182	0.126
Pyrene	mg/kg	0.1	-	0.3880	0.4440	0.0267	0.192	0.0645	0.056
Total Hydrocarbon Content (THC)	mg/kg	-	-	269	120	21.0	22.7	11.9	25.2
PCBs – Sum of ICES 7	ug/kg	10	-	4.48	5.53	<0.56	<0.56	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	10.00	12.00	<2.00	<2.00	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0008	0.0011	<0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0005	0.0005	<0.0001	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	0.0079	0.0086	0.0002	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0015	0.0016	<0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0019	0.0020	<0.0001	<0.0001	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	0.397	0.406	<0.02	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.27	0.317	<0.02	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.5	1.64	<0.02	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.174	0.179	<0.02	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.0954	0.217	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.77	3.75	<0.02	<0.02	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.267	0.543	<0.02	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	0.0538	0.141	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.327	0.705	<0.02	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.174	0.342	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.0861	0.0813	<0.02	<0.02	<0.02	<0.02

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 5 (0 m)	Sample 5 (1.0 m)	Sample 5 (2.0 m)	Sample 5 (3 m)	Sample 5 (4 m)	Sample 5 (4.7 m)
PBDE 209	µg/kg	-	-	62	79.5	0.364	0.203	0.109	0.129
Key	Below AL1								
	Above AL1, Below AL2								
	Above AL2								

Table 8.12. Sediment contamination data for Sample 6 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0 m)	Sample 6 (1.0 m)	Sample 6 (2.0 m)	Sample 6 (3 m)	Sample 6 (4.1 m)
Arsenic	mg/kg	20	100	16.4	27.0	37.8	24.9	7.0
Cadmium	mg/kg	0.4	5	0.30	0.53	1.04	0.70	0.36
Chromium	mg/kg	40	400	43.8	55.6	79.6	72.1	11.3
Copper	mg/kg	40	400	29.0	34.5	55.0	48.9	9.4
Lead	mg/kg	50	500	48.7	59.6	86.8	102	9.1
Mercury	mg/kg	0.3	3	0.14	0.20	0.42	0.32	0.04
Nickel	mg/kg	20	200	30.0	29.7	36.1	43.7	15.9
Zinc	mg/kg	130	800	129	176	221	214	43.8
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	0.013	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	0.012	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.04650	0.06050	0.18100	0.01410	<0.001
Acenaphthylene	mg/kg	0.1	-	0.03320	0.03860	0.09780	0.00527	<0.001
Anthracene	mg/kg	0.1	-	0.09380	0.13300	0.34400	0.01580	<0.001
Benzo[a]anthracene	mg/kg	0.1	-	0.23600	0.28700	0.75500	0.03460	0.00473
Benzo[a]pyrene	mg/kg	0.1	-	0.32800	0.42000	1.07000	0.04640	0.00249
Benzo[b]fluoranthene	mg/kg	0.1	-	0.31900	0.40500	0.93900	0.06300	0.00956

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0 m)	Sample 6 (1.0 m)	Sample 6 (2.0 m)	Sample 6 (3 m)	Sample 6 (4.1 m)
Benzo[e]pyrene	mg/kg	0.1	-	0.3230	0.3940	0.8520	0.0847	0.0153
Benzo[ghi]perylene	mg/kg	0.1	-	0.34000	0.41600	0.90000	0.09580	0.00985
Benzo[k]fluoranthene	mg/kg	0.1	-	0.14000	0.18300	0.57200	0.02110	0.00226
C1-naphthalenes	mg/kg	0.1	-	0.59000	0.74700	1.25000	0.17800	0.00897
C1-phenanthrene	mg/kg	0.1	-	0.40000	0.43300	0.78900	0.14200	0.01470
C2-naphthalenes	mg/kg	0.1	-	0.46800	0.60800	0.97600	0.14300	0.00456
C3-naphthalenes	mg/kg	0.1	-	0.44000	0.53800	0.84900	0.13600	0.00400
Chrysene	mg/kg	0.1	-	0.22100	0.28000	0.67400	0.04860	0.01150
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.06170	0.06460	0.18200	0.01260	0.00210
Fluoranthene	mg/kg	0.1	-	0.40400	0.51900	1.51000	0.06910	0.00617
Fluorene	mg/kg	0.1	-	0.08060	0.09070	0.23000	0.02600	<0.001
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.30000	0.38300	0.94600	0.04670	0.00336
Naphthalene	mg/kg	0.1	-	0.24800	0.29300	0.55400	0.06150	0.00715
Perylene	mg/kg	0.1	-	0.14500	0.17500	0.36000	0.26800	0.27500
Phenanthrene	mg/kg	0.1	-	0.38000	0.43200	0.95900	0.11400	0.01330
Pyrene	mg/kg	0.1	-	0.41600	0.53100	1.32000	0.07270	0.00880
Total Hydrocarbon Content (THC)	mg/kg	-	-	28.00	135.00	142.00	12.10	2.86
PCBs – Sum of ICES 7	ug/kg	10	-	4.47	7.33	31.18	11.74	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	9.60	16.00	70.00	25.00	<2.00
AHCH	mg/kg	-	-	<0.0001	0.0002	0.0002	0.0002	<0.0001
BHCH	mg/kg	-	-	<0.0001	0.0002	0.0004	0.0006	<0.0001
GHCH	mg/kg	-	-	0.0001	0.0005	0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0007	0.0016	0.0079	0.0116	<0.0001
HCB	mg/kg	-	-	0.0005	0.0010	0.0022	0.0006	0.0001
PPTDE	mg/kg	-	-	0.0080	0.0104	0.0246	0.0296	0.0003

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 6 (0 m)	Sample 6 (1.0 m)	Sample 6 (2.0 m)	Sample 6 (3 m)	Sample 6 (4.1 m)
PPDDE	mg/kg	-	-	0.0011	0.0016	0.0045	0.0061	0.0001
PPDDT	mg/kg	0.001	-	0.0006	0.0012	0.0106	0.0068	0.0002
PBDE 17	µg/kg	-	-	0.487	2.17	0.113	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.33	1.12	0.0737	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.61	5.23	0.412	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.197	0.546	0.0412	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.0986	0.516	0.034	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.69	8.2	0.475	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.265	0.819	0.0472	<0.02	<0.02
PBDE 138	µg/kg	-	-	0.0448	0.305	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.276	1.59	0.0615	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.149	0.533	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.0725	0.162	<0.02	0.0237	<0.02
PBDE 209	µg/kg	-	-	71.7	68.8	1.42	0.225	<0.1
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 8.13. Sediment contamination data for Sample 7 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 7 (0 m)	Sample 7 (1.0 m)	Sample 7 (2.0 m)	Sample 7 (3 m)	Sample 7 (4 m)	Sample 7 (4.8 m)
Arsenic	mg/kg	20	100	15.3	30.0	37.0	15.6	16.1	12.9
Cadmium	mg/kg	0.4	5	0.27	0.66	1.01	0.26	0.28	0.32
Chromium	mg/kg	40	400	39.8	64.0	92.7	35.2	35.3	36.8
Copper	mg/kg	40	400	25.2	38.3	75.3	19.5	17.1	17.7
Lead	mg/kg	50	500	49.9	65.2	115	23.1	20.7	20.6
Mercury	mg/kg	0.3	3	0.16	0.25	0.44	0.08	0.06	0.05
Nickel	mg/kg	20	200	27.1	32.7	42.6	40.0	40.4	40.2
Zinc	mg/kg	130	800	131	185	265	103	95.6	91.4
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	0.008	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.0583	0.06200	0.30300	0.00917	0.00630	0.00861
Acenaphthylene	mg/kg	0.1	-	0.0534	0.04590	0.12500	0.00395	0.00224	0.00284
Anthracene	mg/kg	0.1	-	0.1140	0.19300	0.45300	0.01220	0.00719	0.00889
Benzo[a]anthracene	mg/kg	0.1	-	0.2810	0.29300	0.87400	0.02970	0.01940	0.02130
Benzo[a]pyrene	mg/kg	0.1	-	0.4530	0.42900	1.25000	0.03510	0.02250	0.02520
Benzo[b]fluoranthene	mg/kg	0.1	-	0.4000	0.37900	1.10000	0.05830	0.04660	0.04480
Benzo[e]pyrene	mg/kg	0.1	-	0.419	0.3760	0.9930	0.0960	0.0724	0.0706
Benzo[ghi]perylene	mg/kg	0.1	-	0.4410	0.4010	1.0500	0.0965	0.0775	0.0808
Benzo[k]fluoranthene	mg/kg	0.1	-	0.2090	0.202	0.601	0.0152	0.00819	0.0112
C1-naphthalenes	mg/kg	0.1	-	0.7640	0.654	1.25	0.242	0.161	0.168
C1-phenanthrene	mg/kg	0.1	-	0.4890	0.407	0.771	0.175	0.134	0.134
C2-naphthalenes	mg/kg	0.1	-	0.6120	0.509	0.921	0.176	0.12	0.137
C3-naphthalenes	mg/kg	0.1	-	0.5460	0.448	0.823	0.137	0.108	0.121
Chrysene	mg/kg	0.1	-	0.2910	0.268	0.815	0.0575	0.0352	0.0376
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0679	0.074	0.205	0.0143	0.0094	0.00832

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 7 (0 m)	Sample 7 (1.0 m)	Sample 7 (2.0 m)	Sample 7 (3 m)	Sample 7 (4 m)	Sample 7 (4.8 m)
Fluoranthene	mg/kg	0.1	-	0.4880	0.536	1.74	0.0544	0.0314	0.0345
Fluorene	mg/kg	0.1	-	0.0909	0.0982	0.376	0.0267	0.0184	0.0222
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.4050	0.39	1.11	0.0369	0.0229	0.0253
Naphthalene	mg/kg	0.1	-	0.3010	0.268	0.689	0.0713	0.0413	0.051
Perylene	mg/kg	0.1	-	0.1760	0.178	0.439	1.64	0.455	0.4
Phenanthrene	mg/kg	0.1	-	0.4430	0.431	1.03	0.149	0.108	0.106
Pyrene	mg/kg	0.1	-	0.5040	0.552	1.47	0.0663	0.0405	0.0433
Total Hydrocarbon Content (THC)	mg/kg	-	-	21.7	104.00	180.00	6.37	3.06	6.06
PCBs – Sum of ICES 7	ug/kg	10	-	4.63	12.53	28.91	0.62	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	9.99	27.88	65.82	2.10	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	0.0001	0.0002	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	0.0001	0.0005	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	0.0003	0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0008	0.0029	0.0118	0.0002	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0006	0.0010	0.0006	0.0001	0.0000	<0.0001
PPTDE	mg/kg	-	-	0.0075	0.0169	0.0382	0.0007	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0014	0.0030	0.0096	0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0030	0.0092	0.0092	0.0004	0.0002	<0.0001
PBDE 17	µg/kg	-	-	0.496	0.286	<0.02	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.324	0.134	<0.02	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.71	0.711	0.0334	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.199	0.0825	<0.02	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.0971	0.0509	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.69	0.709	0.0301	<0.02	<0.02	<0.02

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 7 (0 m)	Sample 7 (1.0 m)	Sample 7 (2.0 m)	Sample 7 (3 m)	Sample 7 (4 m)	Sample 7 (4.8 m)
PBDE 100	µg/kg	-	-	0.219	0.0944	<0.02	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	0.044	0.0251	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.241	0.0955	<0.02	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.12	0.0383	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.089	0.0201	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	60.9	7.51	0.337	0.115	<0.1	0.132
Key	Below AL1								
	Above AL1, Below AL2								
	Above AL2								

Table 8.14. Sediment contamination data for Sample 8 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 8 (0 m)	Sample 8 (1.0 m)	Sample 8 (2.0 m)	Sample 8 (3 m)	Sample 8 (3.65 m)
Arsenic	mg/kg	20	100	20.2	5.4	6.9	8.2	9.2
Cadmium	mg/kg	0.4	5	0.51	0.19	0.15	0.20	0.27
Chromium	mg/kg	40	400	16.8	12.3	16.5	28.1	28.8
Copper	mg/kg	40	400	18.4	13.7	14.8	18.9	20.3
Lead	mg/kg	50	500	14.6	8.9	10.1	15.4	16.8
Mercury	mg/kg	0.3	3	0.04	0.03	0.02	0.02	0.02
Nickel	mg/kg	20	200	23.8	15.6	20.9	33.7	35.6
Zinc	mg/kg	130	800	79.4	38.1	42.9	58.3	62.4
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005	<0.005

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 8 (0 m)	Sample 8 (1.0 m)	Sample 8 (2.0 m)	Sample 8 (3 m)	Sample 8 (3.65 m)
Acenaphthene	mg/kg	0.1	-	0.00694	0.0049	0.00984	0.0241	0.0157
Acenaphthylene	mg/kg	0.1	-	0.00252	0.00154	0.00313	0.00686	0.00442
Anthracene	mg/kg	0.1	-	0.00736	0.0057	0.0133	0.0234	0.0171
Benzo[a]anthracene	mg/kg	0.1	-	0.0153	0.0152	0.0363	0.0676	0.0489
Benzo[a]pyrene	mg/kg	0.1	-	0.0176	0.0183	0.0408	0.0919	0.0647
Benzo[b]fluoranthene	mg/kg	0.1	-	0.028	0.022	0.0493	0.108	0.0847
Benzo[e]pyrene	mg/kg	0.1	-	0.0321	0.0411	0.0798	0.197	0.141
Benzo[ghi]perylene	mg/kg	0.1	-	0.0369	0.045	0.088	0.238	0.165
Benzo[k]fluoranthene	mg/kg	0.1	-	0.0103	0.00505	0.0192	0.0289	0.0199
C1-naphthalenes	mg/kg	0.1	-	0.0998	0.0854	0.226	0.409	0.31
C1-phenanthrene	mg/kg	0.1	-	0.0659	0.0936	0.221	0.429	0.293
C2-naphthalenes	mg/kg	0.1	-	0.0772	0.0872	0.19	0.391	0.26
C3-naphthalenes	mg/kg	0.1	-	0.0742	0.0968	0.199	0.42	0.251
Chrysene	mg/kg	0.1	-	0.0198	0.0223	0.0484	0.112	0.0742
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0044	0.00343	0.00786	0.0251	0.018
Fluoranthene	mg/kg	0.1	-	0.0303	0.0224	0.0491	0.106	0.0717
Fluorene	mg/kg	0.1	-	0.0161	0.0102	0.0218	0.0664	0.0427
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.0189	0.0095	0.0216	0.0548	0.0433
Naphthalene	mg/kg	0.1	-	0.0347	0.0197	0.0544	0.0799	0.0657
Perylene	mg/kg	0.1	-	3.28	0.00736	0.0124	0.0279	0.0184
Phenanthrene	mg/kg	0.1	-	0.0534	0.0713	0.161	0.316	0.224
Pyrene	mg/kg	0.1	-	0.0385	0.0379	0.0761	0.152	0.108
Total Hydrocarbon Content (THC)	mg/kg	-	-	5.47	28.30	36.20	26.50	32.50
PCBs – Sum of ICES 7	ug/kg	10	-	3.68	<0.56	<0.56	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	11.59	<2.00	<2.00	<2.00	<2.00

Contaminant	Units	Cefas Action Level		Sample Concentration				
		AL1	AL2	Sample 8 (0 m)	Sample 8 (1.0 m)	Sample 8 (2.0 m)	Sample 8 (3 m)	Sample 8 (3.65 m)
AHCH	mg/kg	-	-	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	0.0005	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0012	<0.0001	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	0.0032	<0.0001	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0007	<0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	0.123	<0.02	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.0892	<0.02	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	0.368	<0.02	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.0663	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	0.364	<0.02	<0.02	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.0886	<0.02	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	0.0501	<0.02	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	5.76	0.103	<0.1	<0.1	1.5
Key	Below AL1							
	Above AL1, Below AL2							
	Above AL2							

Table 8.15. Sediment contamination data for Sample 9 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 9 (0 m)	Sample 9 (1.0 m)	Sample 9 (2.0 m)	Sample 9 (3 m)	Sample 9 (4 m)	Sample 9 (4.6 m)
Arsenic	mg/kg	20	100	18.0	24.1	24.6	8.4	9.6	10.3
Cadmium	mg/kg	0.4	5	0.35	0.36	0.43	0.19	0.28	0.23
Chromium	mg/kg	40	400	50.4	58.7	57.6	21.1	32.0	36.9
Copper	mg/kg	40	400	30.5	35.9	35.7	17.5	21.3	23.6
Lead	mg/kg	50	500	63.7	71.4	73.9	13.2	18.3	19.7
Mercury	mg/kg	0.3	3	0.19	0.20	0.22	0.02	0.02	0.02
Nickel	mg/kg	20	200	34.2	37.1	34.6	25.4	40.0	44.3
Zinc	mg/kg	130	800	164	177	177	48.8	69.0	76.6
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	0.012	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	0.011	0.014	<0.005	<0.005	<0.005	0.011
Acenaphthene	mg/kg	0.1	-	0.0481	0.0541	0.0609	0.0149	0.0221	0.0211
Acenaphthylene	mg/kg	0.1	-	0.0286	0.0372	0.0364	0.0053	0.00718	0.00729
Anthracene	mg/kg	0.1	-	0.0953	0.121	0.121	0.019	0.0187	0.0183
Benzo[a]anthracene	mg/kg	0.1	-	0.217	0.254	0.256	0.0523	0.0488	0.0556
Benzo[a]pyrene	mg/kg	0.1	-	0.29	0.341	0.323	0.0643	0.0692	0.0742
Benzo[b]fluoranthene	mg/kg	0.1	-	0.28	0.344	0.316	0.076	0.0816	0.0908
Benzo[e]pyrene	mg/kg	0.1	-	0.292	0.359	0.328	0.137	0.152	0.174
Benzo[ghi]perylene	mg/kg	0.1	-	0.303	0.389	0.335	0.159	0.184	0.188
Benzo[k]fluoranthene	mg/kg	0.1	-	0.1450	0.1840	0.1690	0.0223	0.0233	0.0255
C1-naphthalenes	mg/kg	0.1	-	0.5400	0.7380	0.7600	0.3130	0.5540	0.6960
C1-phenanthrene	mg/kg	0.1	-	0.3860	0.4830	0.5060	0.3170	0.4030	0.4590
C2-naphthalenes	mg/kg	0.1	-	0.4240	0.5830	0.6000	0.2720	0.4000	0.4510
C3-naphthalenes	mg/kg	0.1	-	0.3860	0.5290	0.5420	0.2650	0.3920	0.4020
Chrysene	mg/kg	0.1	-	0.2140	0.2380	0.2480	0.0833	0.0901	0.0977
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.0535	0.0684	0.0462	0.0147	0.0199	0.0226
Fluoranthene	mg/kg	0.1	-	0.4360	0.4840	0.5060	0.0796	0.0921	0.0948

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 9 (0 m)	Sample 9 (1.0 m)	Sample 9 (2.0 m)	Sample 9 (3 m)	Sample 9 (4 m)	Sample 9 (4.6 m)
Fluorene	mg/kg	0.1	-	0.0723	0.0963	0.1000	0.0385	0.0666	0.0822
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.2670	0.3350	0.3060	0.0389	0.0431	0.0453
Naphthalene	mg/kg	0.1	-	0.2090	0.2780	0.3000	0.0666	0.1770	0.2520
Perylene	mg/kg	0.1	-	0.1390	0.1980	0.1780	0.0208	0.0222	0.0206
Phenanthrene	mg/kg	0.1	-	0.3620	0.4550	0.4770	0.2360	0.3330	0.3880
Pyrene	mg/kg	0.1	-	0.4330	0.4920	0.4830	0.1210	0.1210	0.1280
Total Hydrocarbon Content (THC)	mg/kg	-	-	27.90	41.40	48.10	22.30	4.36	7.62
PCBs – Sum of ICES 7	ug/kg	10	-	4.85	7.27	7.25	<0.56	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	10.61	15.00	15.90	<2.00	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	0.0001	0.0003	0.0003	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	0.0005	0.0010	0.0011	<0.0001	<0.0001	<0.0001
HCB	mg/kg	-	-	0.0005	0.0007	0.0007	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	0.0079	0.0088	0.0116	0.0002	<0.0001	<0.0001
PPDDE	mg/kg	-	-	0.0016	0.0018	0.0020	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	0.0021	0.0005	0.0020	<0.0001	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	0.564	1	0.874	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	0.378	0.681	0.649	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	1.77	3.43	3.16	0.0808	<0.02	<0.02
PBDE 66	µg/kg	-	-	0.218	0.402	0.367	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	0.109	0.218	0.209	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	1.86	3.78	3.58	0.195	<0.02	<0.02
PBDE 100	µg/kg	-	-	0.316	0.538	0.544	0.0364	<0.02	<0.02
PBDE 138	µg/kg	-	-	0.0535	0.0787	0.0906	<0.02	<0.02	<0.02

Contaminant	Units	Cefas Action Level		Sample Concentration					
		AL1	AL2	Sample 9 (0 m)	Sample 9 (1.0 m)	Sample 9 (2.0 m)	Sample 9 (3 m)	Sample 9 (4 m)	Sample 9 (4.6 m)
PBDE 153	µg/kg	-	-	0.319	0.526	0.531	0.0466	<0.02	<0.02
PBDE 154	µg/kg	-	-	0.198	0.283	0.287	0.0253	<0.02	<0.02
PBDE 183	µg/kg	-	-	0.105	0.208	0.108	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	95.4	90.8	76.8	1.67	0.622	0.219
Key	Below AL1								
	Above AL1, Below AL2								
	Above AL2								

Table 8.16. Sediment contamination data for Sample 10 collected in October 2021

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 10 (0 m)	Sample 10 (1.0 m)	Sample 10 (2.0 m)	Sample 10 (2.6 m)
Arsenic	mg/kg	20	100	14.9	10.4	3.3	15.1
Cadmium	mg/kg	0.4	5	0.38	0.18	0.17	0.39
Chromium	mg/kg	40	400	36.9	11.3	13.0	14.8
Copper	mg/kg	40	400	19.2	10.4	13.9	16.8
Lead	mg/kg	50	500	19.4	6.9	10.1	12.9
Mercury	mg/kg	0.3	3	0.02	0.02	0.02	0.03
Nickel	mg/kg	20	200	39.3	13.2	17.3	30.8
Zinc	mg/kg	130	800	97.7	37.7	39.8	90.9
Dibutyltin (DBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Tributyltin (TBT)	mg/kg	0.1	1	<0.005	<0.005	<0.005	<0.005
Acenaphthene	mg/kg	0.1	-	0.008	0.002	0.005	0.003
Acenaphthylene	mg/kg	0.1	-	0.003	<0.001	0.002	0.001
Anthracene	mg/kg	0.1	-	0.008	0.001	0.006	0.004

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 10 (0 m)	Sample 10 (1.0 m)	Sample 10 (2.0 m)	Sample 10 (2.6 m)
Benzo[a]anthracene	mg/kg	0.1	-	0.014	0.002	0.020	0.008
Benzo[a]pyrene	mg/kg	0.1	-	0.019	0.002	0.019	0.011
Benzo[b]fluoranthene	mg/kg	0.1	-	0.034	0.003	0.093	0.014
Benzo[e]pyrene	mg/kg	0.1	-	0.0533	0.0058	0.1250	0.0276
Benzo[ghi]perylene	mg/kg	0.1	-	0.061	0.006	0.065	0.034
Benzo[k]fluoranthene	mg/kg	0.1	-	0.00754	0.00150	0.01380	0.00423
C1-naphthalenes	mg/kg	0.1	-	0.12200	0.01060	0.19000	0.05070
C1-phenanthrene	mg/kg	0.1	-	0.12200	0.01220	0.15900	0.05370
C2-naphthalenes	mg/kg	0.1	-	0.10700	0.00874	0.12700	0.04490
C3-naphthalenes	mg/kg	0.1	-	0.09590	0.00797	0.11000	0.04550
Chrysene	mg/kg	0.1	-	0.02530	0.00455	0.08300	0.01430
Dibenzo[ah]anthracene	mg/kg	0.1	-	0.00620	<0.001	0.01190	0.00258
Fluoranthene	mg/kg	0.1	-	0.02770	0.00585	0.03990	0.01400
Fluorene	mg/kg	0.1	-	0.01850	0.00344	0.00916	0.00725
Indeno[1,2,3-cd]pyrene	mg/kg	0.1	-	0.01680	0.00177	0.01970	0.00499
Naphthalene	mg/kg	0.1	-	0.02940	0.00458	0.05760	0.01310
Perylene	mg/kg	0.1	-	0.23300	2.28000	0.00473	0.00623
Phenanthrene	mg/kg	0.1	-	0.09010	0.00932	0.14200	0.03930
Pyrene	mg/kg	0.1	-	0.03530	0.00705	0.04950	0.02910
Total Hydrocarbon Content (THC)	mg/kg	-	-	2.08	3.85	7.85	57.80
PCBs – Sum of ICES 7	ug/kg	10	-	<0.56	<0.56	<0.56	<0.56
PCBs – Sum of 25 Congeners	ug/kg	20	200	<2.00	<2.00	<2.00	<2.00
AHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
BHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
GHCH	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
Dieldrin	mg/kg	0.005	-	<0.0001	<0.0001	<0.0001	<0.0001

Contaminant	Units	Cefas Action Level		Sample Concentration			
		AL1	AL2	Sample 10 (0 m)	Sample 10 (1.0 m)	Sample 10 (2.0 m)	Sample 10 (2.6 m)
HCB	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPTDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDE	mg/kg	-	-	<0.0001	<0.0001	<0.0001	<0.0001
PPDDT	mg/kg	0.001	-	<0.0001	<0.0001	<0.0001	<0.0001
PBDE 17	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 28	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 47	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 66	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 85	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 99	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 100	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 138	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 153	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 154	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 183	µg/kg	-	-	<0.02	<0.02	<0.02	<0.02
PBDE 209	µg/kg	-	-	<0.1	0.211	<0.1	0.192
Key	Below AL1						
	Above AL1, Below AL2						
	Above AL2						

8.7 Future baseline environment

8.7.1 In the absence of the IERRT project, water and sediment quality will continue to be influenced by natural and human-induced variability, ongoing cyclic patterns, and trends (e.g., changes in prevalence of chemicals in marine sediments in response to legislative controls, degradation of some contaminants, ongoing maintenance dredging and disposal, and existing discharge licences in the area). The future baseline will also be influenced by climate change, such as changes in sea pH and temperature, which in turn can have an impact on water quality (e.g., dissolved oxygen concentrations).

8.8 Consideration of likely impacts and effects

8.8.1 This section identifies the potential likely effects on water and sediment quality receptors as a result of the construction and subsequent operation of the IERRT project which have been identified.

8.8.2 The Physical Processes assessment (Chapter 7 of this ES) has informed the outcomes of the water and sediment quality assessment.

8.8.3 Cumulative impacts on water and sediment quality that could arise as a result of other coastal and marine developments and activities in the Humber Estuary and are considered as necessary as part of the cumulative impacts and in-combination effects assessment (Chapter 20 of this ES).

Construction phase

8.8.4 This section contains an assessment of the potential impacts to water and sediment quality receptors as a result of the construction phase of the IERRT project. The following impact pathways have been assessed:

- Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities;
- Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities; and
- Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities.

8.8.5 The construction of the IERRT project may be completed in a single stage, or it may be sequenced such that construction of the southernmost pier takes place at the same time as operation of the northernmost pier (see Chapter 3 of this ES). However, in any case, all capital dredging (and associated disposal activity) will be undertaken together at one time, before operation of the northernmost pier commences. In the case of a sequenced construction, the duration of piling will be extended but it will not increase the magnitude of change. Furthermore, piling and construction activities associated with the southernmost pier will not be undertaken at the same time as maintenance dredging and disposal during operation (see

'Operational phase' section) of the northernmost pier (i.e., piling and construction will pause whilst any maintenance dredging and disposal activities are being undertaken). Therefore, the below impact pathway assessments are considered the worst case and will not be altered by a sequenced construction period.

Changes to dissolved oxygen concentrations as a result of increased SSC

Capital dredging

8.8.6 The increase in biochemical oxygen demand associated with elevated SSC in the water column during capital dredging may have the potential to reduce dissolved oxygen concentrations. The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are unlikely to influence dissolved oxygen concentrations, to clays including alluvium deposits containing organic material (see Table 8.6), for which organic content can result in reduced dissolved oxygen concentrations. However, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the draghead/bucket).

8.8.7 The proposed dredge area is situated within the Humber Lower transitional water body. The physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2019 interim classification, at high status for this water body, despite the area being subject to regular maintenance dredging activities. It is, therefore, considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of the proposed capital dredging.

8.8.8 Increases in SSC will be short-term and localised to the dredging activity (see Chapter 7 of this ES). It is anticipated that any reduction in dissolved oxygen concentration will be short-lived and replenished over the subsequent tidal cycle. The probability of a localised effect is, therefore, medium to high, but the magnitude of change is considered to be small, leading to a low exposure to change. Therefore, while the sensitivity is moderate, based on the direct influence of dredging on water quality, and importance is high, given that changes in water quality is an impact pathway for other receptors and in its own right, the impact significance is assessed as **minor adverse** and not significant.

Piling

8.8.9 The increase in biochemical oxygen demand associated with elevated SSC in the water column during piling activity may, as with dredging, have the potential to reduce dissolved oxygen concentrations. However, the effects are likely to be highly localised (see Chapter 7 of this ES). The piling activity is proposed to occur within the Humber Lower transitional water body, for which the physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2019 interim classification, at high status. The seabed in the area is already subject to regular disturbance (e.g., maintenance dredging) and, therefore, it is considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of piling.

8.8.10 It is considered that the probability of a localised effect will be medium to high, but the magnitude of change is likely to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate based on the direct influence of piling on water quality and importance is high, any impact is considered to be **insignificant**.

Disposal activities

8.8.11 The disposal of dredged material at sea associated with the proposed development is proposed to be fulfilled at licensed disposal sites HU056 and HU060 (see Chapters 2 and 3 of this ES).

8.8.12 During the placement of dredged material at the licensed disposal sites, the potential for reduction in dissolved oxygen concentrations in the water column is considered to be low (see Chapter 7 of this ES for further information on changes in SSC during disposal). Any changes would be localised and short-lived given the dynamic nature of the site, which would rapidly be re-oxygenated. Both HU056 and HU060 licensed disposal sites are located within the Humber Lower transitional water body for which the physico-chemical quality element 'Dissolved oxygen' is currently, based on the 2019 interim classification, at high status, despite routinely receiving maintenance dredging material from the ports within the Humber Estuary.

8.8.13 The probability of a localised effect is likely to be medium to high, but the magnitude of change is likely to be small, leading to a low exposure to change. Therefore, while the sensitivity is moderate based on the direct influence of disposal activities on water quality and importance is high, the impact significance is assessed as **minor adverse** and not significant.

Changes to chemical water quality as a result of potential sediment-bound contaminants

Capital dredging

8.8.14 The proposed dredge area is situated within the Humber Lower transitional water body. This water body is currently, based on a 2019 interim classification, failing chemical status due to cypermethrin and dichlorvos, PBDEs, PFOS, benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds and TBT compounds.

8.8.15 As sediment is disturbed and re-distributed into the water column, any sediment-bound contaminants may be partitioned from the solid phase (i.e., bound to sediments or suspended matter), to the dissolved or aqueous phase (i.e., dissolved in pore water or overlying water) (Luoma, 1983). To determine the maximum dissolved fraction of contaminants released into the water column, it is necessary to consider the relative potential for each contaminant to change from one phase to another (i.e., contaminant adsorbed to sediment surfaces to dissolved in the water), referred to as the partition coefficient. Partition coefficients describe the ratio between the freely dissolved concentration in water and another environmental phase (e.g., sediment-bound) at equilibrium. It should be noted that desorption rates of contaminants from suspended sediments into the water column are highly regulated by hydrodynamics, biogeochemical processes, and environmental conditions (redox, pH, salinity, and temperature) (Eggleton and Thomas, 2004). Due to the variability in environmental conditions, a wide range of partition coefficients are reported in the literature.

8.8.16 There is potential for sediment-bound contaminants to be re-mobilised in the water column following an increase in SSC during the proposed capital dredging. Sediment disturbance will be caused at the bed by abrasion pressure from the dredging equipment (i.e., bucket or draghead). As noted in Chapter 7 of this ES, maximum SSCs are associated with the disposal activities (with relatively small increases in SSC arising from the dredge itself). Peak excess SSC levels resulting from the disposal activities are predicted to be around 600 to 800 mg/l at HU060 licensed disposal site (this site is likely to receive the vast majority of the more unconsolidated dredged material, see Chapter 2 of this ES). Increased SSCs arising from the dredge operations will be of lower magnitude and persist for a shorter distance (and time) than that from the disposal. Therefore, while a different activity, the estimated maximum incremental SSC for disposal activities is used in the calculations below on a precautionary basis.

8.8.17 A Microsoft Excel Spreadsheet tool developed by APEM Ltd, referred to as SeDiChem (short for Sediment Disturbance on Chemical status), was provided by the Environment Agency to support consideration of potential uplift in contaminant concentrations following disturbance of contaminated sediments in estuarine and marine waters.

8.8.18 Table 8.17 provides a summary of the SeDiChem tool outputs, with empirical calculations based on a number of simple assumptions. This includes general site parameters (e.g., net flow rate of 20,736,000 m^3/day based on an average for the Humber of 240 m^3/second (Environment Agency, 2008)), maximum incremental SSC (800 mg/l), worst case (or precautionary) partition coefficients from suggested literature and sediment quality from samples collected within the proposed dredge area. In addition, background water quality concentrations have been inputted based on Environment Agency monitoring data from nearby monitoring station Clean Site - Ti02 Monitoring Point, 1985 (sampling ID: AN-CLNMON1) (see Section 8.6 of this chapter), averaged across the most recent five years of data.

8.8.19 Overall, the uplift in contaminant concentrations is anticipated to be minimal, and unlikely to present a significant issue at the water body level. Where contaminants are already reported to be failing within the water bodies (e.g., PBDEs, benzo(b)fluoranthene, benzo(g-h-i)perylene, mercury and its compounds and TBT compounds), any disturbance of sediments during dredging activities will result in an uplift effectively causing a 'worse failure'. However, the scale of this deterioration is considered to be small and highly localised. As a percentage increase of EQS headroom (i.e., the capacity for the concentration to increase whilst still remaining below the environmental threshold), the increased concentration due to dredging is likely to be less than 1% for mercury, and 35% for TBT. For benzo(b)fluoranthene, the increased concentration due to dredging as a percentage of headroom is likely to be around 6%. The background dissolved concentration for benzo(g,h,i)perylene is above the EQS, therefore no headroom is available according to the SeDiChem tool. However, as a percentage increase of background concentrations, the increase in concentration of this contaminant is calculated as < 1%. Furthermore, these calculations are based on a maximum sediment concentration and worst-case partition coefficients. It is, therefore, considered unlikely that the proposed dredging activity would cause even a short-term deterioration in water quality with regards to contaminants.

8.8.20 Furthermore, the proposed works will not directly introduce contaminants to the marine environment and good practice measures (Defra and Environment Agency, 2019), will be used to prevent/reduce the potential for accidental spillages throughout the dredging process.

8.8.21 The probability of a localised effect is medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is considered to be **insignificant**.

Table 8.17. Potential contaminant concentrations as a result of the proposed development in the Humber Lower transitional water body based on SeDiChem tool outputs

Parameter	Max. Sediment Concentration (mg/kg)	Current WFD Status	Partition Coefficient (l/kg)	EQS (µg/l)	Dissolved Concentration (Background* and Dredging) (µg/l)	Concentration Increase due to Dredging (% of Background)	Concentration Increase as % of EQS Headroom
Arsenic	62.00	High	40	25 (dissolved)	4.216	97.43%	9.10%
Cadmium	1.20	Good	100	0.2 (dissolved)	0.093	21.69%	13.40%
Chromium	113.00	High	79	32 (dissolved)	12.057	18.21%	8.52%
Copper	78.50	High	3,162	3.76 (dissolved)	2.156	1.578%	2.06%
Lead	140.00	Good	35,481	14 (dissolved)	0.069	8.31%	0.04%
Mercury	0.54	Fail	6,310	0.07 (dissolved)	0.010	1.14%	0.19%
Nickel	54.80	Good	500	34 (dissolved)	1.969	7.87%	0.45%
Zinc	324.00	High	12,589	8.8 (dissolved)	3.32	1.05%	0.75%
Benzo(a)pyrene	1.25	Good	9,120	0.027 (total)	0.018	0.99%	2.05%
Benzo(b) fluoranthene	1.11	Fail	20,795	0.017 (total)	0.016	0.45%	5.60%
Benzo(g,h,i) perylene	1.05	Fail	18,904	0.00082 (total)	0.016	0.46%	No headroom
Benzo(k) fluoranthene	0.60	Good	19,859	0.017 (total)	0.009	0.43%	0.51%
Fluoranthene	1.95	Good	1,396	0.12 (total)	0.02	10.23%	1.84%
Tributyltin (TBT)	0.02	Fail	49	0.0015 (total)	0.001	150.84%	34.52%
Congener: BDE-28	0.00112	N/A	4,136	N/A	0.000	0.59%	N/A
Congener: BDE-47	0.00523	N/A	17,793	N/A	0.000	0.62%	N/A

Parameter	Max. Sediment Concentration (mg/kg)	Current WFD Status	Partition Coefficient (l/kg)	EQS (µg/l)	Dissolved Concentration (Background* and Dredging) (µg/l)	Concentration Increase due to Dredging (% of Background)	Concentration Increase as % of EQS Headroom
Congener: BDE-99	0.0082	N/A	45,631	N/A	0.000	0.36%	N/A
Congener: BDE-100	0.000819	N/A	27,325	N/A	0.000	0.059%	N/A
Congener: BDE-153	0.00159	N/A	71,871	N/A	0.000	0.048%	N/A
Congener: BDE-154	0.000533	N/A	58,419	N/A	0.000	0.020%	N/A
Hexachloro-benzene	0.0022	Good	5,978	0.05 (total)	0.001	0.049%	0.00%
* Averaged for the five most recent years of data							

Piling

8.8.22 As discussed for capital dredging above and in Chapter 7 of this ES, maximum SSCs are associated with the disposal activities. Peak excess SSC levels resulting from the disposal activities are around 600-800 mg/l at the HU060 licensed disposal site. Increased SSCs arising from the dredge operations will be of lower magnitude and persist for a shorter distance (and time) than that from the disposal. The anticipated increased SSC concentration related to piling will be less than that of dredging and disposal, as compaction will occur in the sediment rather than complete disturbance. Table 8.17 calculates the potential for sediment-bound contaminants to increase the concentration of in-water contaminants and, even when applying SSCs of 800 mg/l, the proposed piling works are considered unlikely to result in significant water quality impacts.

8.8.23 Overall, the probability of a localised effect is medium to high, but the magnitude of change is likely to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate, and importance is high any impact is considered to be **insignificant**.

Disposal activities

8.8.24 As discussed for capital dredging above and in Chapter 7 of this ES, maximum SSCs are associated with the disposal activities. Peak excess SSC levels resulting from the disposal activities are around 600-800 mg/l at the HU060 licensed disposal site. Table 8.17 calculates the potential for sediment-bound contaminants to increase the concentration of in-water contaminants and, when applying SSCs of 800 mg/l, the proposed disposal activities are considered unlikely to result in significant water quality impacts.

8.8.25 Overall, the probability of a localised effect is considered to be medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is likely to be **insignificant**.

Redistribution of sediment-bound contaminants

Capital dredging

8.8.26 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere. However, it should be noted that the majority of material disturbed during capital dredging works will be lifted from the bed to the hopper/barge, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the bucket/draghead).

8.8.27 The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are generally unlikely to comprise high contaminant levels due to the material characteristics, to muds, silts and clays which are more typically associated with sediment-bound contaminants. The majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. Furthermore, sedimentation away from the dredge location is predicted to be relatively localised (see Chapter 7 of this ES). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution and deposition of material during capital dredging.

8.8.28 Overall, the probability of a localised effect is considered to be medium to high, but the magnitude of change is likely to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is likely to be **insignificant**.

Piling

8.8.29 Similar to capital dredging (see above), the potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere.

8.8.30 However, the majority of contaminants in the sediments in the vicinity of the proposed piling activity are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. Furthermore, sedimentation away from the piling locations is predicted to be highly localised (see Chapter 7 of this ES). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution and deposition of material during piling.

8.8.31 Overall, the probability of a localised effect is at this stage considered to be medium to high, but the magnitude of change is likely to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is likely to be **insignificant**.

Disposal activities

8.8.32 The disposal of dredged material at sea associated with the proposed development will be fulfilled at licensed disposal sites HU056 and HU060 within the Humber Estuary (see Chapters 2 and 3 of this ES).

8.8.33 During the placement of dredged material at the licensed disposal sites, any sediment-bound contaminants within the dredge material will effectively be dispersed and redistributed by the disposal activity. However, the majority of contaminants in the sediments of the proposed dredge area are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed and it is considered that the dredge material is suitable for disposal at sea. It is also noted that disposal sites HU056 and HU060 routinely receive maintenance dredging material from ports within the Humber Estuary. These disposal sites, located within the Humber Estuary, will have similar levels of contamination to the dredge material and therefore disposal activity is not expected to lead to elevated concentrations of contaminants above prevailing background levels.

8.8.34 Overall, the probability of a localised effect is at this stage considered to be medium to high, but the magnitude of change is likely to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is overall likely to be **insignificant**.

Operational phase

8.8.35 This section contains an assessment of the potential impacts to water and sediment quality receptors as a result of the operational phase of the IERRT project. The following impact pathways have been assessed:

- Changes to dissolved oxygen concentrations as a result of increased SSC during the maintenance dredging and disposal activities;
- Changes to chemical water quality as a result of potential sediment-bound contaminants being released during maintenance dredging and disposal activities; and
- Redistribution of sediment-bound contaminants during maintenance dredging and disposal activities.

Changes to dissolved oxygen concentrations as a result of increased SSC

Maintenance dredging

8.8.36 Volumes of material from maintenance dredging (up to 120,000 m³ annually, to be dredged as required, see Chapter 7 of this ES) of the IERRT berth pocket will be lower than those from the original capital dredge (190,000 m³ in total, described in Chapters 2 and 3 of this ES). Furthermore, the density of the newly settled material will be less than that from the consolidated bed dredged during the capital dredge campaign. Rather than a maintenance dredge campaign involving the removal of the full annual maintenance dredge requirement, future maintenance dredge activity will involve more frequent smaller individual dredging events (as required for operational requirements of the terminal). As a result, maintenance dredge arisings and disposal will have a notably lower magnitude and the dredged material being deposited will be more dispersive than the impacts described above for the capital works during construction.

8.8.37 The increase in biochemical oxygen demand associated with elevated SSC in the water column during maintenance dredging may have the potential to reduce dissolved oxygen concentrations. The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are unlikely to influence dissolved oxygen concentrations, to clays including alluvium deposits, for which organic content can result in reduced dissolved oxygen concentrations. That said, it should be noted that the material to be removed during the maintenance dredging campaign will have been recently deposited and in reduced volumes compared to the capital dredge. Furthermore, the majority of material disturbed during maintenance dredging works will be lifted from the bed to the hopper, with only a small proportion raised into suspension and remaining in the water column (i.e., through abrasion pressure from the bucket/draghead).

8.8.38 The dredge area is situated within the Humber Lower transitional water body. The physico-chemical quality element ‘Dissolved oxygen’ is currently, based on the 2019 interim classification, at high status for this water body, despite the area being subject to regular disturbance from dredging. It is, therefore, considered unlikely that dissolved oxygen concentrations will fall below the standards set under the WFD as a result of the proposed maintenance dredging.

8.8.39 Increases in SSC will be short-term and localised to the dredging activity (see Chapter 7 of this ES). It is anticipated that any reduction in dissolved oxygen concentration will be short-lived and replenished over the subsequent tidal cycle. The probability of a localised effect is, therefore, medium to high, but the magnitude of change is likely to be small, leading to a low exposure to change. Therefore, while the sensitivity is moderate and importance is high, the impact significance is assessed as **minor adverse** and not significant.

Disposal activities

8.8.40 It is anticipated that disposal of maintenance dredge material of up to 120,000 m³ annually (see Chapter 7 of this ES) will be required during operation of the proposed development. The frequency and volume of material deposited from each load will not change compared with current maintenance dredging activities as the same plant and methods are proposed to be used. Future disposal of maintenance dredge arisings will, therefore, result in the same changes in SSC within the disposal plumes as existing maintenance dredging activities undertaken for the port.

8.8.41 The disposal of maintenance dredged material at sea associated with the proposed development is proposed to be fulfilled at licensed disposal site HU060 (see Chapters 2 and 3 of this ES).

8.8.42 During the placement of dredged material at the Clay Huts licensed disposal site (HU060), the potential for reduction in dissolved oxygen concentrations in the water column is considered to be low. Any changes would be localised and short-lived given the dynamic nature of the site, which would rapidly be re-oxygenated. HU060 is located within the Lower Humber water body for which the physico-chemical quality element ‘Dissolved oxygen’ is currently, based on the 2019 interim classification, at high status, despite routinely receiving maintenance dredging material from ports within the Humber Estuary. It should be noted that material to be disposed during the maintenance dredging campaign would be recently deposited and in reduced volumes compared to the capital dredge.

8.8.43 The probability of a localised effect is medium to high, but the magnitude of change is likely to be small, leading to a low exposure to change. Therefore, while the sensitivity is moderate and importance is high, the impact significance is assessed as **minor adverse** and not significant.

Changes to chemical water quality as a result of potential sediment-bound contaminants

Maintenance dredging

8.8.44 As discussed for capital dredging above (see Table 8.17), the proposed maintenance dredging activities are considered unlikely to result in significant water quality impacts. The material that will be removed through maintenance dredging is anticipated to be similar to the surficial sediment samples shown in Table 8.7 to Table 8.16. Overall, the probability of a localised effect is medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is considered to be **insignificant**.

Disposal activities

8.8.45 As discussed for the proposed disposal of capital dredge material above, the proposed disposal activities for maintenance dredging are considered unlikely to result in significant water quality impacts (see Table 8.17). Maximum SSCs are associated with the disposal activities and peak excess SSC levels resulting from the disposal activities are predicted to be around 600-800 mg/l at the HU060 licensed disposal site. The material that will be removed and disposed of through maintenance dredging is anticipated to be similar to the surficial sediment samples shown in Table 8.7 to Table 8.16. It should also be noted that this disposal site is already used and has been used by the Port of Immingham for the disposal of maintenance dredge material for over 30 years.

8.8.46 Overall, the probability of a localised effect is medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is likely to be **insignificant.**

Redistribution of sediment-bound contaminants

Maintenance dredging

8.8.47 The potential to impact the marine environment as a result of any sediment-bound contaminants arises primarily when the sediment that is released into the water column disperses and deposits elsewhere.

8.8.48 The material within the proposed dredge area ranges from coarse sediments (sands and gravel) which are generally unlikely to comprise high contaminant levels, to muds, silts and clays which are more typically associated with sediment-bound contaminants. The results of the sediment sampling analysis from within the proposed dredge area confirmed that contaminants are at relatively low concentrations, mostly below, or marginally exceeding, Cefas AL1. There were no exceedances of AL2 in any sediment samples analysed. The material that will accumulate during operation and be removed during maintenance dredging is anticipated to be similar to the surficial sediment samples shown in Table 8.7 to Table 8.16. Furthermore, sedimentation away from the dredge location is predicted to be relatively localised (see Chapter 7 of this ES). It is, therefore, unlikely that sediment quality will decline elsewhere, as a result of the redistribution of material during maintenance dredging. In addition, maintenance dredging of the IERRT berths will be undertaken as part of the Port's existing maintenance dredge licence which requires regular sediment sampling and testing to ensure the material remains suitable for disposal at sea.

8.8.49 Overall, it is considered that the probability of a localised effect is medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is likely to be **insignificant**.

Disposal activities

8.8.50 The disposal of maintenance dredged material at sea associated with the proposed development is proposed to be fulfilled at licensed disposal site HU060 (see Chapters 2 and 3 of this ES).

8.8.51 During the placement of dredged material at the Clay Huts licensed disposal site (HU060), any sediment-bound contaminants within the dredge material will effectively be redistributed by the disposal activity. As discussed in the preceding sections, material types more typically associated with sediment-bound contaminants are muds, silts and clays and all recent sediment sampling data has returned contaminant levels at or around Cefas AL1. Material removed during the maintenance dredging campaign would be recently deposited alluvium and in reduced volumes compared to the capital dredge. It is also anticipated to be similar to the surficial sediment samples shown in Table 8.7 to Table 8.16. The proposed HU060 licensed disposal site has received maintenance dredge arisings from the Port of Immingham (and other ports within the Humber Estuary) for more than 30 years and periodic sediment sampling to assess the suitability for disposal at sea will continue in accordance with the conditions of the Port's existing maintenance dredge licences. This will ensure the material remains suitable for disposal at sea.

8.8.52 The probability of a localised effect is medium to high, but the magnitude of change is considered to be negligible, leading to a negligible exposure to change. Therefore, while the sensitivity is moderate and importance is high, any impact is considered likely to be **insignificant**.

8.9 Mitigation measures

Tertiary mitigation

8.9.1 Tertiary mitigation measures will be undertaken to manage commonly occurring environmental effects. Although these are not likely to alter the assessment conclusions, they are considered to be standard good practice. In terms of water and sediment quality, the potential risk from accidents and spillages/leaks during construction will be avoided or minimised by ensuring that the construction methods, proposed design, and the contractual arrangements follow environmental management best practice (Chapter 3 of this ES, Section 3.3). In particular, the following guidance will be adopted:

- 'Pollution prevention for businesses' Guidance in England (Defra and Environment Agency, 2019);
- Pollution Prevention Guidance (PPG), or Guidance for Pollution Prevention (GPP) in the UK (NetRegs, 2020):
  - Understanding Your Environmental Responsibilities – Good Environmental Practices (PPG1);
  - Works and maintenance in or near water (GPP5);
  - Working at construction and demolition sites (PPG6); and
  - Safe storage and disposal of used oils (GPP8);
- The Oil Care Code; and
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (CIRIA, 2015).

8.9.2 In adhering to this guidance, a number of good practice measures will be followed. All wastes generated on site will be removed in a timely manner and any materials and containers giving rise to possible spills or contamination of the surrounding environment will be taken from site to be processed at a licensed facility. Liquid oils/chemicals required for use during construction will be stored in suitable containers/bunded storage areas. In the event of a pollution incident measures to report, manage, and minimise any impacts will be pursued, with construction spill response procedures to contain any accidental spills. In addition, an oil spill contingency plan is currently in place for the port to minimise any impacts in the event of a spill entering the water.

8.9.3 Plant will also be maintained regularly, and spill kits will be available for use in the event of a spill onsite. Refuelling will be in designated areas to limit the potential for spillages. Fuel will be stored in the site compound overnight, limiting the potential for fuel theft and vandalism which could cause pollution. Should any pollution incidents occur, they will be reported immediately to the relevant authorities. The workforce will be trained in preventing and dealing with pollution incidents.

8.9.4 The CEMP provided with the DCO application (Application Document reference number 9.2) sets out the mitigation measures to manage environmental effects during construction.

8.10 Limitations and assumptions

8.10.1 This assessment has been undertaken based on the following assumptions:

- Dredging is undertaken predominantly by backhoe with disposal at the Clay Huts disposal site (HU060) or the Holme Channel (HU056) disposal site;
- Assessment of sediment release rates are based on modelling outputs presented in Chapter 7 of this ES; and

- The SeDiChem tool outputs based on a number of simple assumptions, namely general site parameters (e.g., net flow rate of 20,736,000 m^3/day based on an average for the Humber of 240 m^3/second (Environment Agency, 2008)), maximum incremental SSC (800 mg/l), worst case (or precautionary) partition coefficients from suggested literature and sediment quality from samples collected within the proposed dredge area.

8.10.2 The assessment within this ES has been undertaken considering the anticipated worst-case scenario in respect of water and sediment quality receptors at the dredge, piling and disposal locations.

8.11 Residual effects and conclusions

8.11.1 A summary of the impact pathways that have been assessed, the identified residual impacts and level of confidence is presented in Table 8.18.

8.11.2 The assessment considered six impact pathways in detail. These addressed the potential for impacts on water and sediment quality receptors as a result of the proposed development during construction, specifically the potential changes to dissolved oxygen concentrations, changes to chemical water quality as a result of potential sediment-bound contaminants, and redistribution of sediment-bound contaminants. The same impact pathways were considered during operation of the proposed development.

8.11.3 All of the potential impacts on water and sediment quality receptors were assessed as insignificant. Given this, no specific mitigation measures have been identified as being likely to be required, and residual effects remain unchanged. However, tertiary mitigation measures will be undertaken to manage commonly occurring environmental effects. As noted in Section 8.5 and Section 8.9, a CEMP has been drafted and submitted with the DCO application and will be implemented prior to works commencing, which sets out the mitigation measures needed to manage environmental effects during the construction phase of the IERRT project (see Chapter 3 of this ES, Section 3.3).

Table 8.18. Summary of potential impact, mitigation measures and residual impacts

Receptor	Impact Pathway	Impact Significance	Mitigation Measure	Residual Impact	Confidence
Construction Phase					
Water and sediment quality	Changes to dissolved oxygen concentrations as a result of increased SSC during piling, capital dredging and disposal activities	Insignificant to minor adverse	N/A	Insignificant to minor adverse	Medium
	Changes to chemical water quality as a result of potential sediment-bound contaminants being released during piling, capital dredging and disposal activities	Insignificant	N/A	Insignificant	High
	Redistribution of sediment-bound contaminants during piling, capital dredging and disposal activities	Insignificant	N/A	Insignificant	High
Operational Phase					
Water and sediment quality	Changes to dissolved oxygen concentrations as a result of increased SSC during the maintenance dredging and disposal activities	Minor adverse	N/A	Minor adverse	Medium
	Changes to chemical water quality as a result of potential contaminants in the seabed sediment being released during maintenance dredging and disposal activities	Insignificant	N/A	Insignificant	High
	Redistribution of sediment-bound contaminants during maintenance dredging and disposal activities	Insignificant	N/A	Insignificant	High

8.12 References

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8.13 Abbreviations/Acronyms

Acronym	Definition
AA	Annual Average
ABP	Associated British Ports
AHCH	alpha-Hexachlorcyclohexane
AL	Action Level
APFP	The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
BDE-##	A Compound/Congener of Polybrominated Diphenyl Ether
BHCH	beta-Hexachlorocyclohexane
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
cSAC	Candidate Special Area of Conservation
DBT	Dibutyltin
DCO	Development Consent Order
DDT	Dichlorodiphenyltrichloroethane
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EC	European Commission
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EQS	Environmental Quality Standards
ES	Environmental Statement
EU	European Union
GHCH	gamma-Hexachlorocyclohexane
GPP	Guidance for Pollution Prevention
HCB	Hexachlorobenzene
HM	Her Majesty's (His Majesty's)
HMWB	Heavily Modified Water Body
HRA	Habitats Regulations Assessment
ICES	International Council for the Exploration of the Sea
ID	Identity
IEMA	Institute of Environmental Management and Assessment
IERRT	Immingham Eastern Ro-Ro Terminal

IOH	Immingham Outer Harbour
LOD	Limit of Detection
LSE	Likely Significant Effect
MAC	Maximum Allowable Concentrations
MAGIC	Multi-Agency Geographic Information for the Countryside
MCAA	Marine and Coastal Access Act
MHWS	Mean High Water Springs
MMO	Marine Management Organisation
MPS	Marine Policy Statement
NLC	North Lincolnshire Council
NPSfP	National Policy Statement for Ports
NSIP	Nationally Significant Infrastructure Projects
NVZ	Nitrate Vulnerable Zone
OCP	Organochlorine pesticides
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAH	Polycyclic Aromatic Hydrocarbons
PBDE	Polybrominated Diphenyl Ethers
PCB	Polychlorinated biphenyl
PEIR	Preliminary Environmental Information Report
PFOS	Perfluorooctane Sulphonate
PINS	Planning Inspectorate
PINS	Planning Inspectorate
PPDDE	p,p'-Dichlorodiphenyldichloroethylene
PPDDT	p,p'-Dichlorodiphenyltrichloroethane
PPG	Planning Practice Guidance
PPTDE	p,p'-Dichlorodiphenyldichloroethane
PSA	Particle Size Analysis
pSPA	Potential Special Protection Area
RBMP	River Basin Management Plan
SAC	Special Area of Conservation
SeDiChem	Sediment Disturbance effects on Chemical status (Microsoft Excel Spreadsheet Tool by APEM Ltd)
SPA	Special Protection Area
SPZ	Source Protection Zone
SSC	Suspended Sediment Concentrations
TBT	Tributyl Tin
THC	Total Hydrocarbon Content

TOC	Total Organic Carbon
UK	United Kingdom
WFD	Water Framework Directive

Cardinal points/directions are used unless otherwise stated.

SI units are used unless otherwise stated.

8.14 Glossary

Term	Definition
Baseline conditions	Existing conditions and past trends associated with the environment in which a proposed activity may take place
Biochemical oxygen demand	Amount of oxygen needed by bacteria and other microorganisms to break down organic material under aerobic (with oxygen) conditions
Groundwater	Water present beneath Earth's surface in rock and soil pore spaces and in the fractures of rock formations
Nitrate Vulnerable Zone	Areas designated as being at risk from agricultural nitrate pollution
Partition coefficient	Describes the ratio of substance between the freely dissolved concentration in water and another environmental phase (e.g., sediment-bound) at equilibrium
Ramsar	Wetlands of international importance designated under the Ramsar Convention
Recoverability	The ability of a receptor to recover from disturbance or stress
Resistance	Resistance characteristics indicate whether a receptor can absorb disturbance or stress without changing character
Risk	The likelihood of a specified level of harm occurring within a specified period of time
Special Area of Conservation	A designated area protecting habitats and species identified in Annexes I and II of the Habitats Directive
Special Protection Area	A designated area protecting one or more rare, threatened, or vulnerable bird species listed in Annex I of the Birds Directive

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